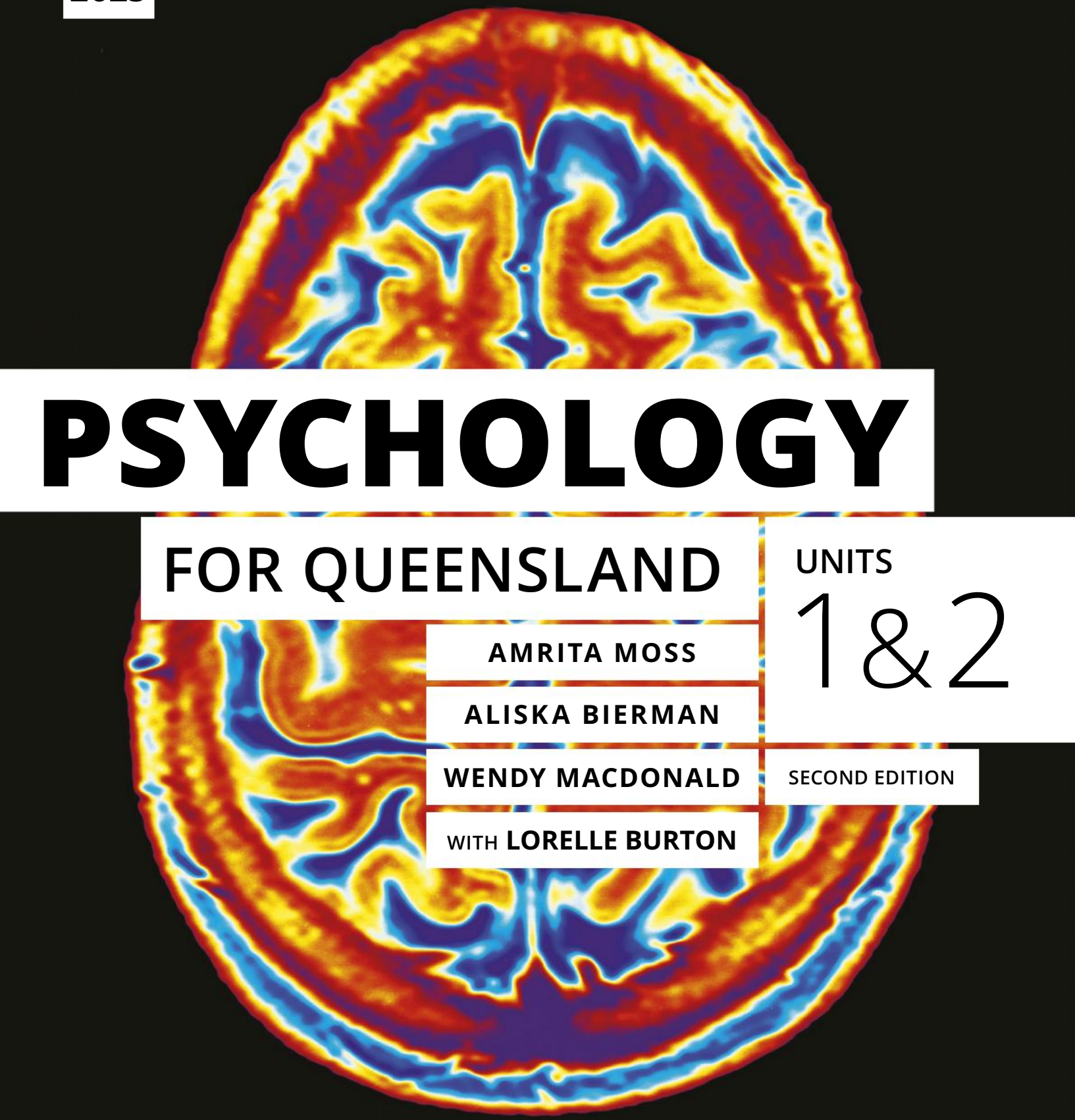
GENERAL SENIOR SYLLABUS 2025

POWERED BY oxforddigital



PSYCHOLOGY

FOR QUEENSLAND

UNITS 1&2

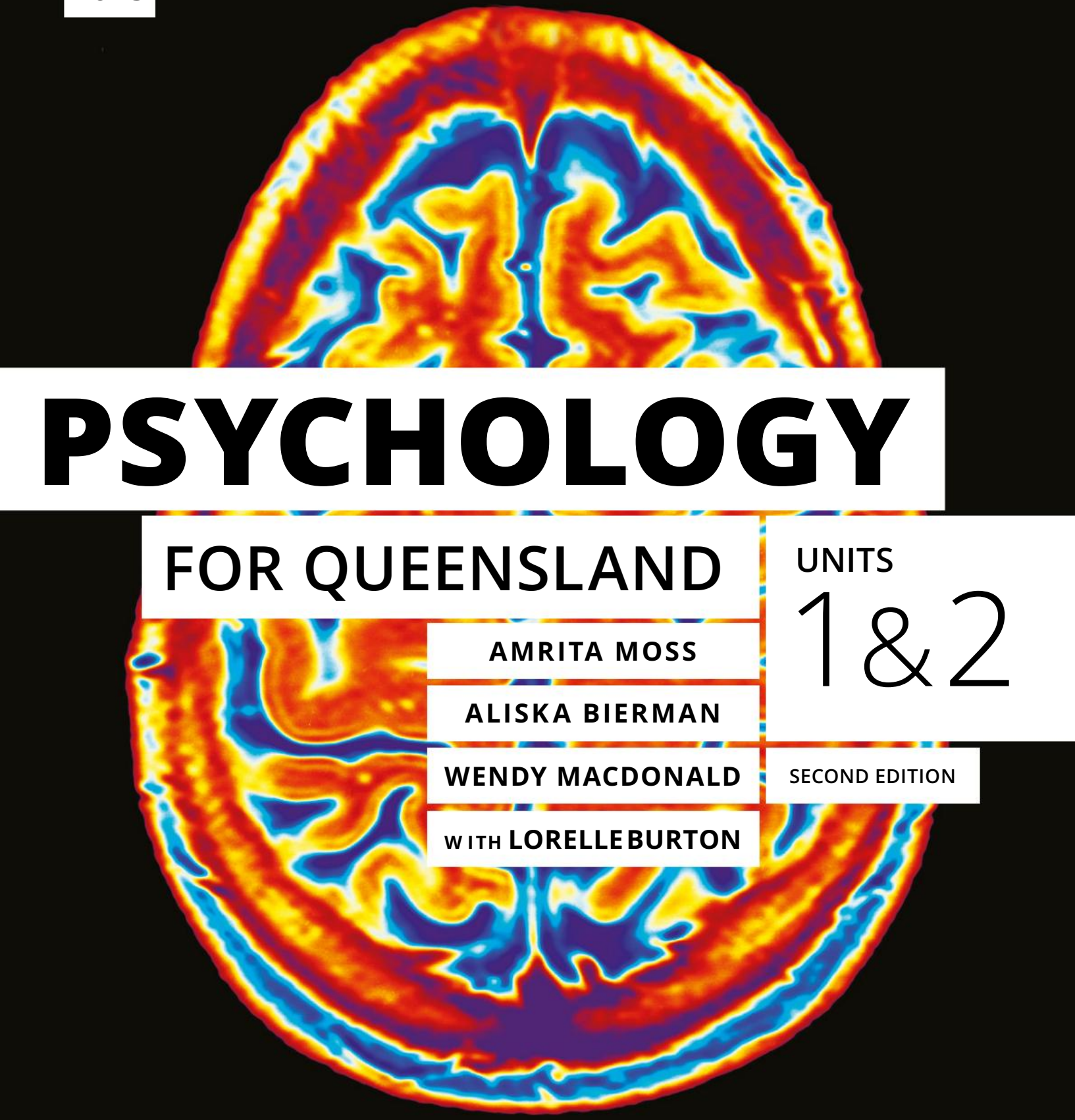
AMRITA MOSS
ALISKA BIERMAN
WENDY MACDONALD
WITH LORELLE BURTON

SECOND EDITION

OXFORD

GENERAL SENIOR SYLLABUS 2025

POWERED BY oxforddigital



PSYCHOLOGY

FOR QUEENSLAND

UNITS 1&2

AMRITA MOSS
ALISKA BIERMAN
WENDY MACDONALD
WITH LORELLE BURTON

SECOND EDITION

OXFORD

OXFORD
UNIVERSITY PRESS

Oxford University Press is a department of the University of Oxford.
It furthers the University's objective of excellence in research, scholarship
and education by publishing worldwide. Oxford is a registered trademark
of Oxford University Press in the UK and in certain other countries.

Published in Australia by
Oxford University Press
Level 8, 737 Bourke Street, Docklands, Victoria 3008, Australia.

First published 2019
Second edition published 2025

ISBN 978 0 1903 4408 5

Edited by Helen Koehne
Typeset by Q2A Media Services Pvt. Ltd., Noida, India
Proofread by Vanessa Lanaway
Indexed by Master Indexing
Printed in Singapore by Markono Print Media Pte Ltd

Oxford University Press Australia & New Zealand is committed to sourcing paper responsibly.

Acknowledgement of Country
Oxford University Press acknowledges the Traditional Owners of the many lands on which we create and share our learning resources. We acknowledge the Traditional Owners as the original storytellers, teachers and students of this land we call Australia. We pay our respects to Elders, past and present, for the ways in which they have enabled the teachings of their rich cultures and knowledge systems to be shared for millennia.

Warning to First Nations Australians
Aboriginal and Torres Strait Islander peoples are advised that this publication may include images or names of people now deceased.

Contents

Lessons available on Oxford Digital.

oxforddigital

This module is available on Oxford Digital.

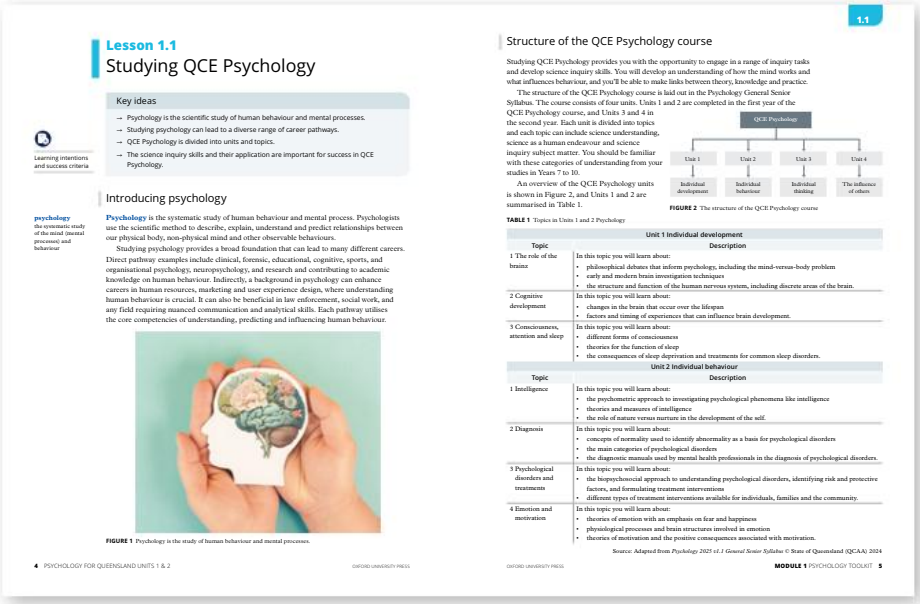
Introducing *Psychology for Queensland Units 1 & 2 (Second edition)*

Congratulations on choosing *Psychology for Queensland Units 1 & 2* as part of your studies this year!

Psychology for Queensland Units 1 & 2 has been purpose-written to meet the requirements of the QCAA Physics 2025 General senior syllabus. It includes a range of flexible print and digital products to suit your school and incorporates a wide variety of features designed to make learning fun, purposeful and accessible for all students!

Key features of the Student Books

The Psychology toolkit module provides an overview of the syllabus, student-friendly guidance for every science inquiry skill and tips for success on assessment tasks.



Lesson 1.1
Studying QCE Psychology

Key ideas
- Psychology is the scientific study of human behaviour and mental processes.
- Studying psychology can lead to a diverse range of career pathways.
- QCE Psychology is divided into units and topics.
- The science inquiry skills and their application are important for success in QCE Psychology.

Learning intentions and success criteria

Introducing psychology

psychology the systematic study of the mind (mental processes) and behaviour

Psychology is the systematic study of human behaviour and mental process. Psychologists use the scientific method to describe, explain, understand and predict relationships between our physical body, non-physical mind and other observable behaviours.

Studying psychology provides a broad foundation that can lead to many different careers. Direct pathway examples include clinical, forensic, educational, cognitive, sports, and organisational psychology, neuropsychology, and research and contributing to academic knowledge on human behaviour. Indirectly, a background in psychology can enhance careers in human resources, marketing and user experience design, where understanding human behaviour is crucial. It can also be beneficial in law enforcement, social work, and any field requiring nuanced communication and analytical skills. Each pathway utilises the core competencies of understanding, predicting and influencing human behaviour.

FIGURE 1 Psychology is the study of human behaviour and mental processes.

4 PSYCHOLOGY FOR QUEENSLAND UNITS 1 & 2 OXFORD UNIVERSITY PRESS

1.1

Structure of the QCE Psychology course

Studying QCE Psychology provides you with the opportunity to engage in a range of inquiry tasks and develop science inquiry skills. You will develop an understanding of how the mind works and what influences behaviour, and you'll be able to make links between theory, knowledge and practice.

The structure of the QCE Psychology course is laid out in the Psychology General Senior Syllabus. The course consists of four units. Units 1 and 2 are completed in the first year of the QCE Psychology course, and Units 3 and 4 in the second year. Each unit is divided into topics and each topic can include science understanding, science as a human endeavour and science inquiry subject matter. You should be familiar with these categories of understanding from your studies in Years 7 to 10.

An overview of the QCE Psychology units is shown in Figure 2, and Units 1 and 2 are summarised in Table 1.

QCE Psychology
Unit 1 | Unit 2 | Unit 3 | Unit 4
Individual development | Individual behaviour | Individual thinking | The influence of others

FIGURE 2 The structure of the QCE Psychology course

TABLE 1 Topics in Units 1 and 2 Psychology

Topic	Description
Unit 1 Individual development	
1 The role of the brains	In this topic you will learn about: • philosophical debates that inform psychology, including the mind-versus-body problem • early and modern brain investigation techniques • the structure and function of the human nervous system, including discrete areas of the brain.
2 Cognitive development	In this topic you will learn about: • changes in the brain that occur over the lifespan • factors and timing of experiences that can influence brain development.
3 Consciousness, attention and sleep	In this topic you will learn about: • different forms of consciousness • theories for the function of sleep • the consequences of sleep deprivation and treatments for common sleep disorders.
Unit 2 Individual behaviour	
Topic	Description
1 Intelligence	In this topic you will learn about: • the psychometric approach to investigating psychological phenomena like intelligence • theories and measures of intelligence • the role of nature versus nurture in the development of the self.
2 Diagnosis	In this topic you will learn about: • concepts of normality used to identify abnormality as a basis for psychological disorders • the main categories of psychological disorders • the diagnostic manuals used by mental health professionals in the diagnosis of psychological disorders.
3 Psychological disorders and treatments	In this topic you will learn about: • the biopsychosocial approach to understanding psychological disorders, identifying risk and protective factors, and formulating treatment interventions • different types of treatment interventions available for individuals, families and the community.
4 Emotion and motivation	In this topic you will learn about: • theories of emotion with an emphasis on fear and happiness • physiological processes and brain structures involved in emotion • theories of motivation and the positive consequences associated with motivation.

Source: Adapted from *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

OXFORD UNIVERSITY PRESS MODULE 1 PSYCHOLOGY TOOLKIT 5

Each module begins with a module opener that includes:
- QCAA subject matter
- reference to a supporting prior knowledge quiz that assesses and informs student understanding of pre-requisite concepts
- a list of practical lessons that support science inquiry

MODULE 16
Emotion and wellbeing

Introduction

Are your emotions the same as your feelings and your moods? What makes you happy? Is happiness the same as wellbeing? Think about times when you were experiencing happiness, or experiencing sadness: did your body do different things or did it react the same way? These questions and the ideas behind them will be explored through this chapter as we approach the way emotions are formed, the role of cognition in your emotions, and the factors that influence our happiness and wellbeing.

Prior knowledge

Prior knowledge quiz — Check your understanding of concepts related to emotion and wellbeing before you start.

Subject matter

Science understanding
- Compare the two-factor (Schachter & Singer 1962) and appraisal (Lazarus 1982) theories of emotion.
- Describe physiological processes associated with emotion, including autonomic arousal and activity in the limbic system, i.e. thalamus, hypothalamus, amygdala, hippocampus, basal ganglia and cingulate gyrus.
- Describe factors that affect happiness.
- Interpret data from an experiment comparing the effect of watching emotive (e.g. a scary movie) versus informative (e.g. an advertisement for toothpaste) stimuli on emotional responses (measured by changes in heart rate).
- Explain subjective wellbeing (Diener 1984), psychological wellbeing (Ryff & Keyes 1995), and the broaden-and-build-theory (Frederickson 2004) of positive emotions.
- Explain mindfulness, with reference to attention and acceptance.
- Describe the positive consequences of the flow experience (Nakamura & Csikszentmihalyi 2002), with reference to enhancing positive affect, life satisfaction, performance and learning.

Science inquiry skills
- distinguish between types of investigations
- use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  - descriptive statistics
  - correlation, e.g. Pearson *r* correlation coefficient
  - parametric inferential statistics
- judge the reliability and validity of the experimental process

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Key studies

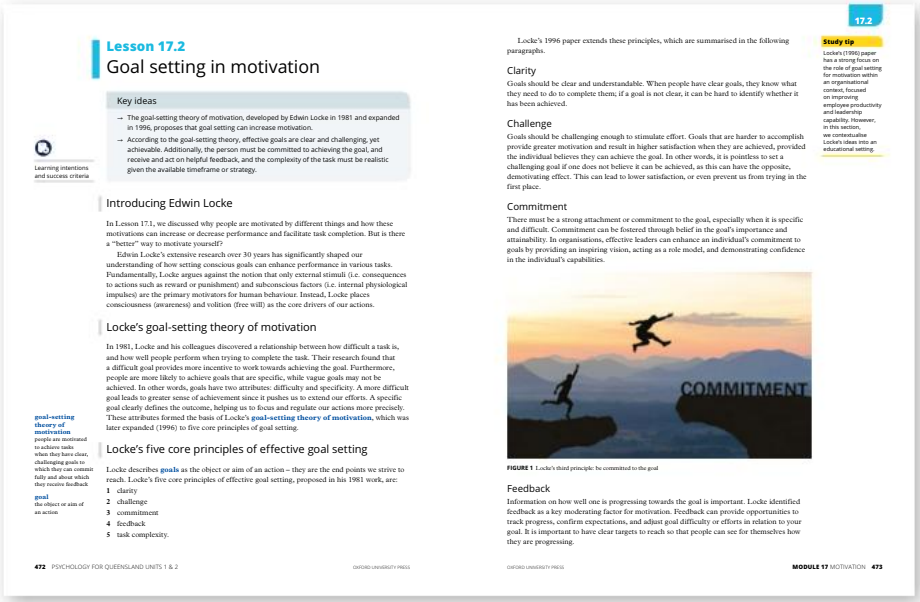
Key study summaries — Read summaries of the key studies for this module.
- Diener, 1984
- Fredrickson, 2004
- Lazarus, 1982
- Nakamura & Csikszentmihalyi, 2002
- Ryff & Keyes, 1995
- Schacter & Singer, 1962

Practicals

oxfordd digital — These lessons are available on Oxford Digital.

Lesson 16.3 Can emotions be influenced?

428 PSYCHOLOGY FOR QUEENSLAND UNITS 1 & 2 OXFORD UNIVERSITY PRESS UNIT 2 INDIVIDUAL BEHAVIOUR 429



Lesson 17.2
Goal setting in motivation

Key ideas
→ The goal-setting theory of motivation, developed by Edwin Locke in 1981 and expanded in 1996, proposes that goal setting can increase motivation.
→ According to the goal-setting theory, effective goals are clear and challenging, yet achievable. Additionally, the person must be committed to achieving the goal, and receive and act on helpful feedback, and the complexity of the task must be realistic given the available timeframe or strategy.

Learning intentions and success criteria

Introducing Edwin Locke

In Lesson 17.1, we discussed why people are motivated by different things and how these motivations can increase or decrease performance and facilitate task completion. But is there a "better" way to motivate yourself?

Edwin Locke's extensive research over 30 years has significantly shaped our understanding of how setting conscious goals can enhance performance in various tasks. Fundamentally, Locke argues against the notion that only external stimuli (i.e. consequences to actions such as reward or punishment) and subconscious factors (i.e. internal physiological impulses) are the primary motivators for human behaviour. Instead, Locke places consciousness (awareness) and volition (free will) as the core drivers of our actions.

Locke's goal-setting theory of motivation

In 1981, Locke and his colleagues discovered a relationship between how difficult a task is, and how well people perform when trying to complete the task. Their research found that a difficult goal provides more incentive to work towards achieving the goal. Furthermore, people are more likely to achieve goals that are specific, while vague goals may not be achieved. In other words, goals have two attributes: difficulty and specificity. A more difficult goal leads to greater sense of achievement since it pushes us to extend our efforts. A specific goal clearly defines the outcome, helping us to focus and regulate our actions more precisely. These attributes formed the basis of Locke's **goal-setting theory of motivation**, which was later expanded (1996) to five core principles of goal setting.

goal-setting theory of motivation people are motivated to achieve tasks when they have clear, challenging goals to which they can commit fully and about which they receive feedback

goal the object or aim of an action

Locke's five core principles of effective goal setting

Locke describes **goals** as the object or aim of an action – they are the end points we strive to reach. Locke's five core principles of effective goal setting, proposed in his 1981 work, are:

1 clarity
2 challenge
3 commitment
4 feedback
5 task complexity.

472 PSYCHOLOGY FOR QUEENSLAND UNITS 1 & 2 OXFORD UNIVERSITY PRESS

17.2

Locke's 1996 paper extends these principles, which are summarised in the following paragraphs.

Study tip
Locke's (1996) paper has a strong focus on the role of goal setting for motivation within an organisational context, focused on improving employee productivity and leadership capability. However, in this section, we contextualise Locke's ideas into an educational setting.

Clarity
Goals should be clear and understandable. When people have clear goals, they know what they need to do to complete them; if a goal is not clear, it can be hard to identify whether it has been achieved.

Challenge
Goals should be challenging enough to stimulate effort. Goals that are harder to accomplish provide greater motivation and result in higher satisfaction when they are achieved, provided the individual believes they can achieve the goal. In other words, it is pointless to set a challenging goal if one does not believe it can be achieved, as this can have the opposite, demotivating effect. This can lead to lower satisfaction, or even prevent us from trying in the first place.

Commitment
There must be a strong attachment or commitment to the goal, especially when it is specific and difficult. Commitment can be fostered through belief in the goal's importance and attainability. In organisations, effective leaders can enhance an individual's commitment to goals by providing an inspiring vision, acting as a role model, and demonstrating confidence in the individual's capabilities.

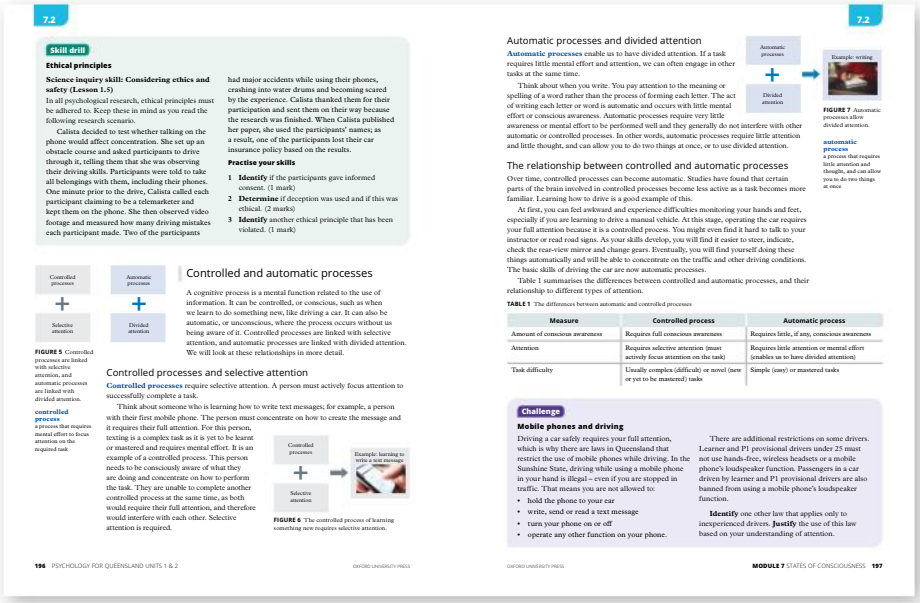
FIGURE 1 Locke's third principle: be committed to the goal

Feedback
Information on how well one is progressing towards the goal is important. Locke identified feedback as a key moderating factor for motivation. Feedback can provide opportunities to track progress, confirm expectations, and adjust goal difficulty or efforts in relation to your goal. It is important to have clear targets to reach so that people can see for themselves how they are progressing.

OXFORD UNIVERSITY PRESS MODULE 17 MOTIVATION 473

Each lesson includes:

- **learning intentions and success criteria**
- clearly structured content written in clear, concise language
- definitions for all key terms on the page
- engaging, relevant and informative images and illustrations
- a range of tips and features designed to bring course content to life including **study tips, worked examples, skill drills** and examples of **real-world science applications**
- references to supporting **digital resources**
- **Check your learning** activities organised according to **Marzano and Kendall's taxonomy** and incorporating cognitive verbs.xonomy and incorporating **cognitive verbs**.



7.2

Skill drill
Ethical principles
Science inquiry skill: Considering ethics and safety (Lesson 1.5)
In all psychological research, ethical principles must be adhered to. Keep these in mind as you read the following research scenario.

Calista decided to test whether talking on the phone would affect concentration. She set up an obstacle course and asked participants to drive through it, telling them that she was observing their driving skills. Participants were told to take all belongings with them, including their phones. One minute prior to the drive, Calista called each participant claiming to be a telemarketer and kept them on the phone. She then observed video footage and measured how many driving mistakes each participant made. Two of the participants had major accidents while using their phones, crashing into water drums and becoming scared by the experience. Calista thanked them for their participation and sent them on their way because the research was finished. When Calista published her paper, she used the participants' names; as a result, one of the participants lost their car insurance policy based on the results.

Practise your skills
1 **Identify** if the participants gave informed consent. (1 mark)
2 **Determine** if deception was used and if this was ethical. (2 marks)
3 **Identify** another ethical principle that has been violated. (1 mark)

Controlled processes + Selective attention
Automatic processes + Divided attention

FIGURE 5 Controlled processes are linked with selective attention, and automatic processes are linked with divided attention.

controlled process a process that requires mental effort to focus attention on the required task

Controlled and automatic processes

A cognitive process is a mental function related to the use of information. It can be controlled, or conscious, such as when we learn to do something new, like driving a car. It can also be automatic, or unconscious, where the process occurs without us being aware of it. Controlled processes are linked with selective attention, and automatic processes are linked with divided attention. We will look at these relationships in more detail.

Controlled processes and selective attention

Controlled processes require selective attention. A person must actively focus attention to successfully complete a task.

Think about someone who is learning how to write text messages; for example, a person with their first mobile phone. The person must concentrate on how to create the message and it requires their full attention. For this person, texting is a complex task as it is yet to be learnt or mastered and requires mental effort. It is an example of a controlled process. This person needs to be consciously aware of what they are doing and concentrate on how to perform the task. They are unable to complete another controlled process at the same time, as both would require their full attention, and therefore would interfere with each other. Selective attention is required.

Controlled processes + Selective attention → Example: learning to write a text message

FIGURE 6 The controlled process of learning something new requires selective attention.

196 PSYCHOLOGY FOR QUEENSLAND UNITS 1 & 2 OXFORD UNIVERSITY PRESS

7.2

Automatic processes and divided attention

Automatic processes enable us to have divided attention. If a task requires little mental effort and attention, we can often engage in other tasks at the same time.

Think about when you write. You pay attention to the meaning or spelling of a word rather than the process of forming each letter. The act of writing each letter or word is automatic and occurs with little mental effort or conscious awareness. Automatic processes require very little awareness or mental effort to be performed well and they generally do not interfere with other automatic or controlled processes. In other words, automatic processes require little attention and little thought, and can allow you to do two things at once, or to use divided attention.

Automatic processes + Divided attention → Example: writing

FIGURE 7 Automatic processes allow divided attention.

automatic process a process that requires little attention and thought, and can allow you to do two things at once

The relationship between controlled and automatic processes

Over time, controlled processes can become automatic. Studies have found that certain parts of the brain involved in controlled processes become less active as a task becomes more familiar. Learning how to drive is a good example of this.

At first, you can feel awkward and experience difficulties monitoring your hands and feet, especially if you are learning to drive a manual vehicle. At this stage, operating the car requires your full attention because it is a controlled process. You might even find it hard to talk to your instructor or read road signs. As your skills develop, you will find it easier to steer, indicate, check the rear-view mirror and change gears. Eventually, you will find yourself doing these things automatically and will be able to concentrate on the traffic and other driving conditions. The basic skills of driving the car are now automatic processes.

Table 1 summarises the differences between controlled and automatic processes, and their relationship to different types of attention.

TABLE 1 The differences between automatic and controlled processes

Measure	Controlled process	Automatic process
Amount of conscious awareness	Requires full conscious awareness	Requires little, if any, conscious awareness
Attention	Requires selective attention (must actively focus attention on the task)	Requires little attention or mental effort (enables us to have divided attention)
Task difficulty	Usually complex (difficult) or novel (new or yet to be mastered) tasks	Simple (easy) or mastered tasks

Challenge
Mobile phones and driving
Driving a car safely requires your full attention, which is why there are laws in Queensland that restrict the use of mobile phones while driving. In the Sunshine State, driving while using a mobile phone in your hand is illegal – even if you are stopped in traffic. That means you are not allowed to:
- hold the phone to your ear
- write, send or read a text message
- turn your phone on or off
- operate any other function on your phone.

There are additional restrictions on some drivers. Learner and P1 provisional drivers under 25 must not use hands-free, wireless headsets or a mobile phone's loudspeaker function. Passengers in a car driven by learner and P1 provisional drivers are also banned from using a mobile phone's loudspeaker function.

Identify one other law that applies only to inexperienced drivers. **Justify** the use of this law based on your understanding of attention.

OXFORD UNIVERSITY PRESS MODULE 7 STATES OF CONSCIOUSNESS 197

Each module contains a range of practical activities designed to meet the requirements of science understanding and science inquiry subject matter and develop science inquiry skills.

Find out more

For a complete overview of all the features and benefits of this Student Book – as well as helpful videos showing you how to get the most out of the series:

> activate your digital access (using the instructions on the inside front cover of this book) and click on "Introducing *Psychology for Queensland Units 1 & 2*" in the Course menu

Key features of Oxford Digital

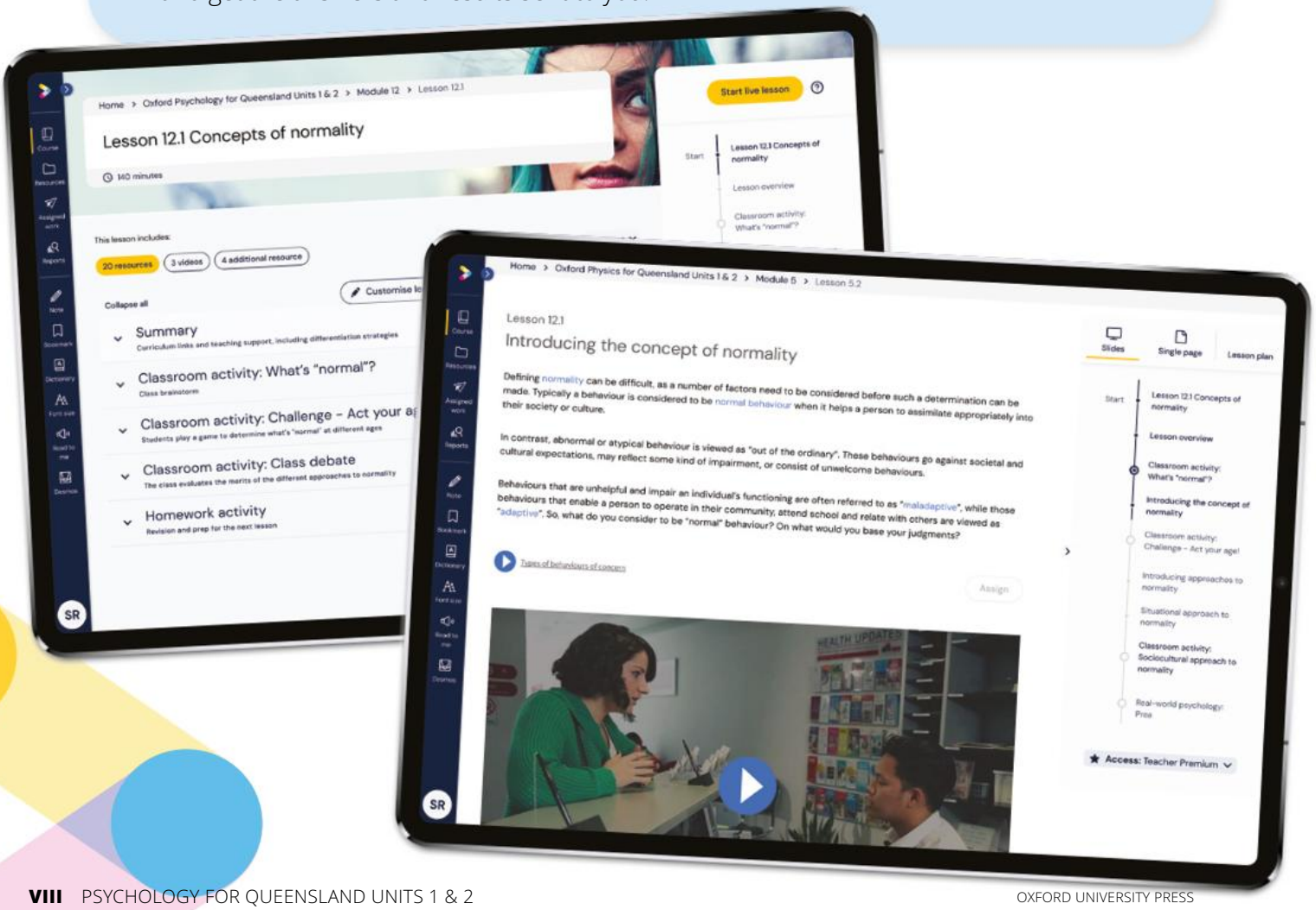
Oxford Digital has been designed in consultation with Australian teachers for Australian classrooms. The new platform delivers fully accessible, reflowable course content with videos, auto-marking activities, interactives and more embedded right where you need them.

There's also a range of unique features designed to improve learning outcomes.

Key features for students

As a student, you can:

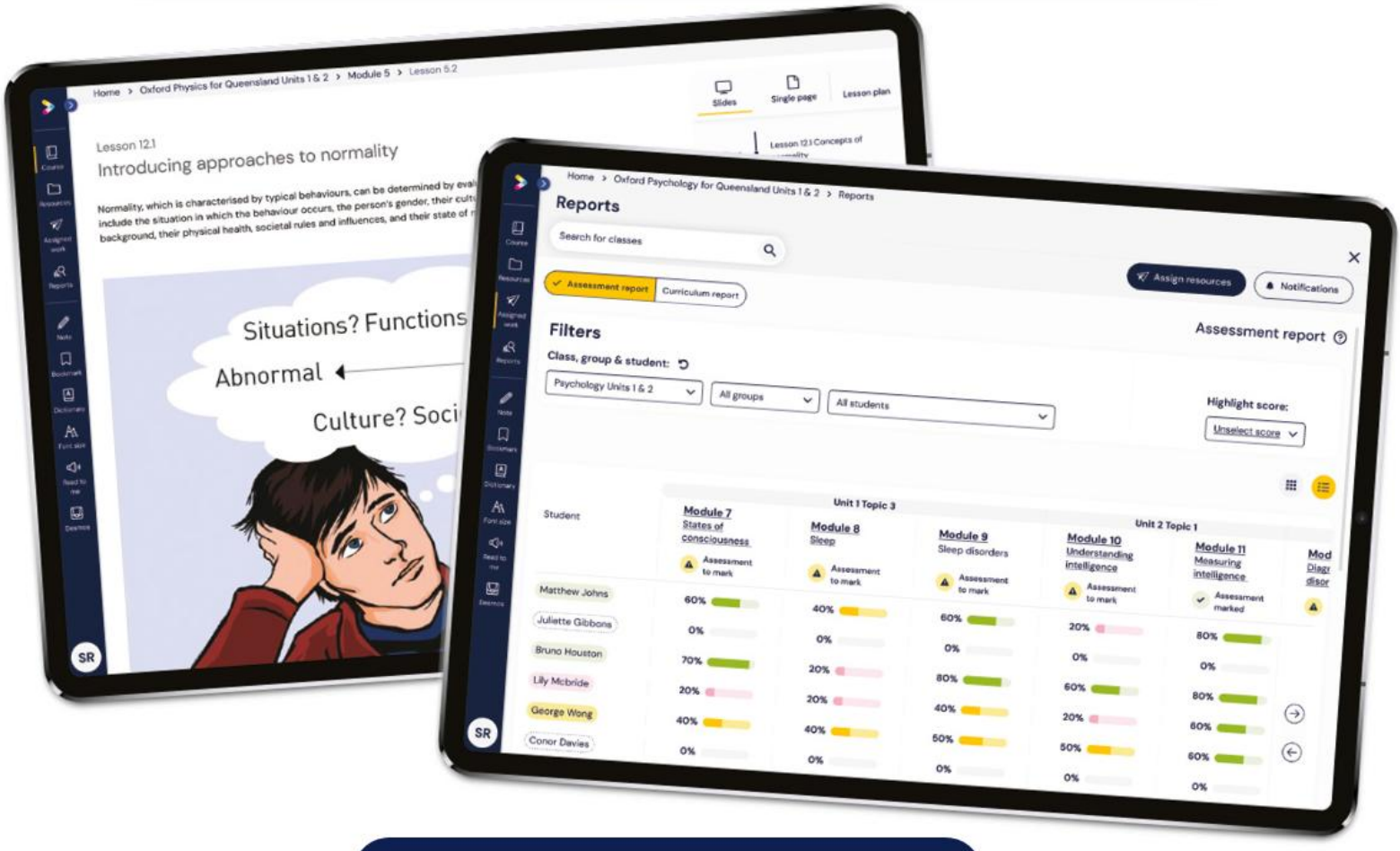
- **view** all course content in a **fully accessible**, reflowable format that's delivered in bite-sized chunks so you can work at you own pace
- use the "Read to me" button to have any part of the course read aloud to you
- **highlight, take notes, bookmark pages**, or define words with the built-in **Australian Oxford Dictionary**
- **watch** short **content videos, worked example videos** and **practical demonstration videos** to help you revise anything you don't understand, catch up on things you've missed, or help you with your homework
- **complete** hundreds of interactive questions and quizzes as you work through the content and get the answers and results sent to you.



Key features for teachers

As a teacher, you can:

- **elevate** your teaching and **reduce planning and preparation time** with **Live Lesson mode.** This is an Australian first that lets you upgrade from traditional print-based lesson plans to **fully interactive, perfectly sequenced and timed interactive lessons complete with classroom activities** that are ready to go
- **personalise** learning for every student and **differentiate** content based on student strengths and weaknesses. Assign support or extension resources to any student using a range of differentiation resources
- **revolutionise** your planning, marking and reporting with powerful analytics on student performance and progress.



Find out more

For a complete overview of all the features and benefits of Oxford Digital – including helpful videos showing you how to get the most out of the platform:

- activate your digital access (using the instructions on the inside front cover of this book) and click on "Introducing *Psychology for Queensland Units 1 & 2*" in the Course menu

Meet the authors & reviewers

Amrita Moss

Lead author

Amrita Moss began her career in 2016 teaching Psychology in the International Baccalaureate curriculum and continues to contribute to the global education community through her role as an external examiner. Amrita has taken on leadership roles, including guiding the Expert Teacher Group for Brisbane Catholic Education (BCE) and leading workshops for the Science Teachers Association of Queensland. Amrita made history by becoming the inaugural chief marker for psychology. Currently, she holds leadership positions involved in endorsing and confirming assessments for the Queensland Curriculum and Assessment Authority (QCAA). Her contributions extend to serving on writing teams for the QCAA and authoring content for the *Oxford Study Buddy Revision and Exam Guide: QCE Psychology Units 3&4*. Amrita holds an adjunct associate lecturer position at the University of Queensland and is a certified highly accomplished teacher. She is an active executive member of the Psychology Teachers Association of Queensland (PTAQ), having served multiple roles including President and Secretary. Through her involvement, she strives to foster a community of educators dedicated to elevating the status of psychology as a secondary school subject and to inspire and guide future educators.

Aliska Bierman

Author

Aliska holds a Bachelor of Engineering (Aerospace Avionics) with Honours, a Graduate Diploma of Education (Secondary) and a Graduate Diploma of Psychology. She has been teaching senior physics and psychology at Brisbane State High School for five years, and she leads the design of teaching and learning programs for psychology. Aliska is an accomplished science author, having written for Education Perfect and Oxford University Press for both the Queensland and Victorian curriculums. Her involvement as a Queensland Curriculum and Assessment Authority (QCAA) marker and writer, along with her role as a digital pedagogy leader at her school, highlight her dedication to educational excellence and innovation.

Wendy Macdonald

Author

Wendy Macdonald has taught Science and Biology in Queensland for 25 years. She currently leads Marist College Ashgrove's Science and Engineering department and was responsible for the implementation of the Queensland Curriculum and Assessment Authority (QCAA) QCE Psychology syllabus at Stuartholme School in 2019. Wendy is a general board member of the Psychology Teachers Association of Queensland (PTAQ) and has presented workshops at PTAQ conferences. She has leadership experience in both student wellbeing and curriculum, holding the Head of Science role at four schools over the past 17 years. Wendy holds a Bachelor of Science (Honours in Psychology), Graduate Diploma of Education (Secondary), Graduate Certificate in Molecular Biology and a Master of Education (Leadership and Management). A passionate educator, she has also been involved in various QCAA teams, including endorsement, confirmation and external exam marking.

Lorelle Burton

Author

Professor Lorelle Burton is an internationally recognised psychology educator with nearly 30 years' experience in higher education. Lorelle

is Dean and Head of the School of Psychology and Wellbeing at the University of Southern Queensland (UniSQ). She is a registered psychologist and the Immediate Past Chair of the national Heads of Departments and Schools of Psychology Association (HODSPA). Lorelle has received numerous national teaching excellence awards, including an Australian Carrick Award and Citation for Teaching Excellence. In 2023, Lorelle received the Australian Psychological Society's (APS) President's Award for Distinguished Contribution to Psychology in Australia. Lorelle has led multiple national research projects on student transition and served on national committees and boards. She is an invited assessor for national learning and teaching awards and grants. Her current research extends beyond academia to promote community-based learning and wellbeing, seeking people's own stories as a powerful way to strengthen communities and find new paths to support them into the future.

Caitlin Ramsay-Rickard

Reviewer

Caitlin Ramsay-Rickard is a nationally certified Highly Accomplished Teacher with eight years experience teaching Psychology in Queensland state schools. She holds degrees from the University of Queensland and has also studied at University College Dublin. In addition to her teaching role, Caitlin actively contributes to the field as a member of the Executive Board of the Psychology Teachers Association of Queensland. She has also played a significant role in the development, moderation, and revision of the Psychology syllabus, working in multiple roles for the Queensland Curriculum and Assessment Authority (QCAA).

Amanda Rockliff

Reviewier

Amanda Rockliff has taught Psychology in Queensland since its inception in 2019. As current President of the Psychology Teachers Association of Queensland, Amanda is passionate about supporting teachers in the Psychology classroom. She currently serves as a lead endorser, confirmer and lead marker for the Queensland Curriculum and Assessment Authority (QCAA) and has also worked as a university tutor for preservice Psychology teachers.

Bernice Zaro

First Nations reviewer

Bernice is a proud Aboriginal and Torres Strait Islander Woman with a strong passion for educational greatness through culturally inclusive learning. With family cultural heritage connection to the Gubbi Gubbi and Bundjalung of South East Queensland area and Kemer Kemer Meriam Nation and Maluligal Nation of the Torres Strait, she is inspired to share and learn continuously. Bernice along with her husband Aicey Zaro, a recognised traditional Artist, have been educating schools and communities through Cultural Awareness art workshops for over 15 years during their time managing the Zaro Cultural Gallery in the Burdekin region. Bernice has a passion for learning through her ongoing studies in community development, child wellbeing, cultural diversity and also sharing personal experiences through family, community and business, which inspire her to take on new opportunities.

Oxford University Press also thanks and acknowledges the following authors for their contributions: Karen Marangio, Roger Edwards, Vicki Moore, Elizabeth Blaher-Lucas and Fiona Ganino-Day.

MODULE 1

Psychology toolkit

Introduction

Psychology is recognised as a science because researchers use the scientific method to establish knowledge, test hypotheses and make systematic observations about human behaviours.

Psychology stands distinct from the natural sciences due to the complexity and variability of its subjects: people. Unlike the other sciences, which allow researchers relatively high control over variables, psychological research must navigate the complexity of human behaviour, as attempting to control one variable can introduce other unwanted variables. Thus, research in this field demands careful balance and considered design while also upholding strict ethical and legal standards to protect participants.

This module lays the foundation for research in psychology and will serve as an invaluable resource throughout Units 1 and 2. The aim of this module is to extend your science inquiry skills for practical application in psychology. You will learn to generate relevant questions and use the scientific method to collect, process, analyse and interpret data so that you can answer your questions.

This module is set out in a way that makes each piece of information easy to access. Science inquiry skills are listed at the beginning of the lesson in which they are discussed. The module is not meant to be read from beginning to end. Rather, it is like a toolkit – you dip your hand into it, get the tool you need and then use it.

Prior knowledge

Prior knowledge quiz Check your understanding of science inquiry skills before you start.

oxforddigital **Full lessons for this module are available on Oxford Digital.**

Online-only Lessons

Lesson 1.2	Considering First Nations perspectives in Psychology
Lesson 1.3	Understanding the scientific method
Lesson 1.4	Planning investigations
Lesson 1.5	Considering safety and ethics
Lesson 1.9	Communicating scientifically
Lesson 1.10	Preparing for your data test
Lesson 1.11	Conducting your student experiment
Lesson 1.12	Conducting your research investigation
Lesson 1.13	Preparing for your exams

Lesson 1.1
Studying QCE Psychology

Key ideas

- → Psychology is the scientific study of human behaviour and mental processes.
- → Studying psychology can lead to a diverse range of career pathways.
- → QCE Psychology is divided into units and topics.
- → The science inquiry skills and their application are important for success in QCE Psychology.

Learning intentions and success criteria

Introducing psychology

psychology the systematic study of the mind (mental processes) and behaviour

Psychology is the systematic study of human behaviour and mental process. Psychologists use the scientific method to describe, explain, understand and predict relationships between our physical body, non-physical mind and other observable behaviours.

Studying psychology provides a broad foundation that can lead to many different careers. Direct pathway examples include clinical, forensic, educational, cognitive, sports, and organisational psychology, neuropsychology, and research and contributing to academic knowledge on human behaviour. Indirectly, a background in psychology can enhance careers in human resources, marketing and user experience design, where understanding human behaviour is crucial. It can also be beneficial in law enforcement, social work, and any field requiring nuanced communication and analytical skills. Each pathway utilises the core competencies of understanding, predicting and influencing human behaviour.

FIGURE 1 Psychology is the study of human behaviour and mental processes.

Structure of the QCE Psychology course

Studying QCE Psychology provides you with the opportunity to engage in a range of inquiry tasks and develop science inquiry skills. You will develop an understanding of how the mind works and what influences behaviour, and you'll be able to make links between theory, knowledge and practice.

The structure of the QCE Psychology course is laid out in the Psychology General Senior Syllabus. The course consists of four units. Units 1 and 2 are completed in the first year of the QCE Psychology course, and Units 3 and 4 in the second year. Each unit is divided into topics and each topic can include science understanding, science as a human endeavour and science inquiry subject matter. You should be familiar with these categories of understanding from your studies in Years 7 to 10.

An overview of the QCE Psychology units is shown in Figure 2, and Units 1 and 2 are summarised in Table 1.

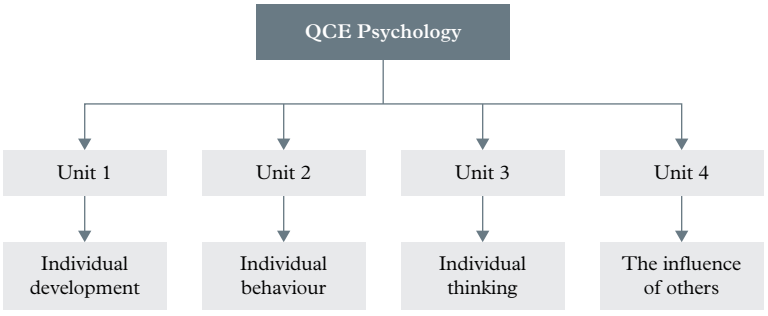


FIGURE 2 The structure of the QCE Psychology course

TABLE 1 Topics in Units 1 and 2 Psychology

Unit 1 Individual development	
Topic	**Description**
1 The role of the brainz	In this topic you will learn about: • philosophical debates that inform psychology, including the mind-versus-body problem • early and modern brain investigation techniques • the structure and function of the human nervous system, including discrete areas of the brain.
2 Cognitive development	In this topic you will learn about: • changes in the brain that occur over the lifespan • factors and timing of experiences that can influence brain development.
3 Consciousness, attention and sleep	In this topic you will learn about: • different forms of consciousness • theories for the function of sleep • the consequences of sleep deprivation and treatments for common sleep disorders.
Unit 2 Individual behaviour	
Topic	**Description**
1 Intelligence	In this topic you will learn about: • the psychometric approach to investigating psychological phenomena like intelligence • theories and measures of intelligence • the role of nature versus nurture in the development of the self.
2 Diagnosis	In this topic you will learn about: • concepts of normality used to identify abnormality as a basis for psychological disorders • the main categories of psychological disorders • the diagnostic manuals used by mental health professionals in the diagnosis of psychological disorders.
3 Psychological disorders and treatments	In this topic you will learn about: • the biopsychosocial approach to understanding psychological disorders, identifying risk and protective factors, and formulating treatment interventions • different types of treatment interventions available for individuals, families and the community.
4 Emotion and motivation	In this topic you will learn about: • theories of emotion with an emphasis on fear and happiness • physiological processes and brain structures involved in emotion • theories of motivation and the positive consequences associated with motivation.

Source: Adapted from *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Assessment in QCE Psychology

In Units 1 and 2, you can be assessed in several ways across the different topics. The syllabus requires that you:

- complete at least two, but no more than four, assessments
- complete at least one assessment for each unit
- are assessed on each unit objective at least once.

Many schools assess students studying Units 1 and 2 as they would assess students studying Units 3 and 4. This means that you will likely complete three assessment pieces and an end-of-year examination or examinations. One possible structure of your assessment is outlined in Table 2. Keep in mind that your school might choose to conduct the data test, student experiment and research investigation in either of Units 1 or 2.

TABLE 2 Units 1 and 2 assessments

Assessment type	Assessment description	Assessment objectives
Data test	Students respond to items using qualitative data and/or quantitative data derived from practicals, activities or case studies from Unit 1 or 2.	2 Apply understanding to given algebraic, visual or graphical representations of scientific relationships and data to determine unknown scientific quantities or features. 3 Analyse data to identify trends, patterns, relationships, limitations or uncertainty in datasets. 4 Interpret evidence to draw conclusions based on analysis of datasets.
Student experiment	Students should be able to analyse and evaluate psychological phenomena associated with content from Unit 1 or 2. This assessment provides opportunities to assess science inquiry skills.	1 Describe ideas and experimental findings. 2 Apply understanding to modify experimental methodologies and process data. 3 Analyse experimental data. 4 Interpret experimental evidence. 5 Evaluate experimental processes and conclusions. 6 Investigate phenomena through an experiment.
Research investigation	Students gather evidence related to a research question to evaluate a claim relevant to Unit 1 or 2 subject matter. This assessment provides opportunities to assess science inquiry skills and science as a human endeavour (SHE) subject matter.	1 Describe ideas and findings. 2 Apply understanding to develop research questions. 3 Analyse research data. 4 Interpret research evidence. 5 Evaluate research processes, claims and conclusions. 6 Investigate phenomena through research.
Units 1 and 2 examination(s)	Includes questions relating to Units 1 and 2 and may ask students to respond using multiple choice, single words, or sentences or paragraphs. The examination/s may ask students to calculate using algorithms or interpret unseen stimulus.	1 Describe ideas and findings about subject matter. 2 Apply understanding about subject matter. 3 Analyse data about subject matter to identify trends, patterns, relationships, limitations or uncertainty. 4 Interpret evidence about subject matter to draw conclusions based on analysis.

Source: Adapted from *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

You can use Lesson 1.10 Preparing for your data test, Lesson 1.11 Conducting your student experiment, Lesson 1.12 Conducting your research investigation and Lesson 1.13 Preparing for your exams to guide you through these assessments. Note that science as a human endeavour content will not be directly assessed in your examinations.

Science inquiry skills

In addition to developing your science understanding in Psychology (which we will cover in Modules 2 to 17), the QCE course requires you to develop and apply a range of science inquiry skills. These skills are specified in the QCE Psychology General Senior Syllabus, and skills relevant to each lesson in this module are listed at the beginning of the lessons. The lessons will help you develop the skills.

The science inquiry skills are applicable to all areas of study in Units 1 to 4 of the QCE Psychology course. They are especially important for preparing and planning for your data test, student experiment and research investigation assessment tasks.

Check your learning 1.1

Check your learning 1.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Define** the term "psychology". (1 mark)
2 **Recall** the structure of the QCE Psychology course. (1 mark)
3 **Describe** how your knowledge and skills will be assessed in Units 1 and 2. (1 mark)

Analytical processes

4 **Compare** the assessment objectives of the data test and student experiment, by
   a identifying similarities (1 mark)
   b identifying differences. (1 mark)

Knowledge utilisation

5 Visit the Australian Psychological Society website and review types of psychologists. Choose the one that interests you the most and conduct further research. **Create** an infographic summarising
   a role description (1 mark)
   b career opportunities (1 mark)
   c qualifications needed (1 mark)
   d how your chosen field positively impacts the world. (1 mark)

Lesson 1.2
Considering First Nations perspectives in Psychology

Key ideas

→ Aboriginal and Torres Strait Islander peoples are the traditional custodians of the land we know now as Australia.
→ Aboriginal and Torres Strait Islander cultures are the oldest living cultures in the world.
→ Correctly acknowledging cultural and/or language groups, rejecting deficit discourse, avoiding Eurocentrism and critically evaluating sources of information can help you to respectfully engage with First Nations perspectives in QCE Psychology.

Learning intentions and success criteria

Science inquiry skills

This lesson provides support for the following science inquiry skills:

- identify strategies to manage risks and environmental impact such as
  - cultural guidelines, e.g. protocols for working with the knowledge of First Nations peoples

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

This lesson is available on Oxford Digital.

Lesson 1.3
Understanding the scientific method

Key ideas

→ The scientific method is a framework that helps to eliminate bias in research so that valid, evidence-based conclusions can be drawn.

→ A research question is a clearly formulated question that defines the focus of an investigation.

→ A hypothesis is a scientific prediction about the outcome of a study; there are different types of hypotheses: alternative (either directional or non-directional, and either experimental or correlational) and null.

→ In psychology, we statistically test the probability of the null hypothesis being true.

Learning intentions and success criteria

Science inquiry skills

This lesson provides support for the following science inquiry skills:

- identify, research and construct questions for investigation
- identify and operationalise variables to be manipulated, measured and controlled
- predict possible outcomes from investigations, e.g. identify null and alternative hypotheses

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Worked examples

This lesson is supported by the following worked examples:

- **Worked example 1.3A** Creating a research question

This lesson is available on Oxford Digital.

Lesson 1.4
Planning investigations

Key ideas

→ Each different type of scientific investigation and research design has strengths and weaknesses that need to be considered.

→ Participants in a study can be selected through convenience, random or stratified sampling methods.

→ Errors and confounds can influence the quality of the results, but they can be minimised through careful design.

Learning intentions and success criteria

Science inquiry skills

This lesson provides support for the following science inquiry skills:

- distinguish between types of investigations, e.g.
  - experiments (independent and dependent variables)
  - independent groups–matched participants–repeated measures
  - correlational research (related variables)
  - quasi-experiments
  - observational research
- identify and use appropriate sampling procedures for selection and allocation of participants, e.g.
  - convenience sampling
  - random sampling
  - stratified sampling
  - random allocation
- identify errors, and extraneous or confounding variables that are likely to influence results; and implement strategies to minimise systematic and random error, e.g.
  - type of participant selection and allocation
  - single-blind and double-blind procedures
  - counterbalancing
  - standardised instructions and procedures

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

This lesson is available on Oxford Digital.

Lesson 1.5
Considering safety and ethics

Learning intentions and success criteria

Key ideas

→ Ethical principles should be applied in psychological research to ensure the safety and wellbeing of participants.

→ Ethical understanding should be applied when conducting research by acknowledging sources and referencing.

Science inquiry skills

This lesson provides support for the following science inquiry skills:

- identify and apply ethical principles, e.g.
  - acknowledgment of sources and referencing
  - consideration of the role and bias of the experimenter
  - protection and security of participants' information
  - confidentiality
  - voluntary participation
  - withdrawal rights
  - informed consent procedures
  - use of deception in research
  - debriefing
- identify strategies to manage risks and environmental impact such as
  - risk assessment, e.g. workplace health and safety (WH&S) guidelines
  - disposal methods

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

This lesson is available on Oxford Digital.

Lesson 1.6
Collecting data

Key ideas

- → Data can be classified as qualitative (descriptive), quantitative (numerical), subjective (personal) or objective (non-personal), continuous or discrete (categorical).
- → Levels of measurement include nominal, ordinal, interval or ratio in order of increasing precision and usability for statistical analysis.
- → Psychologists use case studies, observations, self-reports, interviews and computerised instruments to systematically and safely collect information for research.
- → Researchers use logbooks to systematically record information, observations and data.

Learning intentions and success criteria

Science inquiry skills

This lesson provides support for the following science inquiry skills:

- use appropriate equipment, techniques, procedures and sources to systematically and safely collect primary and secondary data
- distinguish between levels of measurement, i.e.
  - nominal
  - ordinal
  - interval
  - ratio
- design investigations, including the procedure/s to be followed, the materials required, and the type and amount of primary and/or secondary data required to obtain valid and reliable evidence

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Introducing types of data

The aim of scientific investigations is to collect and use data to construct evidence-based arguments. The use of systematically gathered evidence distinguishes scientific ideas from opinions and anecdotes. In QCE Psychology you will need to practise collecting, processing, analysing and interpreting data. The two types of data you will work with are:

- **primary data** – data that is original and has been gathered firsthand through your own research, such as surveys or experiments
- **secondary data** – existing data gathered from second-hand sources such as scientific journals, reputable and authoritative websites, and databases.

Data can be further classified as:

- qualitative or quantitative
- subjective or objective
- continuous or discrete.

primary data
data collected firsthand

secondary data
data collected from second-hand sources

Assessment tip

You need to collect primary data for the student experiment and secondary data for the research investigation.

Qualitative and quantitative data

Primary and secondary data can be further classified as either qualitative or quantitative.

qualitative data
descriptions of the characteristics of what is being studied

Qualitative data comes from descriptions of the qualities or characteristics of what is being studied. Qualitative data is commonly obtained from open-ended questions on surveys or interviews, focus groups or observations. Qualitative data offers in-depth information that is particularly useful for exploring context or gaining deep insight into a particular case or condition. Analysis of qualitative data can be very time-consuming as it involves identifying, examining and interpreting patterns or themes. More commonly, qualitative data is collected through surveys using a Likert-type scale, which allows for much faster analysis. For example:

- emotional state – happy/sad/angry
- difficulty of task – easy/moderate/difficult/very difficult.

quantitative data
measurements (numerical information) about the variables being studied

Quantitative data is information that can be expressed numerically, allowing for statistical analysis and mathematical computation. As the name suggests, the information is "quantified", meaning that the number represents an actual value. This type of data is typically collected using instruments, and can include counts, scores, times, measurements and scales of judgment. Most psychological research aims to gather quantitative data because we can perform statistical procedures on these and, provided the data are accurate and precise, we can determine whether our results are significant and our hypotheses supported.

Subjective and objective data

subjective data
information about the variables being studied based on opinion, with no external criterion by which they are measured

Subjective data are based on personal experience or opinion. If you asked all the people in your class how they feel about maths, you would collect a wide range of responses – all of which are correct because they are based on the individual's own feelings.

objective data
data that is measured according to an identifiable external criterion

Objective data are measured according to an identifiable external criterion. Each person using an objective measure correctly will obtain the same result. In simplest terms, if each person in the class measured the length and breadth of a desk, they would all obtain the same result.

Many standardised measures are used to gain psychological information in an objective way. This includes different IQ tests, and any psychologist who administers one of these would obtain the same result for the same person under the same conditions.

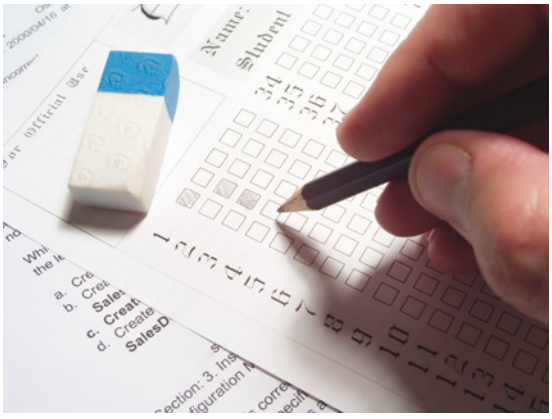


FIGURE 1 Self-report surveys collect subjective data.

Continuous and discrete data

continuous data
data that can take on any value within a range

Continuous data can take on any value within a range. This type of data is measurable and often involves quantities that can be measured to any degree of precision. Examples of continuous data include height, weight, temperature and time. For instance, a person's height can be measured as 1.8 metres or 1.862 metres, and so on, indicating the precision with which this data type can be expressed.

Discrete data consists of countable values that can only take specific values within a range. These are separate, distinct values determined by counting. Examples of discrete data include the number of students in a classroom, the number of cars in a parking lot, or the number of books on a shelf. For example, you can have 20 students in a class but not 20.5 students.

discrete data
data that can only take specific values within a range

Introducing levels of measurement

In order of increasing precision, the levels of measurement used are:

- nominal
- ordinal
- interval
- ratio.

Nominal data

Nominal data represents names or labels that cannot be quantified or ranked. Nominal data represents discrete categories that are mutually exclusive, meaning that a person can only belong to one category. Examples include:

- sex (male/female/nonbinary)
- first language (English/Mandarin/Arabic/Vietnamese/Punjabi/other)
- religion (Islam/Christianity/Hinduism/Buddhism/Sikhism/Judaism/other).

nominal data
data is organised into qualitative categories that cannot be quantified or ranked

FIGURE 2 Hair colour is an example of nominal data that allows us to allocate individuals to groups.

Ordinal data

ordinal data
data that has a definite sequence, but the gap between one level and the next is not constant

Ordinal data can be ordered or ranked in a sequence, but the intervals between the data points are unknown or variable. Data is typically sequenced according to a "more" or "less" dimension such as small to large, or best to worst. Examples include:

- placement (first, second, third): there is no question about the order of achievements but it is not known how much better or faster the person in first place performed than the person in second place. Additionally, the difference in performance between first and second is not necessarily the same as the difference between second and third place
- reviews such as number of stars given to movies or hotels: five stars is better than four stars, but how much better?
- ratings as measured on a Likert-type scale, e.g. strongly disagree/disagree/neutral/agree/strongly agree
- size: small/medium/large
- grades: A/B/C/D/E.

Interval data

interval data
numerical data where the intervals between numbers are equal, but there is no true zero point

Interval data is numerical data where the intervals between numbers are equal, but there is no true zero point. Examples include:

- temperature in degrees Celsius: this is because 0°C does not indicate the absence of heat but rather the temperature at which water freezes. For instance, if today is 30°C, does that mean that it is twice as hot as yesterday when it was 15°C? No, because without a true zero, ratios cannot be used
- time on a clock, e.g. one o'clock, two o'clock: the exact interval between the two times is known (1 hour or 60 minutes) but there is no true zero
- psychological measures such as IQ measured on an intelligence scale.

Ratio data

ratio data
measurements that represent quantities in terms of equal intervals and an absolute zero

Ratio data has all the properties of interval data, with the addition of a meaningful zero point, which allows for the calculation of ratios. In ratio data, zero means the absence of a property. Ratio measurement allows for the most powerful statistical tests to be conducted. Examples include:

- temperature in degrees Kelvin: this is because 0°K indicates the absence of heat and is therefore a true zero
- time, e.g. reaction time
- length or height
- grades measured as a score out of a total: a score of 0 would indicate the absence of correct responses.

Study tip

Both nominal and ordinal levels of measurement are discrete or categorical, meaning that the scales do not allow for fractional amounts. In contrast, both interval and ratio levels of measurement are examples of continuous data that allow for fractional amounts.

Introducing data collection methods

Designing a research method includes choosing the most appropriate type of investigation (Lesson 1.4) as well as choosing a data collection method. We will now learn about techniques and procedures used by psychologists to systematically and safely collect data:

- case studies
- observations
- self-reports
- interviews.

Study tip

Students sometimes struggle to distinguish between interval and ratio scales because they ask themselves whether it is possible to have a zero measurement. It is important to remember that the zero on the scale represents the absence of something. For example, height is ratio because on the scale, 0 cm indicates the absence of height.

Case studies

A **case study** involves a deep, comprehensive examination of a person, group, organisation or event. This research method stems from clinical medicine where physicians collect patient history. In psychology, case studies often involve individuals, and they have led to advancements in our understanding of the mind–body interaction. For example, Phineas Gage helped us understand the relationship between the brain and personality, Henry Molaison helped us discover different types of memory, and "Tan" helped us learn about areas of the brain related to speech.

case study
in-depth examination of a person, group, organisation or event using various methods

Case studies involve collecting both qualitative and quantitative data through various means like interviews, observations and psychometric tests.

Case studies provide rich, detailed data, which can be used to generate hypotheses for future studies. Limitations include the lack of replicability due to the uniqueness of a case, and lack of generalisability due to the small sample size.

Observations

Observation involves recording the behavioural patterns of people, animals or events in a systematic manner. It can be naturalistic (in natural environments) or controlled (in labs or set environments). It may also include participant observation (where the observer is part of the group being studied). Observational studies typically collect qualitative data that can be analysed for patterns or themes. Naturalistic observations have high ecological validity due to limited control over the environment. Controlled observations have fewer confounds due to higher control over the environment, but the higher control lowers ecological validity.

FIGURE 3 Children's behaviour can be observed in a natural environment, such as a playground.

Self-reports

self-report
participants' written or verbal responses to questions, statements or instructions about themselves

One of the most used data collection methods in psychology are **self-reports**. A self-report, as the name suggests, is participants' written or verbal responses to questions, statements or instructions about themselves. Self-reports allow researchers to collect information about participants that cannot be overtly measured, such as their thoughts, beliefs, emotions or behaviours.

A limitation of self-reports is their subjective nature. They rely on participants correctly understanding the questions, and answering honestly and accurately.

Self-reports use questionnaires, a research tool consisting of questions designed to collect information. Questionnaires come in several forms:

- Surveys: May be question-and-answer, or responses to Likert-type scales (rating scales). Surveys are easy to replicate and allow researchers to quickly gather a large amount of qualitative data. Likert-type scales can provide a means of quantifying qualitative data by coding responses using numerical values (Figure 4).

	Never	Sometimes	Often	Always
I complete my Psychology homework on time.	1 ◯	2 ◯	3 ◯	4 ◯

FIGURE 4 A Likert-type scale is a rating scale used to measure behaviours, attitudes or opinions. It can also help turn qualitative data into quantitative data by assigning numerical values to responses.

- Psychological tests: Personality and multiple-choice IQ tests are types of psychological tests. Strengths of psychological tests include being standardised, easy to replicate and easy to score. Limitations include being difficult to construct and validate.

Interviews

Interviews involve face-to-face interaction between the researcher and the participant. Interviews can be structured or clinical. In a structured interview, participants are asked a set of pre-determined, often closed, questions. Clinical interviews include pre-determined questions and make allowance for additional open questions to gain clarification or more information.

Structured interviews are easier to replicate and enable researchers to compare participant responses. However, data may be missed through limited choices in responses. Strengths of clinical interviews are their flexibility and that they are usually high in validity. However, they rely on the objectivity of the interviewer. Interviews are also more susceptible to **social desirability bias**, where respondents answer questions in a manner they believe will be viewed favourably by others.

social desirability bias
the tendency to answer questions in a way that one believes will be viewed favourably by others

Technology in data collection

Technology can make some forms of data collection easier and quicker.

Computerised or automated data collection

Sometimes, a participant will respond to stimuli presented in a computer program or enter data into a spreadsheet. In animal studies, responses such as pressing a button can be recorded. A strength of this data collection method is efficiency, as the researcher does not

need to be present. Other strengths include accuracy, as response rates can be timed to the millisecond, and ease of analysis – once the computer program has been written, data analysis can be instantaneous. A limitation of this method is the need for computer programming or specially constructed measuring devices.

Video/audio taping

For clinical interviews and certain case studies (such as sleep studies), these recordings are very useful. A strength of this approach is that large amounts of data can be collected and analysed in detail. A limitation is that the data analysis is time-consuming.

Study tip

Keeping a logbook is a great way to collect, organise and store the information you have collected, and you can also use it to demonstrate the authenticity of your work.

Recording data

In practice, researchers use logbooks to systematically record information, observations, data, ideas and discoveries. This increases the integrity and reproducibility of their investigations.

Key features of a logbook:

- Date: Each entry is dated, and entries are organised in chronological order.
- Objectivity: Records are factual, and free from personal opinions or bias.
- Completeness: All details are included, such as planning notes, list of equipment used and settings, description and sequence of activities, all measurements, samples, calculations, tables and figures, qualitative observations and personal reflections, and acknowledgement of secondary resources.
- Readability: A detailed logbook is of no use if you or others can't understand and use what is written!

Study tip

For the student experiment, you will likely be collecting data from a group of participants. The best way to organise your raw data is in a table and, most likely, you will transcribe the information directly into a program like Excel. However, you can still use your logbook to plan your table with column and row headings that describe the variables and identify the units.

Check your learning 1.6

Check your learning 1.6: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the following types of data and provide an example of each.
   - **a** Nominal (2 marks)
   - **b** Ordinal (2 marks)
   - **c** Interval (2 marks)
   - **d** Ratio (2 marks)

2 **Summarise** the different methods of data collection by copying and completing the table. (3 marks per method)

Data collection method	Description	Strength	Limitations
Case studies			
Observations			
Self-reports			
Interviews			

Analytical processes

3 **Compare** qualitative and quantitative data. (2 marks)

4 **Distinguish** between continuous and discrete data. (1 mark)

5 **Contrast** interval and ratio data. (1 mark)

Knowledge utilisation

6 A researcher wants to investigate student stress levels during exam periods. They design a questionnaire and distribute it among a group of students, asking them to rate their stress levels during their most recent exam period on a five-point Likert-type scale, where 1 = Little or no stress and 5 = High stress.

Determine the type of data that will be collected. **Justify** your response with reference to the scenario. (2 marks)

Lesson 1.7
Processing and analysing data

Key ideas

- → Statistics are mathematical procedures that help us to make sense of data.
- → Descriptive statistics are numerical or graphical methods used to summarise and organise data in a meaningful way.
- → Inferential statistics allow us to interpret meaning from the data such as drawing conclusions and making inferences and predictions.
- → Statistics, tables and figures should be represented scientifically.

Learning intentions and success criteria

Science inquiry skills

This lesson provides support for the following science inquiry skills:

- use scientific language and representations to systematically record information, observations and data, e.g.
  - measurements
  - sample calculations
  - statistics
  - tables
  - figures
- translate information between graphical, numerical and/or algebraic forms
- use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  - descriptive statistics
    - measures of central tendency: mean and median
    - measures of uncertainty, including dispersion in a sample (range, interquartile range, standard deviation) and using a sample to make an inference about the population from which it was drawn (standard error, confidence intervals)
  - correlation, e.g. Pearson *r* correlation coefficient
  - parametric inferential statistics, e.g.
    - two-sample *t*-test (unpaired and paired)
    - *p*-value from Pearson *r*
- select and construct appropriate representations to present data and communicate findings, e.g. summary tables/statistics, *p*-values, sample calculations, column graphs (with error bars), scatterplots (with trendline and *r*-value)
- analyse data to identify trends, patterns and relationships; recognising error, uncertainty and limitations of evidence

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

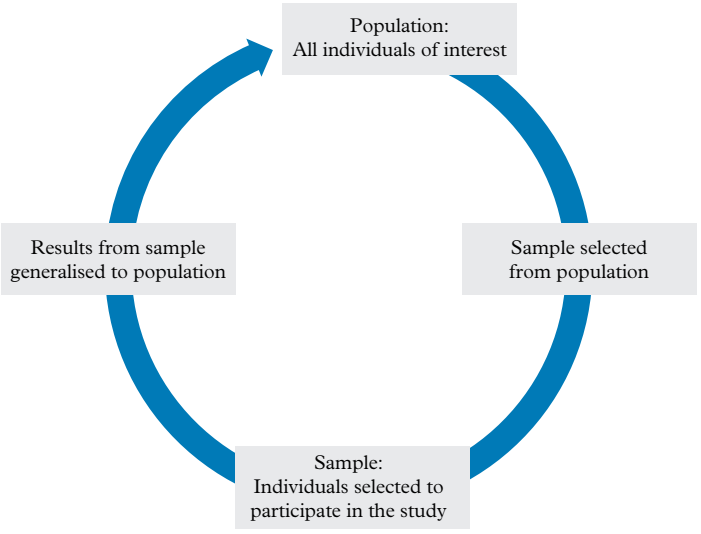
Introducing processing and analysing data

Research originally sets out to draw conclusions and find out something useful about the population of interest. However, researchers typically can't collect data from the entire population of interest. Instead, they sample a smaller subset of the population to participate in the research.

At the end of the investigation, the confidence and extent to which researchers can generalise findings from the sample back to the population of interest depends on:

- the representativeness of the sample
- methodological limitations
- reliability and validity of the procedures
- statistical significance of the results.

The good news is that, in psychology, although we use statistics, we never have to calculate more than the very simplest of them. Computer programs and calculators do it all for us! It is useful, however, to know how these statistics work and what they mean.



Source: Adapted from Gravetter and Wallnau (2014)

FIGURE 1 Researchers generalise findings from a population back to a sample, provided the results are reliable and valid.

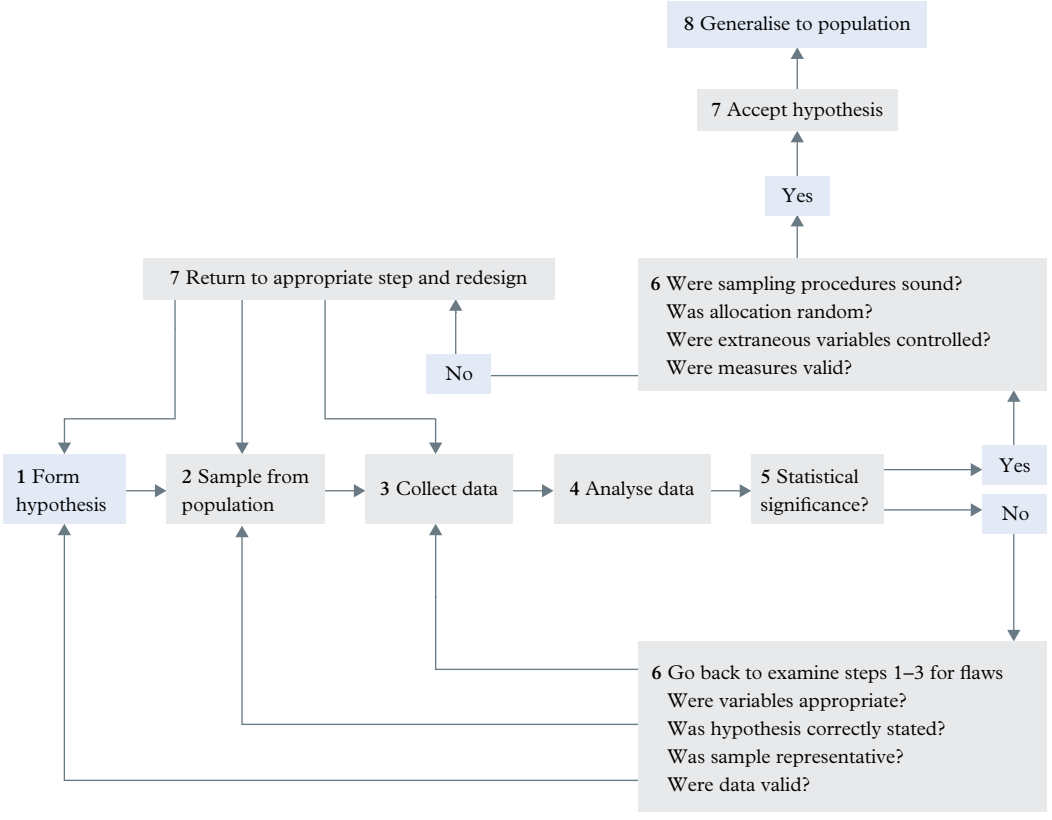


FIGURE 2 Decision-making in research

Descriptive statistics

raw data
original, unprocessed information

Raw data refers to the original, unprocessed information gathered directly from experiments and surveys. For example, Julie rolled a die 80 times and recorded the number shown on each throw. The raw data she collected: 1, 3, 6, 5, 2, 1, 6, 1, 5, 2, 1, 2, 5, 4, 3, 6, 5, 2, 3, 4, 1, 4, 3, 2, 5, 1, 6, 2, 3, 1, 5, 5, 2, 3, 5, 4, 1, 3, 5, 3, 6, 3, 1, 6, 6, 3, 3, 4, 3, 3, 6, 3, 1, 3, 4, 6, 2, 4, 6, 3, 4, 5, 4, 6, 2, 3, 4, 5, 5, 4, 2, 1, 5, 4, 5, 6, 1, 6, 2, 5.

As you can see, raw data can be unstructured and confusing, making it difficult to work out what it means and to spot errors. Descriptive statistics are the processes and mathematical procedures that we can use to organise and summarise the information.

Organising data

Tables

Tables are a helpful way to organise and present data. All tables should include the following:

- Title: The title for a table starts with "Table" followed by a number. Tables should be numbered sequentially, i.e. Table 1, Table 2 etc. The number is followed by a description that summarises what the table shows. For example, "Raw data", "Demographic information" and "Processed data". Include units of measurement for the dependent variable if they can't be shown in the table.
- Column headings:
  - The independent variable (IV) is recorded in the first column. Each row of the first column corresponds to a different version of the independent variable.
  - While it is not required, it is good practice to record the number of participants in each level or condition of the independent variable. This is given a symbol of "n" for a sample or "N" for a population.
  - Raw and/or processed data for the dependent variable (DV) is recorded in subsequent column(s).
- Row headings: If you are summarising different types of information, e.g. demographic data, then the row headings need to clearly identify what is being shown.

Table X The description of the table sits above the table.

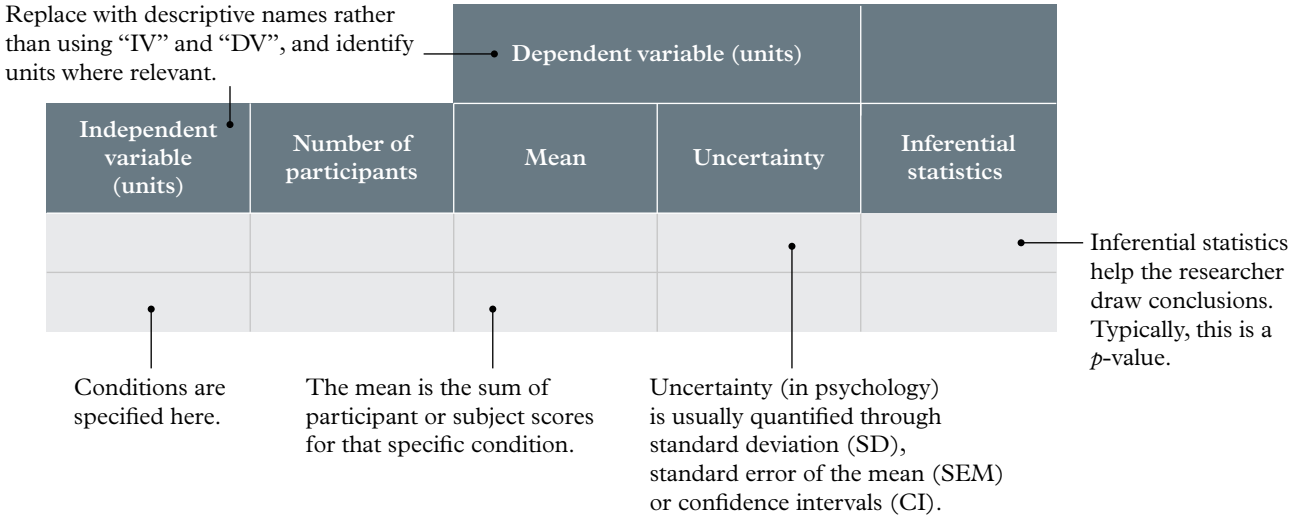


FIGURE 3 Features of a scientific table

Mean employability rating of participants with and without facial tattoos	*n*	*M*	*SD*	*p-value*
With facial tattoo	50	3.5	1.2	0.004
Without facial tattoo	50	7.8	0.9	

FIGURE 4 Mean employability rating of participants with and without facial tattoos. Employability was rated on a scale from 1 to 10; higher rating indicates greater perceived employability.

- Units of measurement: These should be specified in the row or column headings where applicable. Sometimes it is clearer to include this in the title description.
- Footnotes: Use footnotes to explain or provide additional context to the data within the table, such as any superscript letters or symbols.

Frequency tables

A **frequency table** is a tool used in statistics to organise data by showing the frequencies (counts) of different values or categories of a variable. Placing the data into a frequency table helps to simplify the data and makes it easier to perform simple calculations on it. For example, the raw data from the dice rolls could be summarised in a frequency table:

frequency table table that displays the number of occurrences of each category of a variable

TABLE 1 Frequency table

Number on die	Frequency
1	12
2	11
3	17
4	12
5	15
6	13

FIGURE 5 Placing data from rolling a die into a frequency table makes calculations easier.

You can see that this is much clearer and therefore easier to work with than the raw data list of numbers presented earlier in this lesson.

The information in frequency tables can be converted to a graph called a histogram (discussed in the next section). Frequency tables also make it easier to perform certain calculations; for example, calculating the percentage of a dataset represented by a certain score. This can be calculated using the formula:

$$\text{percentage} = \frac{\text{number of times the score occurs}}{\text{total number of scores in dataset}} \times 100$$

For example, if we wanted to know what percentage of rolls scored 6, we would substitute the values from our dataset into the equation:

$$\begin{aligned}\text{percentage} &= \frac{\text{number of times the score occurs}}{\text{total number of scores in dataset}} \times 100 \\ &= \frac{13}{80} \times 100 \\ &= 16.25\%\end{aligned}$$

Worked example 1.7A

Constructing frequency tables

A psychology class was investigating the effect of emotional stimuli on physiological response. Participants watched an infomercial on toothpaste in one condition and a scary movie scene in another. Their heart rates were recorded:

TABLE 2 Participants' heart rate (bpm) measured after 5-minute clip

Participant	Heart rate (bpm): informative	Heart rate (bpm): horror
1	75	90
2	66	74
3	88	98
4	66	68
5	74	81
6	58	85
7	72	82
8	74	77
9	61	76
10	70	89

Construct a frequency table for the "informative" condition data.

Think	Do
Step 1: Identify data categories (bins). • Consider the maximum and minimum values across the dataset. • For nominal data, list each unique category. • For numerical data, decide on sensible intervals or "bins" that cover the range of the data. Aim for an uneven number of bins. The data in this case is numerical.	The data across both conditions ranges from 50 to 99. It makes sense to group these into intervals of 10: Heart rate | Informative 50–59 | 60–69 | 70–79 | 80–89 | 90–99 |
Step 2: Tally observation. • Go through the raw data and count the number of observations that match the category. Record the tally in the table.	Heart rate | Informative 50–59 | 1 60–69 | 3 70–79 | 5 80–89 | 1 90–99 | 0
Step 3: Finalise your table. • Check the table to make sure all data points have been included and there are no errors in the tallying process. • Check that you are communicating scientifically. Does your table have a title and appropriate headings, and include units of measurement and footnotes (if needed)?	Heart rate (bpm) | Informative (frequency) 50–59 | 1 60–69 | 3 70–79 | 5 80–89 | 1 90–99 | 0

Your turn

Construct a frequency table for the "horror" condition data. (3 marks)

Presenting data

Tables help to organise the data, but they don't help us make meaning. Instead, we can visually present the data in an appropriate graph to help us make sense of the information and more easily identify trends, patterns and relationships.

All graphs should include DAILS:

- D = a **d**escription that succinctly describes what the graph is showing
- A = **a**xes: the IV goes on the *x*-axis, DV on the *y*-axis
- I = points on the axes are equally spaced **i**ntervals
- L = **l**abels on each axis; the DV and units of measure on the *y*-axis label and the IV and conditions on the *x*-axis
- S = **s**cale appropriate for the graph and the axes start at zero.

Figure 6 is an example of a column graph showing the average scores for each group with error bars.

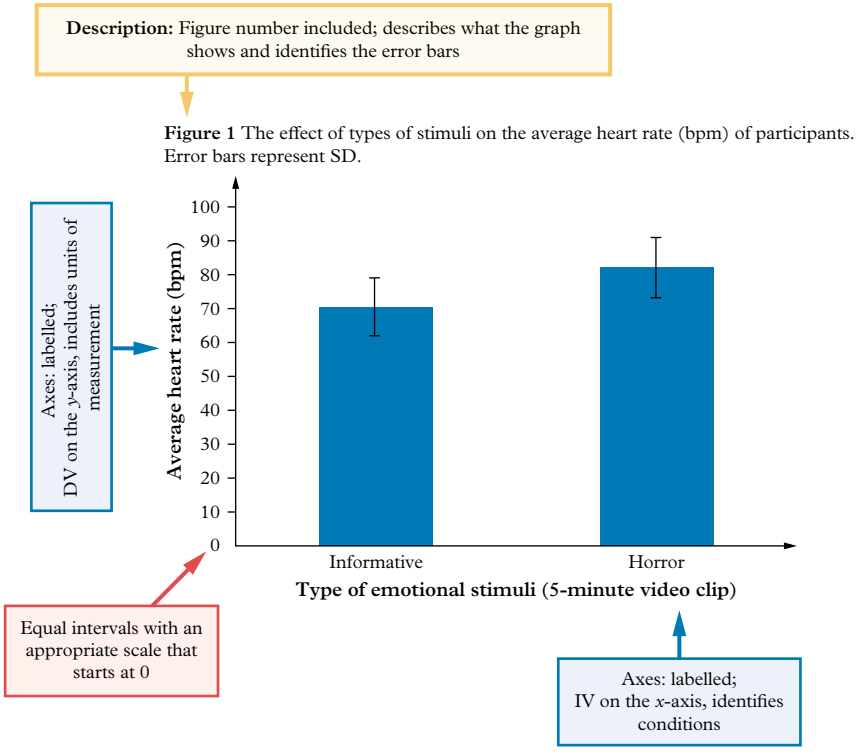


FIGURE 6 All graphs should include DAILS to make sure that the information is presented scientifically.

There are many different graphs that you can use to visually represent data. Let's look at the ones you will most likely need during your study.

Histograms

A **histogram** is a visual representation of a frequency table. It is a type of column graph where the columns touch. Histograms are useful for showing the shape of a data distribution such as whether it is normal or skewed.

histogram
visual representation of a frequency table in the form of a column graph

Study tip

You can create a histogram for each variable to test whether the assumption of normality is met (see inferential tests in Lesson 1.8).

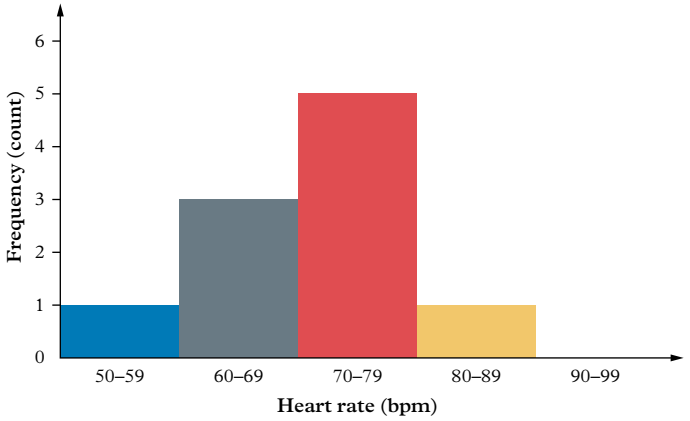


FIGURE 7 The histogram shows the number of participants whose heart rates were in the corresponding range.

Pie charts

pie chart
a circular graph divided into sections that are that are proportional to the data they represent

A **pie chart** displays data in a circular graph where each slice represents a category's proportion of the whole. Pie charts are helpful for showing the relative proportions or percentages of a whole. While these are not commonly used in published research, you can use them to summarise demographic data (data that describes the characteristics of populations).

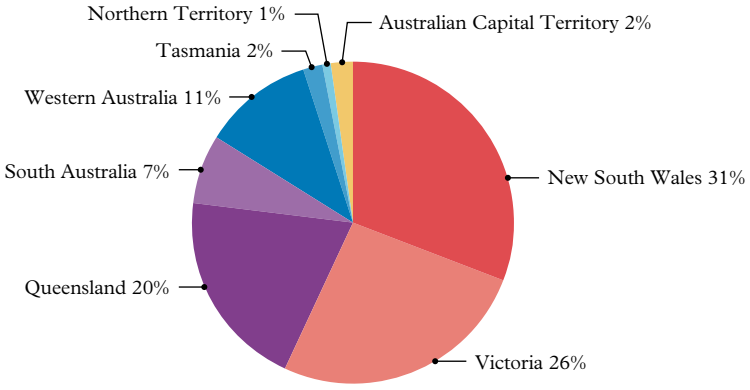


FIGURE 8 The pie chart makes it easier to see relative proportions. This example shows the percentage of the population living in each Australian state and territory, as at 30 September 2023.

Column graphs

column graph
graph typically used for experimental designs where the height of the vertical bar corresponds to the mean and each column represents a condition of the independent variable

error bar
graphical representation of the variability of uncertainty in data, usually either the standard deviation, standard error or confidence interval

A **column graph** uses vertical bars to represent data. Each bar's height corresponds to the value it represents (usually the average of participants in a group), and each bar is separated to distinguish between categories. **Error bars** are shown by markers drawn over the graph. Error bars can represent standard deviation (SD), standard error (SE) or confidence intervals (CI), therefore it is important that the figure description identifies the type of error bars shown. Figure 9 shows the key features of a column graph.

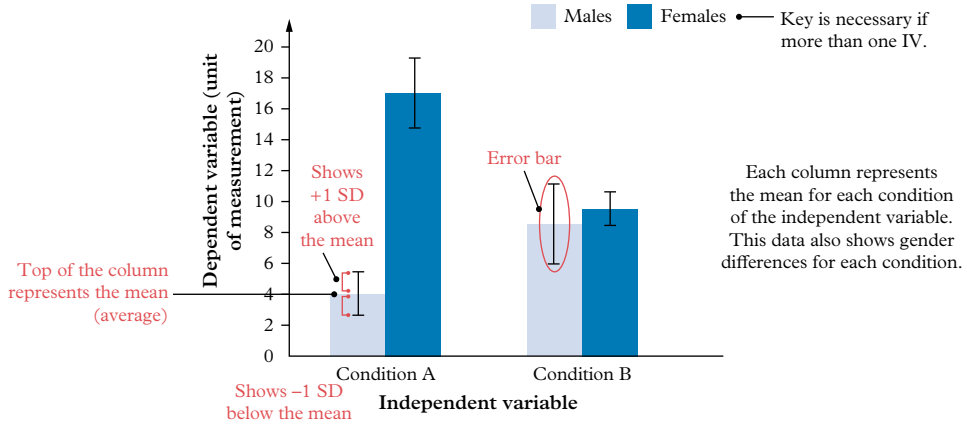


FIGURE 9 Key features of a column graph. In this example, the error bars represent standard deviation.

Study tip

Column graphs are different from bar graphs, where the bars are arranged horizontally, but in everyday use, the terms are used interchangeably.

It is difficult to see error bars on dark-filled columns. To avoid this, columns are often not filled (coloured in) and may only include the error bars (Figure 10).

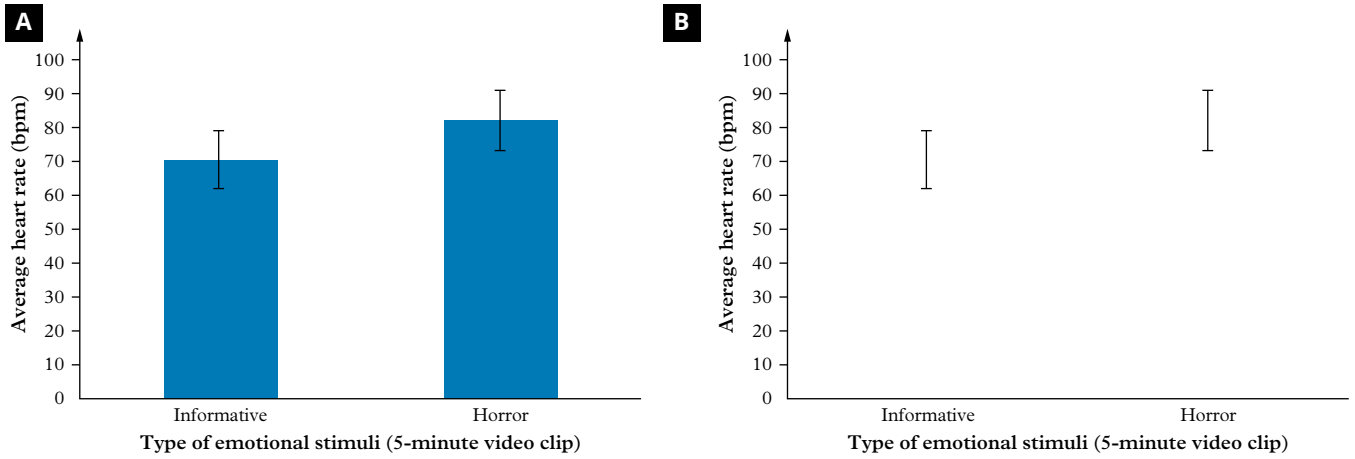


FIGURE 10 Both graphs show the average heart rate (bpm) for participants when they watched the informative and horror clips. (A) The graph has filled-in columns that make it difficult to see the error bars clearly. (B) Sometimes, the columns are removed and only the error bars are shown. They are still interpreted in the same way.

Column graphs are used for experimental research designs where the IV is categorical or discrete (can only take set values), and the mean is the most appropriate measure of central tendency. We will learn about measures of central tendency later in this lesson.

Line graphs

If both variables are continuous (meaning that they can have any value within a certain range) – such as body mass, age in months or IQ – a **line graph** would be more appropriate than a column graph. For example, suppose your teacher sets you a group classwork assignment and you want to find out what sized group is the most efficient.

line graph
a pictorial representation of data linking two variables, where one is plotted on the *y*-axis and the other on the *x*-axis

The data in Table 3 is presented as the line graph shown in Figure 11.

TABLE 3 Time taken to complete classwork for different-sized study groups

Group size	Time (hours)
2	5.0
3	3.0
4	2.5
5	2.0
6	2.5
7	5.0

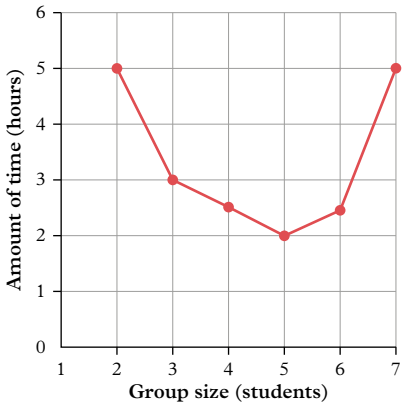


FIGURE 11 Time taken to complete classwork for different-sized study groups

Box and whisker plots

box and whisker plot
graph showing the distribution of data that shows the median, quartiles and outliers

outlier
extreme score that can be objectively calculated as an observation greater than three standard deviations above or below the mean

Box and whisker plots (or box plots) are used for experimental research designs where the median is the most appropriate measure of central tendency. The lines extending parallel from the boxes are known as the "whiskers", which are used to indicate variability outside the upper and lower quartiles. **Outliers** are sometimes plotted as individual dots that are in-line with whiskers as shown in Figure 12.

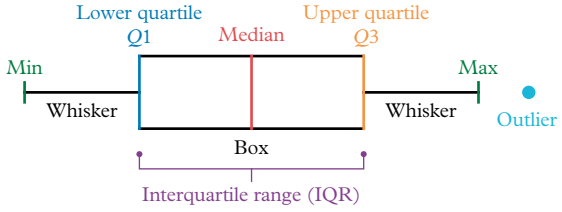


FIGURE 12 Box and whisker plots show median and interquartile range (IQR).

Study tip

You do not need to be able construct box and whisper plots by hand (you can use software) but you must be able to interpret them and return values such as the median (Q2), or calculate the IQR.

Box and whisker plots can be graphed vertically or horizontally. The convention for experimental designs is to plot the boxes for each condition vertically next to one another as it makes comparisons easier.

Scatterplots

scatterplot
diagram that shows the values of the two variables for each participant in the sample by representing the intersection of those two values with a dot on a graph

line of best fit
a straight line drawn through a scatterplot of data points that best expresses the relationship between those points

A **scatterplot** shows the values of the two variables for each participant in the sample by representing the intersection of those two values, one plotted along the *x*-axis and the other plotted along the *y*-axis, with a dot on a graph. The dots are unconnected; however, adding a **line of best** fit is helpful to identify and describe the relationship between the two variables (Figure 13).

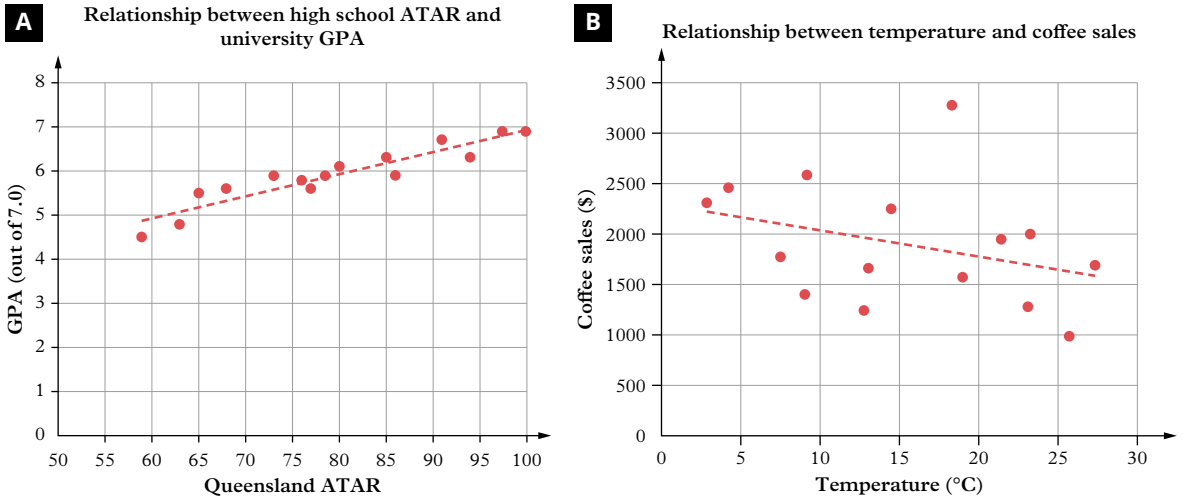


FIGURE 13 Two scatterplots depicting different relationships as shown by the line of best fit

Scatterplots are used for correlational designs. If the line of best fit slopes upwards (Figure 13A), it indicates a **positive correlation**; that is, as one variable increases, there is an associated increase in the other variable. On the other hand, if the line of best fit slopes downwards (Figure 13B) it indicates a **negative correlation**; that is, as one variable increases, there is an associated decrease in the other variable.

positive correlation
two variables change in the same direction; as one increases (or decreases), so does the other

negative correlation
two variables change in opposite directions; as one increases, the other decreases

Remember that in a correlation, there is no independent variable, in which case, it does not matter which variable is plotted on the *x*-axis. The variable presumed to influence or predict the outcome of the other (a pseudo IV) is called the predictor variable. The one presumed to depend on the predictor variable is called the criterion variable. If these are known, then like the IV, the predictor variable is plotted on the *x*-axis while the criterion variable is plotted on the *y*-axis.

Processing data

While graphs help us to visualise the data, descriptive statistics help us to describe the data. A graph can be described by three features:

- shape (symmetrical or skewed)
- central tendency (where the majority of scores are)
- spread of scores.

We will discuss each of these in turn.

Shape

When all scores in a set of data are plotted in a graph, the shape of the distribution is noted. The shape can be symmetrical (Figure 14A) or skewed (Figures 14B and 14C). Skewed distributions are described according to the direction of the tail (where the data tapers off on either side). If the tail heads towards zero, the distribution is said to be **positively skewed** (Figure 14B). Conversely, if the tail is moving away from zero in a positive direction is it said to be **negatively skewed** (Figure 14C).

positively skewed
the tail of the distribution heads away from zero

negatively skewed
the tail of the distribution heads towards zero

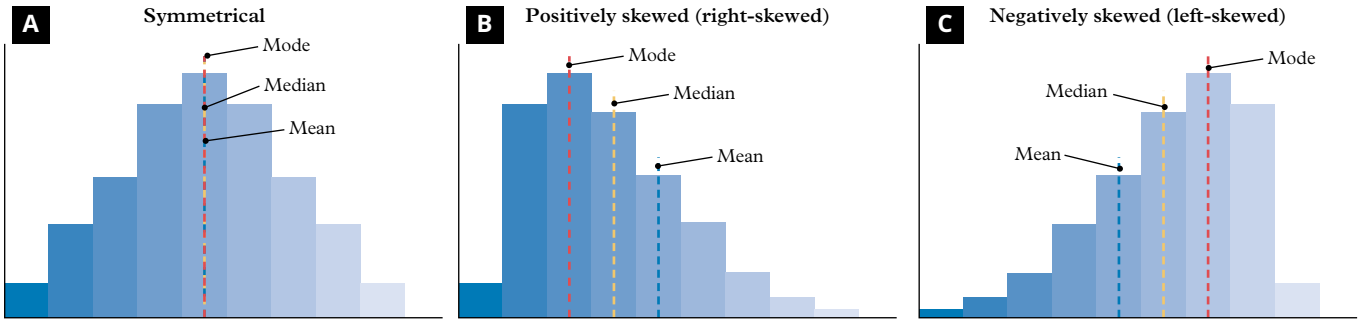


FIGURE 14 Histogram examples showing the relationship between mean, median and mode for (A) a normal or symmetrical distribution, and (B and C) skewed distributions

Sometimes a dataset will have more than one "peak" (Figures 15B and 15C) or no clear peaks (Figure 15A). The curve in Figure 15B shows a bimodal distribution – this often occurs where two distinct populations are plotted on the same curve. What we need to do in this case is to sort out the members of the two different populations.

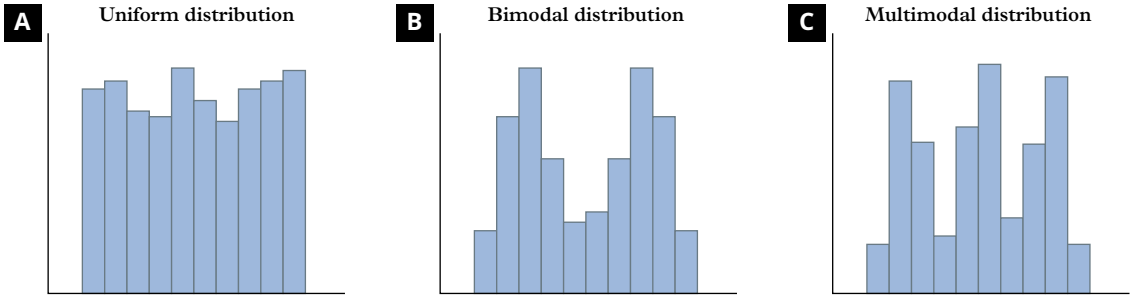


FIGURE 15 Histogram distributions

We will now look at normal distribution.

Normal distribution

normal distribution
a symmetrical, bell-shaped distribution of data where most observations are clustered around the mean and decrease with distance from the centre

The **normal distribution** is a probability distribution, characterised by a bell-shaped curve (Figure 16) where the area under the curve equals 1. The probability distribution describes how the values of a variable are distributed, with the highest frequency of occurrence in the centre (unimodal) and the frequency of occurrence decreasing with distance from the centre. If the distribution is symmetrical, the mean is equal to the median and mode, so that 50% of all the data points lie above the mean and 50% below the mean.

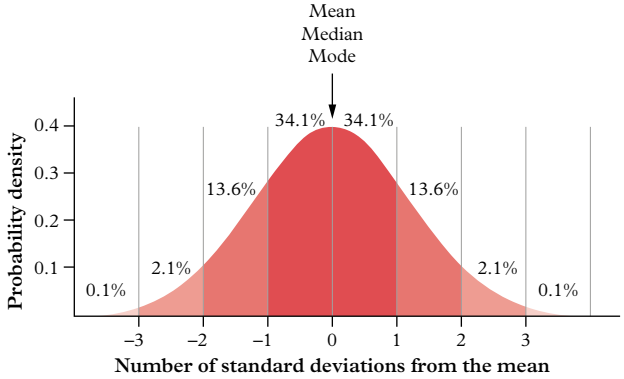


FIGURE 16 The standard normal curve probability distribution based on standard deviation

Given these properties, we can further break down the proportion of data that lies away from the mean using standard deviations (we will learn about standard deviations shortly). As shown in Figure 16, 68% of all the scores in a normal distribution lie within one standard deviation from the mean, 95% lie within two standard deviations and 99.7% lie within three standard deviations.

A **percentile** is a measure that helps us to understand the position or relative standing of a score within a dataset. For example, IQ scores are normally distributed with a mean of 100 and a standard deviation of 15. From Figure 16, if a person has an IQ of 115, they are one standard deviation above the mean, which places them in the 84th percentile (calculated by adding the percentages in Figure 16: 0.1 + 2.1 + 13.6 + 34.1 + 34.1 = 84). This means that they performed better on the IQ test than 84% of others.

percentile
measure that indicates the value below which a given percentage of observations in a group fall

Study tip

When visually inspecting a histogram to test the assumption of normality, it is unlikely that you will see a perfectly symmetrical distribution. As long as the distribution resembles a bell shape and there is no obvious skew, the assumption is met.

Introducing measures of central tendency

Central tendency is a statistical measure used to quantify the centre of a distribution, i.e. where most of the scores are located. While we could find central tendency by looking for the peak in a histogram, quantifying central tendency makes it easier to compare two or more distributions. Central tendency is a single value, that is most typical or representative of the entire set of scores. There are three measures of central tendency: mean, median and mode. The syllabus does not require you to calculate the mode, but it is included here for completeness.

Mean

The **mean** (or average) of all the scores is calculated by adding up all the scores and dividing that total by the number of scores in the dataset. This can be represented mathematically:

mean
the average of all the scores, calculated by adding up all the scores and dividing that total by the number of scores

$$M = \frac{\Sigma X}{n} = \frac{x_1 + x_2 + \ldots x_n}{n}$$

where x is the raw scores in the dataset and n is the size of the sample.

For example, the mean for the dataset 11, 13, 14, 15, 12, 13, 13 is

$$M = \frac{\Sigma X}{n} = \frac{11+13+14+15+12+13+13}{7} = \frac{91}{7} = 13$$

Changing a value of a score or adding a new score (not equal to the mean) changes the mean. If the scores are very large or very small (outliers), they can skew the mean and give a misleading result.

For example, imagine if the last score in the above data set changed from 13 to 23:

$$M = \frac{\Sigma X}{n} = \frac{11+13+14+15+12+13+23}{7} = \frac{101}{7} = 14.4$$

Study tip

In maths, the mean is often shown as $\overline{X}$. In psychology it is more common to use the APA recommended statistical symbol to represent mean, which is a capital and italicised *M*. By convention, the mean is typically reported to the same level of precision as the data values, but no more than 2 decimal places.

When to use the mean

The mean is only the most appropriate measure of central tendency to use if the following conditions are met:

- level of measurement is interval or ratio (Lesson 1.6)
- there are no outliers
- the distribution is normal.

If these conditions are not met, the mean could be misleading and it would be better to use a different measure of central tendency.

Median

median
the middle number (or mean of the two middle numbers) of a number series listed in numerical order

The **median** is the middle value (or mean of the two middle values) of a dataset. To calculate the median, the data first needs to be organised sequentially, before finding the middle number:

11, 12, 13, 13, 13, 14, 15

The median = 13.

For an even number of scores, the median is found by calculating the mean of the two middle scores. For example:

11, 12, 13, 13, 13, 14, 15, 17

$$\text{median} = \frac{(13+13)}{2} = 13$$

Changing a value of a score does not change the value of the median, making it less susceptible to outliers than the mean. Using the same example as before:

11, 12, 13, 13, 13, 14, 15, **23**

the median is still 13.

When to use the median

The median is the most appropriate measure of central tendency to use when:

- level of measurement is ordinal
- level of measurement is interval/ratio but there are outliers
- the distribution is skewed.

Mode

mode
the most commonly occurring score in the dataset

The **mode** is the most commonly occurring score in the dataset. For this dataset – 11, 12, 13, 13, 13, 14, 15 – the mode is 13.

The mode is the most appropriate measure of central tendency to use for nominal data. (Remember that the syllabus does not require you to calculate the mode.)

Worked example 1.7B

Calculating measures of central tendency

Calculate the mean and median of the dataset in Table 4.

TABLE 4 IQ scores of 12 students in a Year 6 class

Student	IQ score	Student	IQ score
John	88	Hanna	111
Robert	94	Jacob	111
Kiet	99	Adelina	119
Luke	102	Ahmed	125
Kerry	105	Arisa	125
Shelley	111	Akash	130

Think	Do
Calculate the mean. Step 1: Write the formula. Step 2: Sum all the values in the dataset – this is the numerator. Step 3: Count the number of values in the dataset and write it in the denominator. Step 4: Solve and present your answer.	$M = \frac{\Sigma X}{n}$ $= \frac{1320}{12}$ $= 110$ The mean IQ score for this group of students is 110.
Calculate the median. Step 1: Organise the data sequentially. Step 2: If there is an odd number of scores, the median is the middle number. If there is an even number of scores, the median is the mean of the middle two numbers. Step 3: Present your answer.	88, 94, 99, 102, 105, 111, 111, 111, 119, 125, 125, 130 $\text{Median} = \frac{(111+111)}{2} = 111$ The median IQ score for this group of students is 111.

Your turn

Calculate the mean and median for the following dataset: 2, 5, 7, 3, 9, 6, 4, 6. (2 marks)

Introducing measures of variability (spread)

Another way to describe data is by looking at the spread of scores within a distribution. Like measures of central tendency, measures of variability provide a quantitative measure to indicate the degree to which scores in the scores distribution are spread out or clustered together. When used along with measures of central tendency, they tell us a great deal about the features of a dataset. Common measures of spread include range, standard deviation and interquartile range.

Range

The most basic measure of spread is range. The **range** is the difference between the highest score and the lowest score in the dataset.

range
the difference between the highest score and the lowest score in the dataset

$$\text{range} = x_{\text{max}} - x_{\text{min}}$$

For the IQ scores listed in Table 5 in Worked example 1.7B, the range would be 130 – 88 = 42.

Range is not a very informative measure of spread because it is based on only two scores rather than all the data. As such, it gives no indication of how the scores are spread along the range and it is considered an unreliable measure of variability.

Standard deviation

Standard deviation (SD) is the most common and most precise measure of variability from the sample mean. The standard deviation uses information for each score in the dataset and gives us a measure of how much, on average, the scores differ from the mean.

standard deviation
a statistical measure of the average deviation of scores from the mean, calculated as the square root of variance

Study tip

The SD indicates the amount of variability (or certainty) in the sample mean. The higher the SD, the greater the variability in the distribution, which lowers the certainty in the sample mean estimate.

Study tip

The standard deviation for a sample is calculated differently than for a population. In your psychology studies, you will only calculate the standard deviation for samples.

Study tip

There is no rule for determining whether an individual standard deviation of a distribution is high or not. Typically, the variability of two or more datasets is compared.

The standard deviation:

- describes the sample distribution, indicating whether the scores are clustered or more spread out around the mean
- tells us how well the mean represents the sample.

Standard deviation for a sample is given by the formula:

$$SD = \sqrt{\frac{\Sigma(X - M)^2}{n - 1}}$$

where X is the score, M is the mean, and n is the sample size.

When to use standard deviation

Like the mean, standard deviation is sensitive to outliers. Standard deviation is the most appropriate measure of variability to use when:

- level of measurement is interval or ratio
- there are no outliers
- data has a normal distribution.

Note that the QCAA General Senior Syllabus for Psychology 2025 does not require you to calculate standard deviation; however, you must understand what standard deviation is, and knowing how it is calculated, as shown in Worked example 1.7C, will help you achieve that understanding.

Worked example 1.7C

Calculating standard deviation

Calculate the standard deviation of the IQ scores shown in Table 5.

Note: The purpose of this worked example is to help you understand what standard deviation is and what it represents. You may use a calculator.

TABLE 5 IQ scores of 12 students in a Year 6 class

Student	IQ score	Student	IQ score
John	88	Hanna	111
Robert	94	Jacob	111
Kiet	99	Adelina	119
Luke	102	Ahmed	125
Kerry	105	Arisa	125
Shelley	111	Akash	130

Think	Do
Step 1: Calculate the mean.	$M = \frac{\Sigma X}{n} = \frac{1320}{12} = 110$

<table>
<tr><th>Think</th><th>Do</th></tr>
<tr><td>Step 2: Calculate the difference between each score and the mean.</td><td>
<table>
<tr><th>Score</th><th>Subtract the mean</th><th>Deviance of score from mean</th><th>Variance, v</th></tr>
<tr><td>88</td><td>–110 =</td><td>–22</td><td></td></tr>
<tr><td>94</td><td>–110 =</td><td>–16</td><td></td></tr>
<tr><td>99</td><td>–110 =</td><td>–11</td><td></td></tr>
<tr><td>102</td><td>–110 =</td><td>–8</td><td></td></tr>
<tr><td>105</td><td>–110 =</td><td>–5</td><td></td></tr>
<tr><td>111</td><td>–110 =</td><td>1</td><td></td></tr>
<tr><td>111</td><td>–110 =</td><td>1</td><td></td></tr>
<tr><td>111</td><td>–110 =</td><td>1</td><td></td></tr>
<tr><td>119</td><td>–110 =</td><td>9</td><td></td></tr>
<tr><td>125</td><td>–110 =</td><td>15</td><td></td></tr>
<tr><td>125</td><td>–110 =</td><td>15</td><td></td></tr>
<tr><td>130</td><td>–110 =</td><td>20</td><td></td></tr>
</table>
</td></tr>
<tr><td>Step 3: Square the answers to remove the negative deviations.</td><td>
<table>
<tr><th>Score</th><th>Subtract the mean</th><th>Deviance of score from mean</th><th>Variance, v</th></tr>
<tr><td>88</td><td>–110 =</td><td>–22</td><td>484</td></tr>
<tr><td>94</td><td>–110 =</td><td>–16</td><td>256</td></tr>
<tr><td>99</td><td>–110 =</td><td>–11</td><td>121</td></tr>
<tr><td>102</td><td>–110 =</td><td>–8</td><td>64</td></tr>
<tr><td>105</td><td>–110 =</td><td>–5</td><td>25</td></tr>
<tr><td>111</td><td>–110 =</td><td>1</td><td>1</td></tr>
<tr><td>111</td><td>–110 =</td><td>1</td><td>1</td></tr>
<tr><td>111</td><td>–110 =</td><td>1</td><td>1</td></tr>
<tr><td>119</td><td>–110 =</td><td>9</td><td>81</td></tr>
<tr><td>125</td><td>–110 =</td><td>15</td><td>225</td></tr>
<tr><td>125</td><td>–110 =</td><td>15</td><td>225</td></tr>
<tr><td>130</td><td>–110 =</td><td>20</td><td>400</td></tr>
</table>
</td></tr>
<tr><td>Step 4: Average the sum of the squared deviations (known as variance, v).</td><td>$v = \frac{484+256+121+64+25+1+1+1+81+22+225+400}{12-1}$
$= 171.3$</td></tr>
<tr><td>Step 5: The standard deviation is equal to the square root of the variance.
$SD = \sqrt{variance}$</td><td>$SD = \sqrt{171.3} = 13.1$
The standard deviation of the sample is presented as SD = 13.1.</td></tr>
</table>

Standard deviation and outliers

Outliers are extreme scores. As we've seen, outliers can skew the distribution, resulting in misleading descriptive statistics. Therefore, outliers need to be identified so that the most appropriate statistics can be calculated.

Outliers can be identified by visually inspecting graphs to spot scores that are far away. However, this relies on subjective interpretation, and researchers prefer to use more objective ways to identify outliers.

One such way is to use the mean plus or minus three standard deviations (Howell, 1999). For example, using the IQ scores from Table 6:

$$\text{lower limit} = M - 3 \times \text{SD} = 110 - (3 \times 13.1) = 70.7$$

$$\text{upper limit} = M + 3 \times \text{SD} = 110 + (3 \times 13.1) = 149.3$$

Since none of the scores in the dataset are less than the lower limit of 70.7, nor higher than the upper limit of 149.3, we can conclude that there are no outliers.

Interquartile range

The interquartile range (IQR) divides the dataset into four equal quarters and indicates variability by calculating the difference between the first and third quartiles. This is represented mathematically as:

$$\text{IQR} = \text{Q3} - \text{Q1}$$

Higher IQR indicates greater variability or spread of scores in the dataset.

When to use interquartile range

IQR is the most appropriate measure of variability to use when:

- the level of measurement is ordinal
- you have calculated the median
- the data does not have a normal distribution.

Worked example 1.7D

Calculating interquartile range

Calculate the IQR of the IQ scores shown in Table 6. (2 marks)

TABLE 6 IQ scores of 12 students in a Year 6 class

Student	IQ score	Student	IQ score
John	88	Hanna	111
Robert	94	Jacob	111
Kiet	99	Adelina	119
Luke	102	Ahmed	125
Kerry	105	Arisa	125
Shelley	111	Akash	130

Think	Do
Step 1: Organise the scores sequentially.	88, 94, 99, 102, 105, 111, 111, 111, 119, 125, 125, 130
Step 2: Divide the dataset into four equal portions and identify Q1, Q2 and Q3.	88, 94, 99, 102, 105, 111, 111, 111, 119, 125, 125, 130 Q1 Lower quartile; Q2 Middle quartile (median); Q3 Upper quartile
Step 3: Calculate Q1 and Q3 if needed.	$\text{Q1} = \frac{99+102}{2} = 100.5$ $\text{Q3} = \frac{119+125}{2} = 122.0$
Step 4: Subtract Q1 from Q3.	IQR = Q3 − Q1 = 122.0 − 100.5 = 21.5

Your turn

Calculate the IQR for the following dataset: 13, 16, 30, 17, 20, 29, 20, 24, 30, 16, 20, 28. Show your working. (2 marks)

Worked example 1.7E

Calculating interquartile range from box and whisker plots

Calculate the interquartile range (IQR = Q3 – Q1) for the noisy test condition. Show your working. (2 marks)

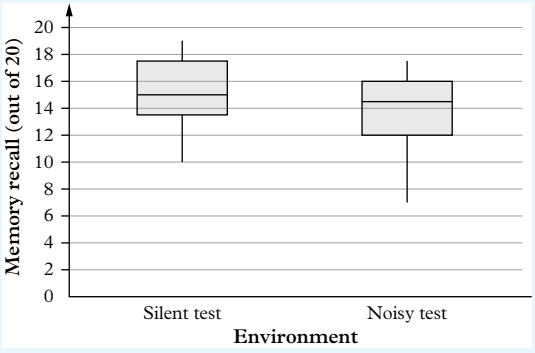


FIGURE 17 Graph showing the median and IQR of scores for participants in the noisy and silent environments

Think	Do
Step 1: Identify the cognitive verb.	The cognitive verb is "calculate", which means to work out the amount or number of something mathematically.
Step 2: Identify cues in the question.	Cues are instructions or other pieces of information that are needed to answer the question. Cues in this question include the IQR formula and the instruction to "show working".
Step 3: Identify how many marks this question is worth and plan your response.	This question is worth 2 marks, so 1 mark is likely to be for the correct answer and 1 mark is for showing the working.
Step 4: Draft the response.	1 Inspect the graph and make sure to choose the correct condition. 2 Use a ruler to draw lines from the top of the box (Q3) and the bottom of the box (Q1) that are parallel to the axis. 3 Read the corresponding *y*-values and substitute into the formula. 4 IQR = Q3 – Q1 = 16 – 12 = 4
Step 5: Check that you have completed all the steps as per your plan in step 3. If necessary, update your draft response and present the final answer.	The IQR for the noisy test condition is 4.

Your turn

Calculate the interquartile range (IQR = Q3 – Q1) for the silent test condition. Show your working. (2 marks)

Introducing uncertainty

statistic
numerical value that describes aspects of a sample

parameter
numerical value that describes aspects of a population

A **statistic** is a numerical value that describes aspects of the data collected from a sample, while a **parameter** describes a population. In most psychological investigations, researchers do not have access to population parameters and instead, use statistics to estimate population parameters.

All measurements and estimates are subject to uncertainty, or a degree of unknown variability. Uncertainty arises from many sources including random measurement error and, of course, variability in people.

Uncertainty reduces the confidence with which we can make inferences and draw conclusions about the findings. Two methods to help us identify uncertainty in the data are standard error and confidence intervals.

Standard error

standard error
numerical value that quantifies the variability of the sample mean estimate with respect to the true population mean

While standard deviation is a statistic that tells us about how well the mean represents the sample data, **standard error** (SE) (or standard error of the mean) tells us how well the sample mean estimates the population mean.

Standard error is given by the formula:

$$SE = \frac{SD}{\sqrt{n}}$$

where SE = standard error, SD = standard deviation, and n = the sample size

Study tip

SE indicates the amount of variability in the sample mean estimate. A lower SE indicates that the sample mean is a more accurate estimate of the population mean, which leads to higher certainty in the conclusions drawn. The converse is also true.

From the mathematical formula, we can see that the lower the variability in the sample (that is, the lower the SD), the lower the SE. Similarly, increasing the sample size reduces SE.

SE is visually shown as error bars on a column graph.

Confidence intervals

confidence interval
range of values, derived from sample statistics, that is likely to contain the value of an unknown population parameter

confidence level
a percentage that reflects the proportion of times the confidence interval is likely to contain the true population parameter (e.g. mean)

Confidence intervals (CI) provide a range of estimated values within which we can be confident that the true population parameter lies.

Confidence intervals are associated with a specific **confidence level** (CL), which represents the proportion of times that the interval would contain the true population mean if the study were repeated many times. In psychology, we typically estimate to a 95% confidence level.

95% confidence level is calculated using the following formula:

$$95\%\ CL = 1.96 \times SE$$

From this, we can calculate the 95% confidence interval:

$$95\%\ CI = M \pm 95\%\ CL$$

The confidence interval is reported as a range: 95% CI [lower bound, upper bound] where the lower bound is the mean minus the CL and the upper bound is the mean plus the CL.

Similar to SD and SE, CI can be displayed as error bars on a graph.

Worked example 1.7F

Calculating confidence intervals

The IQ scores of 12 Year 6 students were recorded (M = 110, SD = 13.1). **Calculate** the 95% confidence interval of the sample.

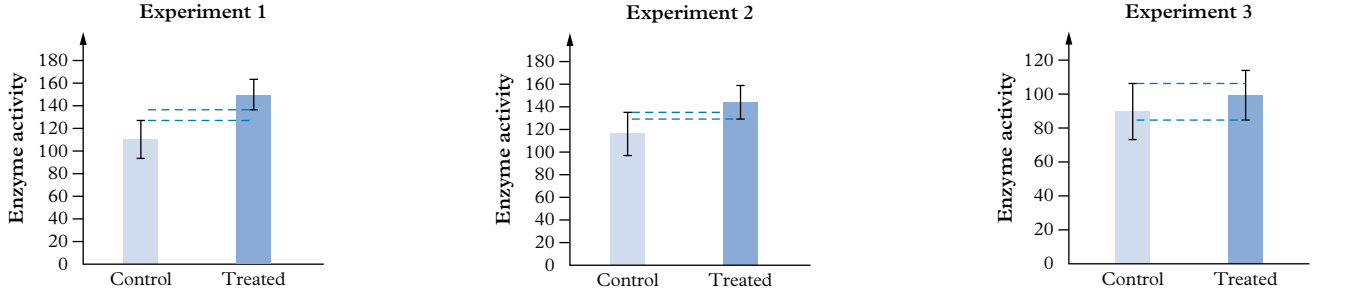
Think	Do
Step 1: Calculate the confidence level.	$95\%\ \text{CL} = 1.96 \times SE$ $= 1.96 \times \frac{SD}{\sqrt{n}}$ $= 1.96 \times \frac{13.1}{\sqrt{12}}$ $= 7.4$
Step 2: Calculate the upper and lower bounds of the interval.	Lower bound $= M - 95\%\ \text{CL}$ $= 110 - 7.4$ $= 102.6$ Upper bound $= M + 95\%\ \text{CL}$ $= 110 + 7.4$ $= 117.4$
Step 3: Report the confidence interval.	95% CI [102.6, 117.4]

Your turn

Calculate the 95% confidence interval for a sample of 24 students with a mean IQ of 111 and a standard deviation of 13. Show your working. (2 marks)

Making inferences using error bars

There is a lot of controversy over using confidence intervals to draw conclusions because they are not as precise as using a p-value. However, the appeal is that conclusions about statistical significance can be drawn by visually inspecting a graph where the error bars represent confidence intervals. Rules for visually interpreting statistical significance using confidence intervals are (Cumming & Finch, 2005) summarised in Figure 18.



No overlap between the error bars indicates that the **difference** between conditions/groups **is statistically significant**.

If error bars overlap by **less than 50%**, the **difference** between the conditions/groups **is statistically significant** (the 50% is of one CI).

If error bars **overlap by more than 50%**, the difference between conditions/groups is **not statistically significant**.

FIGURE 18 Inferring statistical significance from confidence intervals

Study tip

Make sure that you identify the type of error bar being used (SE or CI) when interpreting statistical significance. If in doubt, refer to the *p*-value for a more objective measure of significance.

We can also infer statistical significance using SE error bars. Recall that confidence intervals are a multiple of standard error (CI = 1.96 × SE) and therefore the bars are always longer than SE. Thus, CI error bars make it easier to identify when results are not likely to be significant than SE error bars.

Introducing measuring relationships

Unlike the experimental method, the correlational method makes no attempt to manipulate variables (Lesson 1.4). Rather, the intent of such a study is usually to establish the strength and direction of the relationship that may exist between the two observed variables.

Correlation coefficients

A correlation coefficient is a statistical measure of the strength and direction of a relationship. It is a numerical value, expressed as a decimal between –1.00 and +1.00 (Figure 19). The direction of the relationship is indicated by the sign, "+" or "–", of the coefficient.

- A "+" sign indicates that the relationship is positive: A positive correlation is one in which the two variables change in the same direction – that is, as one increases, so does the other, or as one decreases, so does the other. For example, we might expect to find a positive correlation between hours spent studying each week and results in Senior Psychology – meaning that as the number of hours spent studying each week increases, there is an associated increase in average study scores in Psychology.
- A "–" sign indicates that the relationship is negative: A negative correlation is one in which the two variables change in the opposite direction – that is, as one increases, the other decreases. For example, we might expect to find a negative correlation between hours spent playing online games and study scores for Psychology – meaning that as the number of hours spent playing online games increases, there is an associated decrease in average study scores in Psychology.

The strength of the relationship is determined by the absolute value of the correlation coefficient. The closer the value is to 1.00 the stronger the relationship, while a value of 0 indicates no relationship. The stronger the relationship, the more confidently we can predict changes in one variable as another changes. It is important to remember, however, that even with a perfect correlation of 1.00, a causal conclusion cannot be drawn.

Study tip

When interpreting correlation coefficients, identify the strength and direction separately. This is because a "–" symbol indicates the direction of the relationship rather than an integer value that is less than zero.

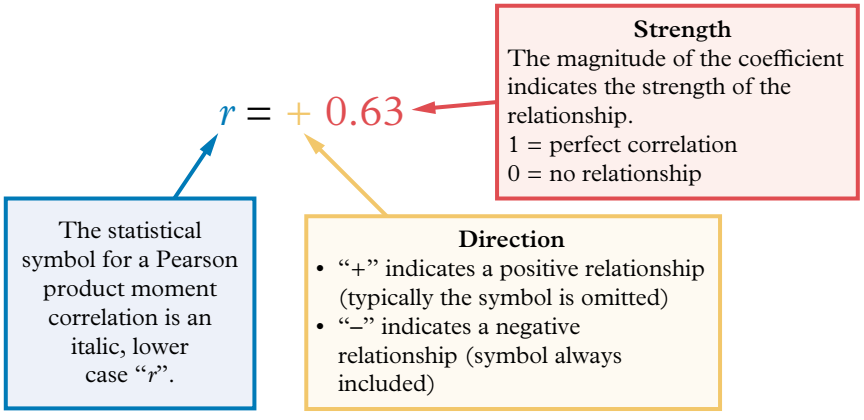


FIGURE 19 A correlation coefficient communicates the strength and direction of the relationship between two variables.

Describing strength of relationship

The strength of a correlation coefficient can be described based on its numerical value (Figure 20). A correlation is often described as:

- **weak** or low if the *r*-value is greater than 0 up to 0.30
- **moderate** if the *r*-value is greater than 0.30 and less than 0.70
- **strong** if it is greater than 0.70.

These ranges are a rough guide and can change in different texts. People may also prefer to use descriptors such as low, moderate and high.

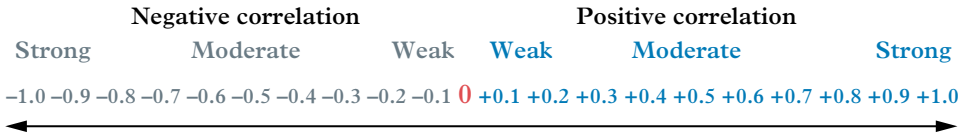


FIGURE 20 Negative and positive correlation

Study tip

In statistics, you may come across the statistical symbols *R*, *r*, or even r^2. These are all different types of statistics that offer different information about the data. When reporting your work, it is important to communicate scientifically and use the correct statistical symbol. In your QCE Psychology course, you are only concerned with *r*, the correlation coefficient.

Types of correlation coefficients

The **Pearson product moment correlation**, denoted, *r* measures the linear relationship between two continuous variables: a change in one variable (variable A) is associated with a proportional change in the other variable (variable B).

In contrast, the Spearman correlation, denoted r_s, measures the relationship between two ordinal variables and uses the ranked values for each to examine how the variables tend to change together, but not necessarily at a constant rate. Note, if one variable is continuous while the other is not, you should also use a Spearman's correlation.

Pearson product moment correlation
a measure of the strength of the linear relationship between two continuous variables

Examining relationships with scatterplots

The relationship between variables can also be examined using a scatterplot (Figure 21). Visual inspection of the trendline indicates the direction of the relationship, while the spread of dots indicates the strength. The closer the dots are to the trendline, the stronger the relationship.

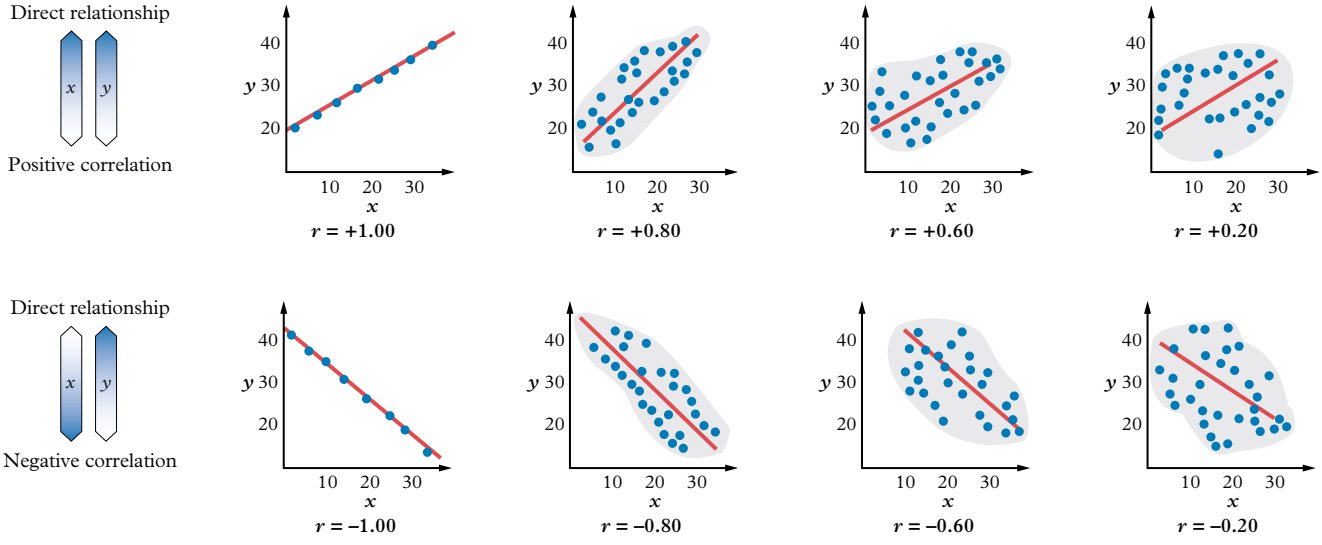


FIGURE 21 Scatterplots showing relationships and correlations – the scatterplots show various strengths and directions of correlation, from perfect positive correlation to perfect negative correlation.

Introducing inferential statistics

As discussed at the start of this lesson, the goal of research is to gather evidence to test the hypothesis and help answer the research question. Descriptive statistics help us organise, summarise and present data to make meaning, whereas inferential statistics help us draw conclusions about the findings.

Inferential statistics, as the name suggests, are mathematical processes that help us make inferences about the findings of a study. Typically, we use a statistical method called null hypothesis testing. In simple terms, we calculate the probability (represented by a ***p*-value**) of the null hypothesis being true and compare it to a pre-determined level of statistical significance (α).

***p*-value**
decimal value indicating the probability that observed results occurred by chance under the assumption that the null hypothesis is true

In psychology, the level of statistical significance that is most used is 5%, which is expressed in decimal form, 0.05. If the probability of the null hypothesis being true is less than the level of significance, that is, $p < 0.05$, the results are said to be statistically significant. This means we are confident that we do not have sufficient evidence to support the null hypothesis. We consequently reject the null hypothesis and gain confidence that the alternative hypothesis is true. On the other hand, if the *p*-value is greater than 0.05 we are not confident that the evidence is sufficient to reject the null hypothesis, so we accept the null hypothesis and lose confidence that the alternative hypothesis is true.

So how do we calculate *p*-values?

Study tip

Recall from Lesson 1.3 that the null hypothesis predicts that there will be no statistically significant relationship (correlation design) or no statistically significant difference (experimental design).

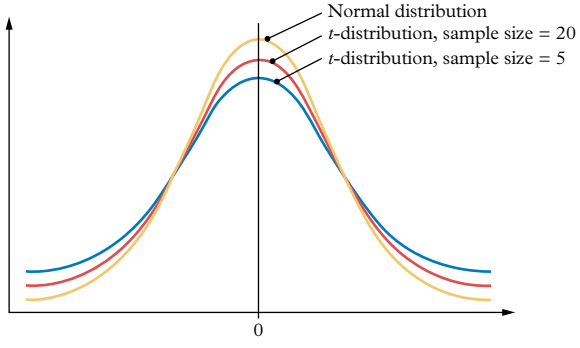
Tests of statistical significance

Researchers collect data through experiments or observations and use that data to calculate a test statistic (e.g. *t*-statistic) that measures the degree of difference between the observed data and what would be expected if the null hypothesis were true, and then determine the probability (*p*-value) of the observation. Here, we will look at parametric *t*-tests.

Parametric *t*-tests

***t*-test**
comparison of means in data that reveals how significant the differences are

A parametric ***t*-test** is a statistical method used to determine whether there is a significant difference between the means of two groups or between the mean of one group and a known standard. The *t*-test uses the *t*-distribution, which is similar to the normal distribution but flatter. The shape of the curve depends on the number of participants.



Source: Gravetter and Wallnau (2014)

FIGURE 22 Example *t*-distributions compared to normal distribution

The *t*-test calculates a *t*-statistic (symbol *t*) using the sample data, which represents the difference between the group means relative to the variability in the data. For the difference between two sample means, the *t*-statistic is calculated using the following formula:

$$t = \frac{M_1 - M_2}{\sqrt{\frac{SD_1^2}{n_1} + \frac{SD_2^2}{n_2}}}$$

where:

- M_1, M_2 are the means of samples 1 and 2 respectively
- SD_1, SD_2 are the standard deviations of samples 1 and 2 respectively
- n_1, n_2 are the sample sizes of samples 1 and 2 respectively.

Study tip

You do not need to know or use this formula in your high school studies because you can use Excel or other online calculators to calculate a *t*-statistic. Furthermore, you don't need to record or report *t*-statistics, only the *p*-value which is calculated from it.

Assumptions of parametric *t*-tests

Parametric *t*-tests are widely used in psychological research and other sciences to test hypotheses about differences in means. They offer robust measures for analysing experimental data, provided the underlying assumptions are met:

- level of measurement
- independence
- normality
- equal variance.

Violations of these assumptions can change the interpretation of the results and reduce the certainty of the conclusion reached. Alternatively, non-parametric equivalent tests can be used when assumptions are violated.

The first two assumptions, level of measurement and independence, are controlled methodologically (i.e. through the design of the investigation):

- Level of measurement: Is the DV nominal, ordinal, interval or ratio? Parametric tests require interval or ratio data. For nominal or ordinal data, non-parametric equivalent tests should be used instead.
- Independence: Observations are independent of each other when the occurrence of the first has no effect on the probability of the other, and the dependent variable is measured at the interval or ratio level.

The remaining two assumptions need to be assessed during data processing.

- Normality: Parametric tests of statistical significance require data that has a normal distribution. **Normality** can be assessed by:
  - visually inspecting the shape of the distribution. That is, create a histogram, and if it resembles a bell curve with a hill in the middle that decreases on either side, then you can state that the normality assumption has been met. If the distributions are clearly skewed, state that the assumption has been violated
  - using the central limit theorem to assume normality if the sample (per group) is greater than 30 (Field, 2013; Gravetter & Wallnau, 2014). We will look at the central limit theorem shortly.
- Equal **variance** (or homoscedasticity): The variances in the two groups are equal when conducting an independent samples *t*-test. To assess this assumption:
  - compare the standard deviation scores to see whether they are similar. Note: this method is subjective and should consider the context of the data
  - use Levene's test. Academics prefer objective ways to assess **homogeneity of variance**, such as Levene's test. You can use online calculators for this. To interpret the results of Levene's test, a *p*-value greater than 0.05 indicates that the variances are equal; that is, the assumption is met. If the assumption is violated, choose a *t*-test for unequal variances.

Presuming the assumptions are met, a *t*-test can be conducted and the results interpreted with confidence.

normality
the assumption that a dataset is approximately normally distributed, following the classic bell-shaped curve

variance
a statistical measure of the spread of data, calculated as the average of the squared differences from the mean

homogeneity of variance
the assumption that different samples or groups have similar variances in their respective distributions

Types of *t*-tests

There are different types of *t*-tests. Make sure that you choose the one that is most appropriate based on the type of experimental design you have chosen.

- Independent samples *t*-tests (or unpaired *t*-tests) are used to compare the means of two independent experimental groups (e.g. males vs females on a psychological trait).
- Dependent samples *t*-tests (or paired *t*-tests) are used to compare the means of two related groups; that is, groups from a repeated measures or matched experimental design.

Mann-Whitney U test
non-parametric test of statistical significance used to compare differences between two independent groups with either ordinal data or continuous data that does not have a normal distribution

Wilcoxon signed-rank test
non-parametric test used to compare two matched samples, or repeated measurements with either ordinal data or continuous data that does not have a normal distribution

central limit theorem
given a sufficiently large sample size, the sampling distribution of the sample mean will approximate a normal distribution, regardless of the shape of the population distribution

Violations of assumptions

Where testing reveals violations of assumptions, the violations should be identified as limitations and sources of uncertainty in your evaluation. Alternatively, you could use an equivalent non-parametric test of statistical significance; however, these are not required by the syllabus.

- The **Mann-Whitney U test** is an alternative to the unpaired *t*-test as it does not require the assumption of normal distributions. The U test is used to compare the differences between two groups when the dependent variable is either ordinal or continuous.
- The **Wilcoxen signed-rank test** can similarly be used as an alternative to the paired *t*-test, when the population cannot be assumed to be normally distributed. It is used to compare two from the same or matched set of participants.

The central limit theorem

Somewhere along the way, some very clever statisticians demonstrated that when samples are large enough (30 or more), the sampling distribution will approximate a normal distribution (Field, 2013, Gravetter & Wallnau, 2014). This is known as the **central limit theorem** (CLT). Furthermore, *t*-tests are fairly robust against violations of the normality assumption (Knief & Forstmeier, 2021), meaning that we can use the CLT to "test" for normality.

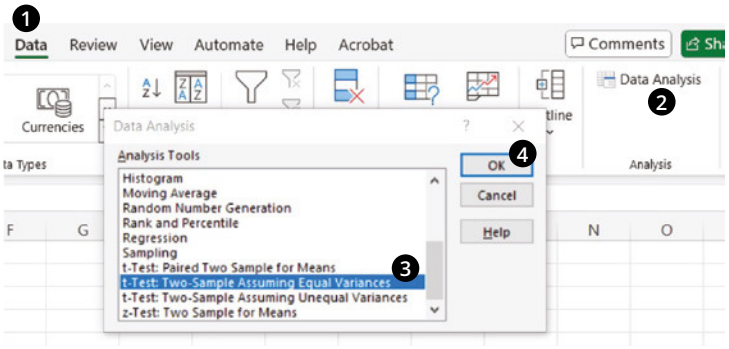
Calculating *p*-values from *t*-tests using Excel

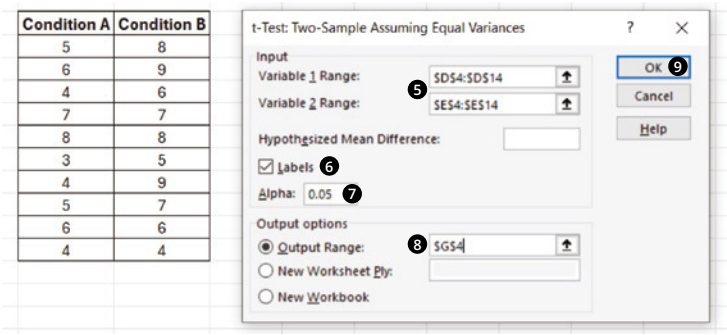
The good news is that you don't require fancy or expensive statistical software to calculate *p*-value from *t*-tests, you can use the "Data analysis" tool in Excel.

Worked example 1.7G

Calculating *p*-values from *t*-tests using Excel

Calculate the *p*-value from *t*-tests using the Data analysis tool in Excel.

Think	Do
Step 1: In the Excel menu, click on "Data". Step 2: Select "Data analysis" from the menu. Step 3: From the pop-up menu, select the type of *t*-test you need. For: • Repeated measures, select "*t*-test: Paired Two Sample for Means" • Independent groups, select either "*t*-test: Two Sample Assuming Equal Variances" if the variances are equal, or "*t*-test: Two Sample Assuming Unequal Variances" if the variances are not equal. Step 4: Click "OK".	

Think	Do
Step 5: Select the data range for variable 1 and for variable 2. Step 6: Check the "Labels" box if your data selection from Step 5 includes column headings (recommended). Leave blank if they do not. (Hint: including column headings makes it easier to interpret the result.) Step 7: Check the level of statistical significance (α) is correct; the default is 0.05. Step 8: Choose where in Excel you would like the results to be displayed. Step 9: Click "OK".	
Step 10: The results are presented in a table and include p-values for both one-tailed (A, directional hypothesis) or two-tailed (B, non-directional hypothesis) t-tests.	t-Test: Two-Sample Assuming Equal Variances 10 *Condition A* *Condition B* Mean 5.2 6.9 Variance 2.4 2.766666667 Observations 10 10 Pooled Variance 2.583333333 Hypothesized Mean Difference 0 df 18 t Stat -2.365068368 P(T<=t) one-tail 0.014730267 A t Critical one-tail 1.734063607 P(T<=t) two-tail 0.029460533 B t Critical two-tail 2.10092204

Your turn

Use the data shown in the worked example to practise calculating the p-value. (1 mark)

Interpreting experimental *p*-values

When interpreting experimental p-values, keep the following in mind:

- If $p < 0.05$, then we reject the null hypothesis and accept the alternative hypothesis. The alternative hypothesis predicts that there will be a statistically significant difference between the groups and that the difference in the means between the experimental group(s) and the control group are not due to chance. We are therefore confident that the measured changes in the DV were caused by changes in the IV.
- If $p > 0.05$, then we accept the null hypothesis and reject the alternative hypothesis. This means that the difference in mean values between the groups was not sufficiently large for us to be confident that it wasn't just a coincidence. We cannot infer a cause-and-effect relationship, and therefore conclude that the IV did not affect the DV.

Interpreting correlational *p*-values

Calculating a p-value from the Pearson product moment correlation coefficient, r, involves assessing the statistical significance of the observed correlation between two variables. The process typically relies on the sample size (n) and the correlation coefficient itself to

determine the likelihood that the observed correlation could have occurred by chance if the true correlation in the population is zero (null hypothesis).

When interpreting correlational *p*-values, keep the following in mind:

- If $p < 0.05$, then we reject the null hypothesis and accept the alternative hypothesis. The alternative hypothesis predicts that there will be a statistically significant relationship between the two variables.
- If $p > 0.05$, then we accept the null hypothesis and reject the alternative hypothesis. This means that the sample is not large enough to detect a statistically significant relationship.

Check your learning 1.7

Check your learning 1.7: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the three measures of uncertainty that can be represented as error bars. (3 marks)

2 **Identify** what statistic the vertical bar in a column graph represents. (1 mark)

3 **Describe** the characteristics of a normal distribution. (3 marks)

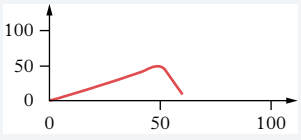
4 **Explain** how to identify outliers in a dataset. (2 marks)

5 **Explain** the central limit theorem. (2 marks)

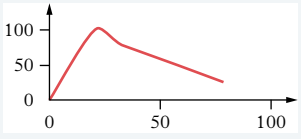
6 **Identify** the assumptions that need to be tested to use parametric *t*-tests. (4 marks)

7 **Identify** whether the following graphs are positively or negatively skewed.

a (1 mark)



b (1 mark)



8 **Calculate** the mean, median and mode of the following data: 20, 23, 23, 25, 25, 26, 29, 33, 35, 31, 29, 22, 27, 28. (3 marks)

Analytical processes

9 **Determine** the most appropriate visual representation for the following types of data

a showing an experiment with a categorical independent variable (1 mark)

b plotting raw data points from a correlational design (1 mark)

c demonstrating demographic data. (1 mark)

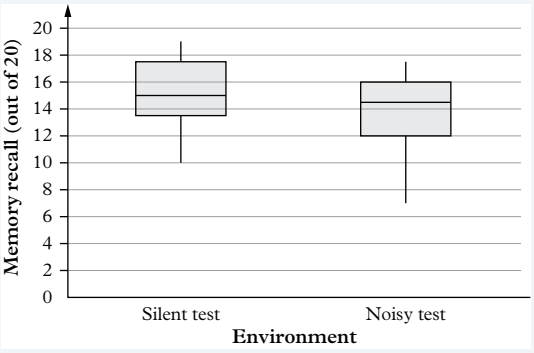
10 **Sequence** the following correlation coefficients in order of increasing strength.
$r = +0.35$, $r = -0.60$, $r = +0.28$, $r = -0.89$, $r = +0.70$ (1 mark)

11 **Distinguish** between the types of conclusions that can be drawn from a *p*-value for experimental and correlational studies. (1 mark)

12 **Analyse** the following graph.

a **Identify** the median for the silent condition. (1 mark)

b **Contrast** the IQR for the silent and noisy test conditions. (1 mark)



Knowledge utilisation

13 Professor Prada investigated whether personality type is related to the proportion of income spent on clothes. She assessed participants on the extroversion–introversion scale and found the following results:

Group	Proportion of net income spent on clothes
Extroverts	45%
Introverts	33%

Professor Prada uses a *t*-test and finds that, for this difference, $p = 0.06$.

a **Identify** the trend, pattern or relationship between personality type and income spent on clothes. (1 mark)

b **Draw a conclusion** about the effect of personality type on spending. Use evidence to support your answer. (2 marks)

c **Determine** the generalisability of the results. Use evidence to support your answer. (3 marks)

14 A researcher investigated the effectiveness of a new sleep hygiene intervention aimed at improving cognitive performance. Participants ($n = 35$) were recruited locally. Each participant underwent a cognitive performance under two conditions: once after their usual sleep routine (baseline) and once after 2 weeks of adhering to the new sleep routine. Cognitive performance is measured using a scale of 0 to 100, where higher scores indicate better results.

Sleep routine	M	SD
Usual sleep routine (baseline)	62	8
After new sleep routine	68	7

Determine the most appropriate test of statistical significance to use. **Justify** your response. (2 marks)

Lesson 1.8
Evaluating evidence

Key ideas

- → A conclusion is a judgment about the hypothesis and/or research question. Generalisations extend conclusions beyond the study to broader population and context.
- → Limitations limit a researcher's ability to confidently answer the research question, generalise the findings or extrapolate to a claim.
- → The quality of an investigation depends on the extent to which the evidence is reliable (consistent) and valid (measured what was intended). Uncertainty and confounding variables reduce the quality of the evidence.
- → Secondary sources should be evaluated for biases, currency, relevance, authority and accuracy. Peer-review is a control measure to verify the quality of published research.

Learning intentions and success criteria

Science inquiry skills

This lesson provides support for the following science inquiry skills:

- select, synthesise and use evidence to
  - explain findings
  - construct scientific arguments
  - draw conclusions, using *p*-values to infer significance, allowing for the possibility of type I and II errors
- extrapolate findings to determine unknown values, predict outcomes and evaluate claims
- use data and reasoning to discuss and evaluate the reliability and validity of evidence
- judge the reliability and validity of the experimental process
  - reliability of observers (selection, training)
  - reliability of psychological tests/measures
  - internal validity and external validity
  - validity of psychological tests/measures
- suggest improvements and extensions to minimise uncertainty, address limitations and improve the overall quality of evidence
- identify and explain the uncertainty associated with conclusions, with reference to limitations of the data, including violations of the assumptions of inferential tests, e.g. small sample size
- appreciate the role of peer review in scientific research

Study tip

Scientists typically avoid using the term "prove" in describing their findings. The scientific method allows for the formulation of hypotheses, theories and laws that can be supported or refuted by data, but it seldom offers the absolute certainty implied by "proof" due to limitations of the methodology, uncertainty, errors, complexity and reasoning flaws.

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Drawing conclusions

conclusion
an evidence-based decision about the hypothesis and/or research question

A **conclusion** is the final decision about what the results mean in terms of whether the evidence "supports" or "does not support" the hypothesis (student experiment) or the claim (research investigation) and the corresponding answer to the research question. The overall conclusion takes into account the findings, uncertainty and limitations, and also the overall evaluation of the quality of the investigation (the reliability and validity of the evidence).

generalisation
a judgment about the extent to which the research findings can be applied outside the study

A **generalisation** is a judgment about the extent to which the research findings can be applied to populations, environments or tasks outside of the study. The extent to which results from a sample can be generalised depends on:

- the representativeness of the sample
- methodological limitations
- reliability and validity of the procedures
- statistical significance of the findings.

extrapolate
extend or project known information to estimate unknown values or outcomes beyond the original observation range, based on the trends and patterns identified in the data

Extrapolation refers to the process of extending or projecting results beyond the original scope of the study, to evaluate a claim or make predictions. This means using the data collected and the trends, patterns or relationships observed within the controlled conditions of a study to make inferences about what might happen in situations or populations that were not directly studied.

justify
to provide sound reasons or evidence in support of a decision

A **justified** conclusion is one that:

- logically follows from the collected evidence and adheres to sound reasoning
- is supported by empirical data and aligns with established theories, demonstrating consistency and transparency in how it was derived
- acknowledges any limitations that influence the quality and generalisability of the findings.

Introducing limitations and uncertainty

Limitations are assumptions, features or constraints from an investigation that limit a researcher's ability to confidently answer the research question, generalise the findings or extrapolate to a claim. Limitations can arise from various aspects of the research process, including constraints in the research question, the design and methodology (including sample size), and ethical considerations.

Uncertainty refers to the ambiguity that exists in data or findings. Uncertainty can be identified by looking for:

- contradictory or incomplete data
- alternative explanations (confounding variables)
- uncertainty calculations
- measurement errors
- type I and type II errors.

limitation
assumption, feature or constraint from an investigation that limits a researcher's ability to confidently answer the research question, generalise findings or extrapolate to a claim

uncertainty
ambiguity that exists in data or findings

Sample size as a limitation

Sample size is a methodological limitation that can affect uncertainty, or **precision**, in sample estimates.

A larger sample size:

- reduces the effect of outliers and reduces the variability in the results (indicated by lower standard deviation and interquartile range)
- leads to more precise estimates (indicated by lower standard error and confidence intervals), which enhances reliability
- better represents the target population, which increases external validity and the ability to generalise the findings.

The opposite is likely to occur for smaller sample sizes.

precision
the extent to which repeated observations or measurements yield similar results

What is a considered a large or small sample?

There isn't a strict rule that universally defines a "small" or "large" sample size. In psychological research, the appropriate size of the sample varies based on the research question, the specific statistical analysis used, the expected effect size, and variability of the data. A general rule of thumb is to consider the central limit theorem. Statistically, a sample of 30 or above is considered to approximate a normal distribution.

There are other factors you can also consider:

- Compare your sample to previous research: Look at similar studies in the literature to see what sample sizes have been commonly used. This can provide a point of reference to judge whether your sample size is in line with what other researchers have used for similar studies.
- Consider variability: If your sample size is small, pay attention to the variability within your data. High variability can reduce the confidence in your findings, while low variability might make your results more convincing.
- Acknowledge limitations: In your research report, acknowledge any limitations related to sample size. Highlight that a small sample size is less likely to be representative of the target population, which limits the generalisability of the findings.
- Suggest extension: If your study suggests interesting findings despite a small sample, recommend that future research with larger sample sizes could further investigate and validate your findings.

Type I and type II errors as a source of uncertainty

It is also important to be aware of errors as a source of uncertainty when deciding to accept or reject a hypothesis on *p*-values. Acceptance or rejection of the null hypothesis is based on the level of statistical significance (α) set by the researcher before conducting the study. In psychological research, the α-level is usually 0.05; however, in medical research the -level is set much lower at 0.01 or even 0.001. Since hypothesis testing is based on probabilities, it is possible that we incorrectly reject or accept the null hypothesis when the opposite is true. This gives rise to errors.

type I error
when a true null hypothesis is incorrectly rejected, also known as a "false positive"

type II error
when a false null hypothesis is not rejected, also known as a "false negative"

- If $p < 0.05$, it is possible that we are making a **type I error**, which is incorrectly rejecting the null when it is true. This is also known as a false positive because we have incorrectly accepted the alternative hypothesis.
- If $p > 0.05$, it is possible that we are making a **type II error**, which occurs if we incorrectly accept the null hypothesis when it is false. A type II error is also called a false negative.

While there are yet more statistical methods that help us determine the likelihood of a type I or type II error having occurred, we won't really know until the study is replicated. You can identify the type of error that may have occurred as a source of uncertainty in your analysis.

The quality of research

The purpose of conducting research is to be able to provide an answer to the research question with confidence. Researchers seek answers to important real-world questions that can have applications in education, health, business, sports, environment, the legal system, technology, the military, marketing and public policy. However, the research is not meaningful if the results are not reliable and valid.

Therefore, it is equally important for researchers and those who use their work to be able to critically evaluate the quality, or the reliability and validity, of the evidence. Experimental processes and evidence that are reliable and valid can be used to predict outcomes and evaluate claims.

Reliability

reliability
the degree to which an experiment, test or any measuring procedure yields the same results on repeated trials

In psychological research, the reliability of the experimental process ensures that the findings are consistent and replicable. **Reliability** refers to the degree to which an experiment, test or any measuring procedure yields the same results on repeated trials. The experimental process is reliable if it produces similar results under similar conditions. Reliability can be assessed by using a correlation; the stronger the correlation, the higher the reliability.

There are different types of reliability related to the experimental process; these are summarised in Table 1.

TABLE 1 Types of reliability related to the experimental process

Type of reliability	Description	How to evaluate	How to improve
Internal reliability	The extent to which a study or instrument is consistent within itself	Consider: • low precision in measurements due to random error • lack of standardised instructions and processes.	• Use standardised instructions and processes. • Reduce sources of random error. • Increase sample size.

internal reliability
the extent to which a study or instrument is consistent within itself

Type of reliability	Description	How to evaluate	How to improve
	Internal consistency is internal reliability calculated across items within a test instrument.	Measure using correlational techniques; a higher *r*-value indicates higher internal consistency.	Use a more reliable instrument.
External reliability	The extent to which a study or instrument yields findings that are consistent across repeated measures	Ask if the findings of the study are: • replicable (by the same researchers, using the same instruments under the same conditions) • reproducible (measuring the same quantity under changed conditions) • consistent with other researchers.	• Use reliable and precise instruments. • Use standardised procedures and instructions. • Reduce sources of error and confounds.
	Inter-rater reliability is external reliability calculated across individuals. A reliable instrument should give consistent results no matter who administers or grades it.	Consider the level of agreement or consistency between different observers or raters. Lower inter-rater reliability suggests that the ratings may be influenced by rater subjectivity or bias.	• Select properly trained raters, or train raters on the techniques to use for scoring. • Clearly operationalise variables (stating how the variable(s) will be measured). • Use a score sheet.
	Test-retest reliability is external reliability calculated across time. Low test-retest reliability suggests that either the testing conditions are not consistent or the instrument is problematic.	Consider the strength of the correlation between multiple attempts (by the same or different researchers). Stronger correlation indicates higher test-retest reliability.	• Use standardised instructions and processes. • Check the instrument design.

internal consistency
internal reliability calculated across items within a test instrument

external reliability
consistency of a measure or test across different occasions or different observers

inter-rater reliability
the extent to which different observers or raters agree in their assessments

test-retest reliability
the stability of test scores or measurements over time with repeated administrations

Study tip

You will most often see "observer reliability" referred to as "inter-rater reliability" in psychology references.

Validity

The **validity** of the experimental process is the extent to which the research or instrument accurately measured what it was intended to measure. Validity ensures that the conclusions drawn from the research are trustworthy and can be used to support broader theories or applications.

- **Internal validity** refers to whether the effects observed in a study are due to the manipulation of the independent variable and not other factors. It ensures that the study is methodologically sound and that the cause-and-effect relationships are accurately identified within the study.
- **External validity** concerns the extent to which the findings from a study can be generalised to other contexts beyond the study's setting, including other populations, locations and times. It is essential for the applicability of the research findings to real-world settings.

Both types of validity are reduced by confounding variables. These are summarised in Table 2.

validity
the extent to which a study or instrument accurately measures what it intends to measure

internal validity
the extent to which the observed changes in a study can be attributed to the manipulation of the independent variable and not other factors

external validity
the extent to which the findings of a study can be generalised

TABLE 2 Controlling errors and confounding variables in research

Possible confound	Description	Control procedures (to do *before* the experiment)	Effect on the quality of the study
Systematic error	Can be caused by: • confounding variables and bias • instrumental errors. Detect by examining the experimental process or inspecting data.	• Carefully design the experiment. • Inspect and test equipment (e.g. calibrate and zero before use). • Use test instruments with demonstrated validity and in the manner for which they are intended.	Decreases accuracy and reduces internal validity
Random error	Can be caused by: • variations in procedures or instructions • confounds related to participants • unreliable instruments. Detect by examining the experimental process or inspecting data. High variability in measurements indicates random error.	• Use standardised instructions and procedures • Increase the sample size.	Decreases precision and reduces internal reliability, which, in turn, reduces internal validity
Sample bias	Caused by a non-representative sample. Detect by comparing the sample characteristics to those of the target population.	Use a better sampling procedure, e.g. stratified sampling, to obtain a more representative sample.	Reduces external validity (or population validity); findings may not be generalisable to the target population
Participant variables	Caused by individual differences among participants that can influence the outcome. Detect by inspecting the data; for example, did one group perform much better than the other because of the independent variable or because they had certain characteristics (such as higher average IQ) that could provide an alternative explanation?	Use • random allocation • repeated measures • matched pairs.	Reduces interval validity if the outcome could be due to participant variables rather than the independent variable
Demand characteristics	Caused by participants guessing the aim of the experiment and changing their behaviour	Use: • independent groups experimental design • blinding • deception • standardised instructions and procedures.	Reduces the study's reliability and internal validity

Possible confound	Description	Control procedures (to do *before* the experiment)	Effect on the quality of the study
Order effects	Caused by participants' responses changing because of the order in which the experiment is conducted; for example: • practice effect: improved performance over time due to repeated testing • fatigue effect: declined performance over time due to fatigue or boredom	• Use independent groups or matched design • Counterbalance the order of conditions or randomise the order for each participant.	Reduces internal validity if performance changed due to order effects rather than the independent variable
Attrition	Caused by participants dropping out of the study	• Use designs with shorter time frames (e.g. independent groups or cross-sectional designs) • Provide incentives • Over-sample initially.	Reduces validity as the final sample may differ from the initial sample
Cohort effect	Caused by differences in characteristics or experiences of particular age groups that may affect outcomes	Use cross-sectional methods, or ensure the sample includes multiple cohorts.	Reduces validity; results may be specific to one cohort and not applicable to others
Placebo effect	Caused by actual or perceived improvements due to participants' belief that they are receiving real treatment	Use single-blind procedure.	Reduces interval validity if performance changed due to the placebo effect rather than the independent variable
Experimenter effect	Caused by cues given by the experimenter that change the outcome	Use double-blind procedure.	Reduces internal validity if performance changed due to the experimenter effect rather than the independent variable
Situational variables	Caused by changes in the environment or inconsistencies in the experimental procedure	Use standardised instructions and procedures.	Reduces reliability and internal validity
Mundane realism	Caused by using artificial tasks or stimuli	Use more realistic tasks.	Reduces external validity and the ability to generalise findings to the real world
Artificial environment	Caused by conducting the study in an artificial or contrived environment	Use naturalistic observation.	Reduces external, ecological validity and the ability to generalise findings to the real world

Study tip

Demand characteristics and experimenter effects are confounding variables, but come from different sources. Demand characteristics come from participants and experimenter effect comes from the researcher.

Validity and psychological test instruments

There are different types of validity related to psychological test instruments:

face validity
a subjective judgment on the extent to which a psychological instrument appears to measure what it is supposed to measure

content validity
whether a test comprehensively accounts for all the relevant aspects of the construct it aims to assess

predictive validity
how well a test score or measure predicts outcomes or behaviours in the future

concurrent validity
the extent to which a test correlates with a benchmark test or measure taken at the same time

- **Face validity** is a subjective judgment of whether a psychological test *appears* to measure what it claims to measure. For example, do the questions on your exam appear to assess the content you learnt in class?
- **Content validity** reflects whether a psychological instrument measures all aspects of the construct it intends to measure. For example, an IQ test should assess a variety of cognitive functions related to intelligence, such as verbal skills, abstract thinking and memory.
- **Predictive validity** gauges the instrument's ability to predict relevant future outcomes such as an individual's performance or behaviour. For example, correlating students' university GPA with their high school ATAR to determine whether ATAR has high predictive ability.
- **Concurrent validity** refers to the degree to which scores on one measure of intelligence are correlated to scores on another measure taken at the same time. This is measured by correlating test results from the current instrument with those from an established, validated instrument measuring the same construct.

When psychologists select instruments for evaluation or diagnoses, it is important that the instruments are valid and measure what they intend to measure.

Evaluating secondary sources

For both your student experiment and research investigation, you will need to conduct your own research to choose good sources and evaluate the quality of evidence from those secondary sources.

When you conduct research, seek out credible sources. Credible sources are those that are current, relevant to your investigation, come from authoritative sources, and have reliable and valid evidence. Sources of information such as opinions (personal views), anecdotes (story) and non-scientific ideas have low credibility and may not be suitable to the aim of the investigation.

Here are some criteria you can use to assess the quality of secondary sources before relying on them for your investigations:

- **Currency**: Ensure the source is up-to-date and relevant to current understandings in the field.
- **Relevance**: Choose sources that are directly related to your research question or hypothesis, and that contribute meaningfully to your investigation.
- **Authority**: Check the credentials of the author or organisation responsible for the content.
- **Accuracy and verifiability**: High-quality sources present information that can be verified through citations and references to primary research, official data or other reliable secondary sources.
- **Objectivity**: Assess the source for potential biases. Scholarly and peer-reviewed articles tend to be more objective, whereas materials from advocacy groups or commercial entities may have inherent biases.

Peer review is an essential component of scientific research, acting as a quality control mechanism. When researchers submit a study for publication, other experts in the same field evaluate their work. These peer reviewers critically assess the study's methodology, data analysis, results and conclusions, ensuring the research is robust and sound, and adds value to the field. Thus, peer-reviewed journal articles make excellent secondary sources.

peer review process where experts in a field evaluate the quality and accuracy of a research paper, study or scholarly work before it is published

It is also important that you don't only read information that suits your hypothesis or research question. A well-rounded literature review looks at all sides of a theory. For example, if you were researching the effects of caffeine on memory, your literature review would need to present prior research that supports and refutes the impact of caffeine on memory.

Check your learning 1.8

Check your learning 1.8: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Recall** which statistic is used to draw conclusions in psychological research. (1 mark)
2 **Identify** three sources of uncertainty. (3 marks)
3 **Describe** what limitations are. (1 mark)
4 **Explain** why sample size is important in research. (1 mark)
5 **Explain** how you would detect a potential type I or type II error. (2 marks)

Analytical processes

6 **Distinguish** inter-rater reliability from test-retest reliability. Include examples for each. (3 marks)
7 **Compare** external and internal validity. (2 marks)
8 **Distinguish** generalisation and extrapolation. (1 mark)
9 **Explain** how you would detect the following sources of uncertainty when analysing a secondary source. **Determine** whether the uncertainty would impact the reliability, validity or both of an investigation.
   a Results that are inconsistent with other research (2 marks)
   b Bias (2 marks)
   c Order effects (2 marks)
10 Dr Johnson conducted a study to investigate how cultural background affects people's perception and therefore preference for Vegemite. She surveyed 50 Australian students and 50 international students and found that 45 of the Australian students liked Vegemite, while only 10 international students liked it ($p = 0.045$).
   Infer whether a type I or type II error may have occurred. (1 mark)

Knowledge utilisation

11 Search online for the news article titled "The mixed-up brothers of Bogota". In the article, journalist Susan Dominus reports the story of how one twin from each of the two sets born on the same day in the same hospital were swapped. They ran into each other by accident and compared how similar their lives were despite different upbringings.
   Evaluate the credibility of the article as a secondary source for a research investigation on the claim "Intelligence is fixed". Copy the table and record your evaluation. (1 mark for each step)

Criteria	Evaluation
Currency	
Relevance	
Authority	
Accuracy and verifiability	
Objectivity	

Lesson 1.9
Communicating scientifically

Learning intentions and success criteria

Key ideas

→ Scientific writing has its own particular requirements and expectations around terminology, representations, and conventions for reporting and referencing.

Science inquiry skills

This lesson provides support for the following science inquiry skills:

- use appropriate psychological terminology, representations and conventions for reporting research
- acknowledge sources of information with standard scientific referencing conventions

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

oxforddigital **This lesson is available on Oxford Digital.**

Lesson 1.10
Preparing for your data test

Learning intentions and success criteria

Key ideas

→ The data test requires you to apply understanding of the dataset, analyse the data presented and interpret the evidence presented by the data.

→ Prepare for your data test by participating in class practicals and practising your science inquiry skills.

Assessment objectives

This lesson provides support for achieving the assessment objectives for a data test:

2. Apply understanding of Units 1 or 2 subject matter to given algebraic, visual or graphical representations of scientific relationships and data to determine unknown scientific quantities or features.
3. Analyse data about Units 1 or 2 subject matter to identify trends, patterns, relationships, limitations or uncertainty in datasets.
4. Interpret evidence about Units 1 or 2 subject matter to draw conclusions based on analysis of datasets.

Source: Adapted from *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

oxforddigital **This lesson is available on Oxford Digital.**

Lesson 1.11
Conducting your student experiment

Key ideas

→ The student experiment requires you to conduct your own practical by modifying an existing experiment.

→ Ensure that ethical and informed consent obligations will be met before you start your experiment.

→ If you write a scientific report to present your findings, consider following APA style.

Learning intentions and success criteria

Assessment objectives

This lesson provides support for achieving the assessment objectives for a student experiment:

1. Describe ideas and experimental findings about Units 1 or 2 subject matter.
2. Apply understanding of Units 1 or 2 subject matter to modify experimental methodologies and process data.
3. Analyse experimental data about Units 1 or 2 subject matter.
4. Interpret experimental evidence about Units 1 or 2 subject matter.
5. Evaluate experimental processes and conclusions about Units 1 or 2 subject matter.
6. Investigate phenomena associated with Units 1 or 2 subject matter through an experiment.

Source: Adapted from *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

This lesson is available on Oxford Digital.

Lesson 1.12
Conducting your research investigation

Key ideas

→ The research investigation requires you to evaluate a claim about a significant issue from your study of psychology.

→ You must use credible sources to answer your research question.

→ To avoid bias, it is good practice (but not necessary for your research investigation) to consider sources that both support and refute the claim.

Learning intentions and success criteria

Assessment objectives

This lesson provides support for achieving the assessment objectives for a research investigation:

1. Describe ideas and findings about Units 1 or 2 subject matter.
2. Apply understanding of Units 1 or 2 subject matter to develop research questions.
3. Analyse research data about Units 1 or 2 subject matter.
4. Interpret research evidence about Units 1 or 2 subject matter.
5. Evaluate research processes, claims and conclusions about Units 1 or 2 subject matter.
6. Investigate phenomena associated with Units 1 or 2 subject matter through research.

Source: Adapted from *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

This lesson is available on Oxford Digital.

Lesson 1.13
Preparing for your exams

Learning intentions and success criteria

Key ideas

→ Exam preparation should be an ongoing process throughout your course, which includes managing your class time and at-home study wisely.

→ Use exam techniques and understanding of the cognitive verbs to maximise your exam outcomes.

Assessment objectives

This lesson provides support for achieving the assessment objectives for an examination:

1. Describe ideas and findings about Units 1 and 2 subject matter.
2. Apply understanding of Units 1 and 2 subject matter.
3. Analyse data about Units 1 and 2 subject matter to identify trends, patterns, relationships, limitations or uncertainty.
4. Interpret evidence about Units 1 and 2 subject matter to draw conclusions based on analysis.

Source: Adapted from *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

This lesson is available on Oxford Digital.

MODULE 1

Lesson 1.14
Review: Psychology toolkit

Summary

1.1
- Psychology is the scientific study of human behaviour and mental processes.
- Studying psychology can lead to a diverse range of career pathways.
- QCE Psychology is divided into units and topics.
- The science inquiry skills and their application are important for success in QCE Psychology.

1.2
- Aboriginal and Torres Strait Islander peoples are the traditional custodians of the land we know now as Australia.
- Aboriginal and Torres Strait Islander cultures are the oldest living cultures in the world.
- Correctly acknowledging cultural and/or language groups, rejecting deficit discourse, avoiding Eurocentrism and critically evaluating sources of information can help you to respectfully engage with First Nations perspectives in QCE Psychology.

1.3
- The scientific method is a framework that helps to eliminate bias in research so that valid, evidence-based conclusions can be drawn.
- A research question is a clearly formulated question that defines the focus of an investigation.
- A hypothesis is a scientific prediction about the outcome of a study; there are different types of hypotheses: alternative (either directional or non-directional, and either experimental or correlational) and null.
- In psychology, we statistically test the probability of the null hypothesis being true.

1.4
- Each different type of scientific investigation and research design has strengths and weaknesses that need to be considered.
- Participants in a study can be selected through convenience, random or stratified sampling methods.
- Errors and confounds can influence the quality of results, but they can be minimised through careful design.

1.5
- Ethical principles should be applied in psychological research to ensure the safety and wellbeing of participants.
- Ethical understanding should be applied when conducting research by acknowledging sources and referencing.

1.6
- Data can be classified as qualitative (descriptive), quantitative (numerical), subjective (personal) or objective (non-personal), continuous or discrete (categorical).
- Levels of measurement include nominal, ordinal, interval or ratio in order of increasing precision and usability for statistical analysis.
- Psychologists use case studies, observations, self-reports, interviews and computerised instruments to systematically and safely collect information for research.
- Researchers use logbooks to systematically record information, observations and data.

1.7
- Statistics are mathematical procedures that help us to make sense of data.
- Descriptive statistics are numerical or graphical methods used to summarise and organise data in a meaningful way.
- Inferential statistics allow us to interpret meaning from the data such as drawing conclusions, making inferences and predictions.
- Statistics, tables and figures should be represented scientifically.

1.8
- A conclusion is a judgment about the hypothesis and/or research question. Generalisations extend conclusions beyond the study to broader population and context.
- Limitations limit a researcher's ability to confidently answer the research question, generalise the findings or extrapolate to a claim.
- The quality of an investigation depends on the extent to which the evidence is reliable (consistent) and valid (measured what was intended). Uncertainty and confounding variables reduce the quality of the evidence.
- Secondary sources should be evaluated for biases, currency, relevance, authority and accuracy. Peer-review is a control measure to verify the quality of published research.

1.9
- Scientific writing has its own particular requirements and expectations around terminology, representations, and conventions for reporting and referencing.

1.10
- The data test requires you to apply understanding of the dataset, analyse the data presented and interpret the evidence presented by the data.
- Prepare for your data test by participating in class practicals and practising your science inquiry skills.

1.11
- The student experiment requires you to conduct your own practical by modifying an existing experiment.
- Ensure that ethical and informed consent obligations will be met before you start your experiment.
- If you write a scientific report to present your findings, consider following APA style.

1.12
- The research investigation requires you to evaluate a claim about a significant issue from your study of psychology.
- You must use credible sources to answer your research question.
- To avoid bias, it is good practice (but not necessary for your research investigation) to consider sources that both support and refute the claim.

1.13
- Exam preparation should be an ongoing process throughout your course, which includes managing your class time and at-home study wisely.
- Use exam techniques and understanding of the cognitive verbs to maximise your exam outcomes.

Review questions 1.14A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 A research study categorises participants into groups such as "creative", "musical" or "sporty". The level of measurement being used is
- **A** nominal.
- **B** ordinal.
- **C** interval.
- **D** ratio.

2 Dr Brown conducts a study where she observes children in a playground without participating or interfering with their activities. What type of observation is Dr Brown using?
- **A** Controlled
- **B** Participant
- **C** Naturalistic
- **D** Structured

3 A sociologist uses census data to examine the demographic changes in a region over the past 50 years. What type of data are they using?
- **A** Primary qualitative
- **B** Secondary quantitative
- **C** Primary quantitative
- **D** Secondary qualitative

4 The term that describes the ability to apply findings from a sample to a larger population, ensuring that the sample is representative of the population from which it was drawn, is
- **A** generalisability.
- **B** validity.
- **C** reliability.
- **D** standardisation.

5 When researchers manage all variables in a study to ensure that the results are solely due to the treatment and not other factors, the study is said to have high
A external validity.
B internal validity.
C concurrent validity.
D experimental validity.

6 Professor Bugs is researching the effects of increased vitamin intake through drinking carrot juice on eyesight. He gives his experimental group 125 mL of carrot juice each day, while he gives the control group carrot juice that has been boiled and cooled to remove the vitamin content. The purpose of the control group in this experiment is to
A show the effects of the independent variable.
B control or eliminate the effects of participant variables.
C form a basis for comparison with the experimental group.
D show the effects of the dependent variable.

7 Select the response that correctly identifies the characteristics of each type of research investigation.

	Experimental analysis	Experimental conclusion	Correlational analysis	Correlational conclusion
A	Scatterplot	Causal	Column graph	Non-causal
B	Scatterplot	Non-causal	Column graph	Causal
C	Column graph	Causal	Scatterplot	Non-causal
D	Column graph	Non-causal	Scatterplot	Causal

8 The type of research design that involves testing different age groups only once is known as
A longitudinal.
B cross-sectional.
C sequential.
D matched pairs.

9 Inferential statistics are statistical procedures. They allow us to
A prove or disprove a hypothesis.
B draw conclusions from data.
C describe the properties of the data gathered.
D manipulate data and calculate standard scores.

10 A researcher wishes to use deception in an experiment, where participants would believe that they were taking part in research that investigated their ability to solve visual puzzles on a computer, but in reality the computer would "crash" near the end of the test and their emotional response to the frustration would be measured.

Identify the statement that best describes this scenario.
A This research would be ethical if no psychological or physical harm was caused to the subjects in the long term and debriefing procedures were carried out.
B This research would be ethical if the research aim was considered sufficiently important and the ethics committee of the researcher's university had approved it, and debriefing procedures were carried out.
C This research would be ethical if the subjects gave informed consent about the deceit and debriefing procedures were carried out.
D This research would be unethical since deceit in research can never be ethical and is not permitted even if debriefing procedures are carried out.

11 How does sample size affect the standard error of the mean?
A Increasing the sample size has no effect on the standard error.
B Increasing the sample size increases the standard error.
C Increasing the sample size decreases the standard error.
D The standard error is only affected by the range of the sample, not the size.

12 A researcher investigated the effect playing video games had on academic success. He compared the memory skills for learning a list of 40 botanical names of plants of students who spent more than 5 hours per week playing games with the memory skills of students who spent less than 5 hours per week playing video games.

What is the dependent variable and how is it operationalised in this research?
A Excessive time spent playing video games; number of hours per week spent playing video games
B Students who play video games; more than 5 hours per week spent playing video games
C Academic success; average percentage score in school examinations
D Academic success; score on test of memory of 40 botanical names of plants

Use the following information to answer questions 13 to 15.

A researcher investigated the effects of using a lavender-scented pillow on the sleep cycle of participants. It was hypothesised the pillows would decrease nightmares. The study included two groups of participants: group 1 was given lavender-scented pillows and group 2 was given pillows scented with other herbs. The researcher analysed the subjects' dreams for negative content the next day. The subjects were not aware of which herbs were thought to reduce nightmares and the researcher was not aware of which subjects were given the lavender or other herbs.

13 What type of design was used?

- **A** A single-blind design to eliminate the placebo effect
- **B** A single-blind design to eliminate subject expectations
- **C** A double-blind design to eliminate experimenter bias
- **D** A double-blind design to eliminate placebo and experimenter effects

14 Which one of the following ethical guidelines was violated in the study?

- **A** Confidentiality of participant information
- **B** Informed consent from participants
- **C** voluntary participation in the research
- **D** withdrawal rights for participants

15 Which of the following is most likely a confounding variable?

- **A** Attrition
- **B** Order effects
- **C** Demand characteristics
- **D** Participant variable (e.g. whether they have nightmares)

Review questions 1.14B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

16 **Describe** the following types of validity

- **a** ecological validity (1 mark)
- **b** mundane realism. (1 mark)

17 **Describe** a strength and limitation of using case studies in research. (2 marks)

18 **Explain** the role and bias of the experimenter with respect to ethical conduct of psychological research. (2 marks)

Analytical processes

Use the following information to answer questions 19 to 23.

A study was conducted to evaluate the effectiveness of a new teaching strategy aimed at improving test scores in mathematics for high school students. A sample of 25 students participated in the study. They were given a maths test before and after being taught for a term using the new strategy. The scores out of 100 were as follows:

Raw data:

Pre-teaching strategy test scores: 45, 48, 50, 51, 52, 54, 55, 56, 57, 58, 59, 60, 62, 63, 64, 65, 66, 67, 68, 70, 72, 74, 76, 82, 85

Post-teaching strategy test scores: 55, 56, 57, 58, 60, 61, 61, 62, 63, 64, 65, 66, 67, 68, 69, 70, 71, 72, 73, 74, 76, 78, 80, 86, 92.

Descriptive statistics:

	M	SD	SE
Pre-test	62.36	10.36	2.07
Post-test	68.16	9.32	

19 **Determine** the mode for the pre-teaching strategy condition. (1 mark)

20 **Identify** two characteristics of the data that make the mean the most appropriate measure of central tendency. (2 marks)

21 **Calculate** the standard error of the post-test condition. Use the formula $\text{SE} = \frac{\text{SD}}{\sqrt{n}}$. (2 marks)

22 **Identify** the trend in the mean values. (1 mark)

23 **Contrast** the standard deviation scores. (1 mark)

Knowledge utilisation

Use the following information to answer questions 23 to 30.

A guidance officer wished to compare the moods of Year 10 students after they had role-played being a victim of bullying (Condition 1) with their mood after they had role-played helping an injured person (Condition 2).

She decided to measure mood using a 40-item "mood test" downloaded from the internet. Responses were given on a scale of 1 to 10, with 1 being "depressed" and 10 being "elated".

The first 30 students on the school's alphabetical roll were measured. The role-plays took place on Monday afternoons, 1 week apart. The guidance officer made sure that half the students role-played Condition 1 the first week and Condition 2 the second, with the other half role-playing the conditions in the opposite sequence.

The results showed that the mean mood score for Condition 1 was 3.4 and the mean mood score for Condition 2 was 7.2. This difference was statistically significant ($p = 0.04$).

24 **Identify** the population in this research. (1 mark)

25 With respect to the sample

- **a** **identify** the type of sampling method used. (1 mark)
- **b** **determine** whether the sampling method was appropriate. **Justify** your response. (2 marks)

26 With respect to the variables in this research

- **a** **identify** the operationalised independent variable. (1 mark)
- **b** **identify** the operationalised dependent variable. (1 mark)

27 **Create** a directional, alternative hypothesis for the experiment. (1 mark)

28 Answer the following questions about the design.

- **a** **Identify** the experimental design used in this research. (1 mark)
- **b** **Explain** why the guidance officer made sure that "half the students role-played Condition 1 the first week and Condition 2 the second, with the other half role-playing the conditions in the opposite sequence"? (3 marks)
- **c** **Identify** the type of data collection method. (1 mark)
- **d** **Identify** the level of measurement of the dependent variable. (1 mark)

29 **Draw a conclusion** about the effect of the role-play on mood. (1 mark)

30 **Evaluate** the quality of the evidence by answering the following questions.

- **a** **Identify** a potential confounding variable, **describe** its effect on the quality of the study and **propose** an improvement. (3 marks)
- **b** **Identify** a limitation and **explain** how it affects the quality of the study. (2 marks)

Module 1 checklist: Psychology toolkit

Quizlet: Revise key terms online to test your understanding

UNIT 1

Individual development

Unit 1 overview

Since psychology became established as a science more than 120 years ago, its links with traditional and social sciences have enabled researchers to investigate and explain the many changes that take place as a person matures, grows and develops as a unique individual over a lifespan. Unit 1 examines how human behaviour and mental processes are shaped and how each person's brain functions slightly differently.

What makes you the person you are? What makes us unique, even though we are all human beings? Psychologists have taken up these questions and seek to understand the brain and the development of our specific behaviour and mental processes. The complex nature of our psychological development may be influenced in many ways – from the structure and function of our brains and nervous systems, to the many hereditary and environmental factors that influence the way we develop. This unit will explore the way our consciousness changes, and how sleep provides greater understanding of human behaviours and processes.

Unit 1 objectives

1. Describe ideas and findings about the role of the brain, cognitive development, and human consciousness and sleep.
2. Apply understanding of the role of the brain, cognitive development, and human consciousness and sleep.
3. Analyse data about the role of the brain, cognitive development, and human consciousness and sleep.
4. Interpret evidence about the role of the brain, cognitive development, and human consciousness and sleep.
5. Evaluate processes, claims and conclusions about the role of the brain, cognitive development, and human consciousness and sleep.
6. Investigate phenomena associated with the role of the brain, cognitive development, and human consciousness and sleep.

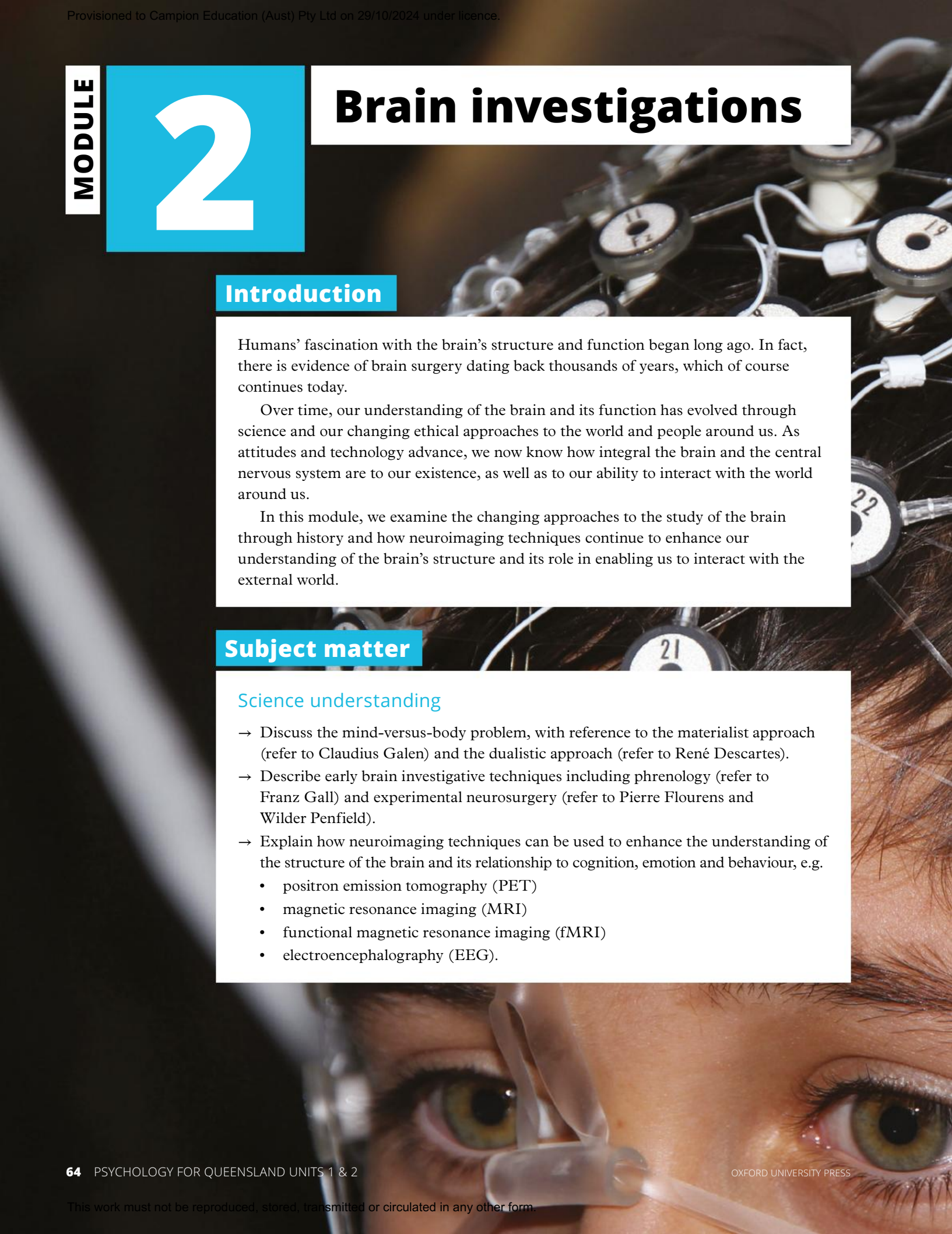
Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Unit 1 Topics

Topic	Module	
Topic 1 The role of the brain	**Module 2**	Brain investigations
	Module 3	The brain
	Module 4	The nervous system
Topic 2 Cognitive development	**Module 5**	Development and neural plasticity
	Module 6	Emotional and cognitive development
Topic 3 Consciousness, attention and sleep	**Module 7**	States of consciousness
	Module 8	Sleep
	Module 9	Sleep disorders

MODULE 2

Brain investigations



Introduction

Humans' fascination with the brain's structure and function began long ago. In fact, there is evidence of brain surgery dating back thousands of years, which of course continues today.

Over time, our understanding of the brain and its function has evolved through science and our changing ethical approaches to the world and people around us. As attitudes and technology advance, we now know how integral the brain and the central nervous system are to our existence, as well as to our ability to interact with the world around us.

In this module, we examine the changing approaches to the study of the brain through history and how neuroimaging techniques continue to enhance our understanding of the brain's structure and its role in enabling us to interact with the external world.

Subject matter

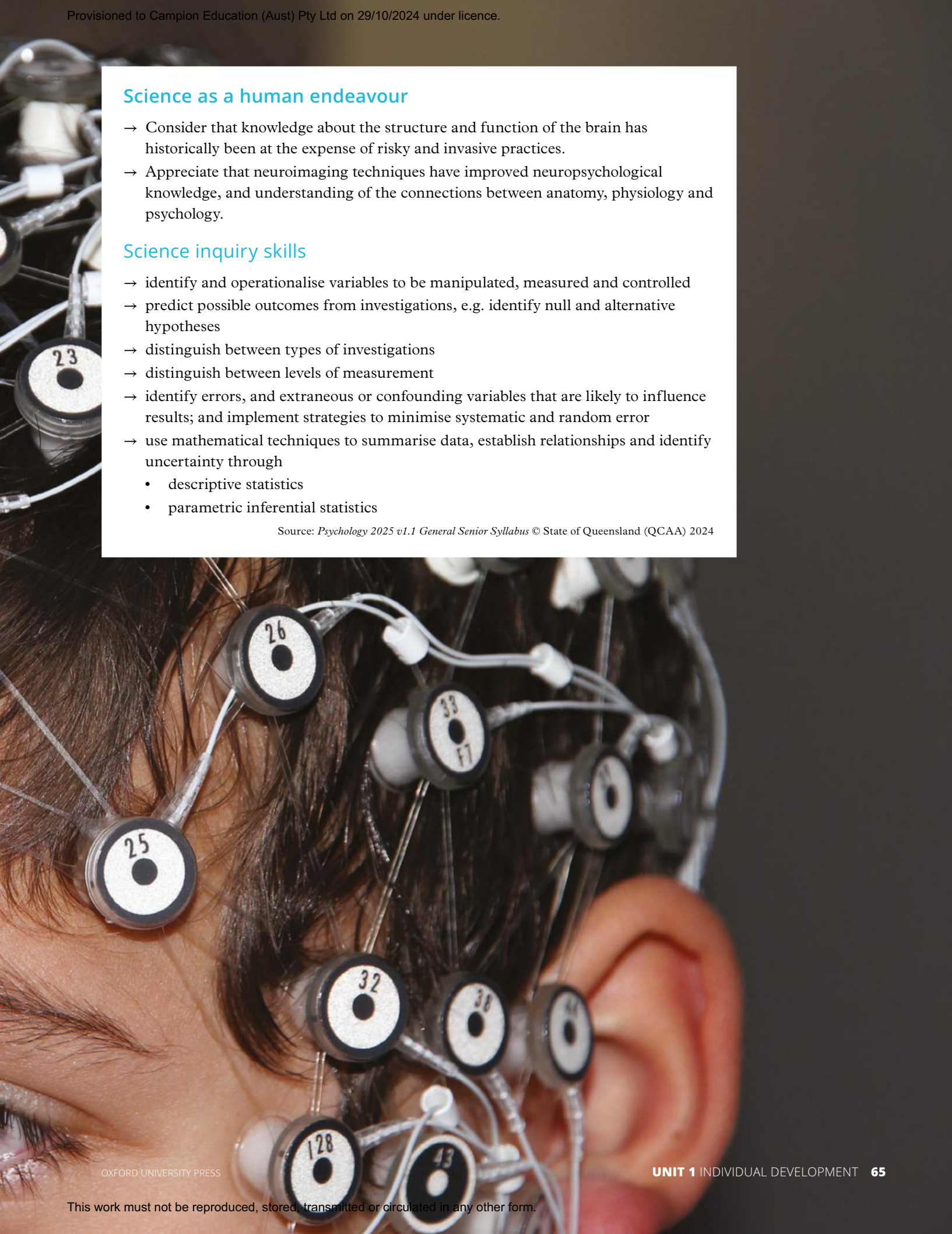
Science understanding

→ Discuss the mind-versus-body problem, with reference to the materialist approach (refer to Claudius Galen) and the dualistic approach (refer to René Descartes).

→ Describe early brain investigative techniques including phrenology (refer to Franz Gall) and experimental neurosurgery (refer to Pierre Flourens and Wilder Penfield).

→ Explain how neuroimaging techniques can be used to enhance the understanding of the structure of the brain and its relationship to cognition, emotion and behaviour, e.g.

- positron emission tomography (PET)
- magnetic resonance imaging (MRI)
- functional magnetic resonance imaging (fMRI)
- electroencephalography (EEG).



Science as a human endeavour

→ Consider that knowledge about the structure and function of the brain has historically been at the expense of risky and invasive practices.

→ Appreciate that neuroimaging techniques have improved neuropsychological knowledge, and understanding of the connections between anatomy, physiology and psychology.

Science inquiry skills

→ identify and operationalise variables to be manipulated, measured and controlled

→ predict possible outcomes from investigations, e.g. identify null and alternative hypotheses

→ distinguish between types of investigations

→ distinguish between levels of measurement

→ identify errors, and extraneous or confounding variables that are likely to influence results; and implement strategies to minimise systematic and random error

→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through

- descriptive statistics
- parametric inferential statistics

Lesson 2.1
Understanding the role of the brain

Key ideas

- → Attempts to understand the brain date back to prehistoric times.
- → The mind-versus-body problem considers the relationship between the mind and the body (which includes the brain).
- → Claudius Galen championed the materialist approach to the mind-versus-body problem, which says that the mind is the same thing as the body.
- → René Descartes championed the dualistic approach to the mind-versus-body problem, which says that the mind and body are separate.

Learning intentions and success criteria

Introducing the role of the brain

It is beneficial to understand how psychology has developed over time by looking at some early psychological investigations. In this lesson, we will briefly discuss developments in psychology over time with a focus on the mind-versus-body problem; that is, is the mind a separate entity from the brain and the body?

Psychology through the ages

Have you ever experienced a really bad headache? In prehistoric times, you might have been held down and had a hole drilled into your skull while you were awake – to be cured! Over the centuries, a range of physical and mental conditions have been attributed to evil spirits, demon possession, sorcery and angry gods. Exploration and debate regarding the role of the brain and its functions has continued over the centuries among philosophers and physicians. Our understanding of the brain has certainly followed some interesting – and controversial – paths.

Prehistoric times

Trephination

The first archaeological evidence of treating brain-related ailments and mental illness dates back to prehistoric times, approximately 6000 BCE, with a procedure known as trephination.

trephination
a surgical procedure that involves creating a hole in a patient's skull while they are still awake

Trephination involved making a surgical hole in the skull while the patient was awake. This was to allow a healing spirit in or an evil spirit out. Cave paintings show that this method was used to manage a range of conditions, including headaches, epilepsy and psychosis. There seemed to be an understanding that a range of symptoms were related to the head and possibly the brain of the patient. Many of the patients lived after the operation, with cave paintings showing scar tissue around the hole in the skull. Some skulls are shown with more than one surgically made hole.

Trephination still occurs today in the form of craniotomy, but with a clearer understanding of the brain and nervous system, and using far more sophisticated surgical instruments than the implements shown in Figure 2.

FIGURE 1 A Neolithic skull with a trephination – a hole in the skull – that was made with a sharp instrument, such as an obsidian-tipped tool.

FIGURE 2 Neolithic trephining tools, used to make a hole in the skull of a person suffering from severe headaches, epilepsy and other mental conditions.

Ancient times

Philosophical and physiological debate

While many ancient cultures continued to use trephination as a treatment method, the philosophers and physicians of ancient Greece and Egypt held conflicting views about the brain's role in physical and mental illness. The philosophers of ancient Greece (such as Plato and Aristotle) were interested in explaining the experience of consciousness and argued whether or not the mind (referred to as the "soul" in ancient times) was separate from the physical body. The ancient Egyptians attributed abnormal behaviours and physical illness to supernatural origins and used magic spells and prayer to help treat ailments. There was little understanding of the brain and nervous system. Indeed, they viewed the heart as the centre of intelligence and reason.

FIGURE 3 Ancient Egyptians would remove the brain during mummification, as it was considered an unimportant organ.

Claudius Galen

The Greek anatomist and philosopher Claudius Galen (130–210 CE) was one of the first to research the brain in detail. He conducted dissections on animals, mainly apes, to determine by inference and experiments how the human body was structured and how it worked. Galen showed, experimentally, the vital role of the brain. For example, cutting the medulla (which sits right above the spinal cord at the base of the brain) in the brain of animals resulted in stopping respiration (breathing).

He also observed people who had suffered strokes, and noted that they could lose a particular sense even though there was no apparent damage to the sensory organ. He deduced that the brain played an important role in sensation. This work contributed to the materialist approach to the mind-versus-body problem that is discussed later in this lesson.

Modern times

Thomas Willis

personality lasting and distinctive behaviours, thoughts, motives and emotions that typify how we react and adapt to other people and situations

phrenology a pseudoscience that suggests our mental abilities and personality are controlled by 37 areas of the brain and that the shape and size of the skull can be measured to determine a person's character

By the mid-seventeenth century, English doctor Thomas Willis (1621–75) had developed the terms "hemisphere" and "lobe" to discuss the brain, and theorised that particular cortical (brain) structures had specialised functions. Willis conducted an in-depth study of the brain and determined that automatic processes, such as breathing, heart rate and other motor functions, are controlled by specific areas of the lower brain. He also discovered the circle of arteries at the base of the brain, known as the "Circle of Willis".

Franz Gall

In 1796, Franz Joseph Gall (1758–1828), a neuroanatomist and physiologist, suggested that **personality** was directly linked to brain structures, and he is noted for the development of **phrenology**. His theory looks at the brain as an organ, where the shape of the skull reflects an individual's personality and intelligence. Although flawed, the theory links personality and intelligence with cortical structures. We will consider phrenology in more detail in Lesson 2.2.

Introducing the mind-versus-body problem

mind-versus-body problem a much debated and controversial question of whether the mind is a separate entity from the body, including the brain

body the physical being, including the brain

monism the view that the mind is the same thing as the brain

materialist approach the view that consciousness (the mind) results from the complex physical interactions between the neurons

neuron nerve cells, responsible for communication within the body

Raise your arm. Raise it up high, just as primary school students do when they want to answer a question. Did you raise your arm? If yes, why did you raise your arm? If no, why didn't you? What caused you to make the decision not to follow instructions?

The "raise your arm" instruction is a classic example that has been used over centuries to highlight one of the oldest and most debated topics in psychology: the **mind-versus-body problem**, which emerged with the ancient Greeks. The mind-versus-body problem asks, "Is the mind a separate entity from the brain and the body?"

Although we know that the brain is crucial to behaviour, the relationship between the brain and the mind is not clear. In terms of the mind-versus-body problem, the **body** consists of physical entities (parts), including the brain, and these entities can be measured physically in terms of size, mass, shape and density. The body occupies space and exists in time.

In contrast, the mind relates to mental processes, our self-awareness, our ability to reflect, think and reason about ourselves and the world. In other words, it relates to consciousness – our awareness of ourselves and our environment. Hence, the act of deciding to raise your arm demonstrates how the mind can cause change in the body – it can make you raise your arm.

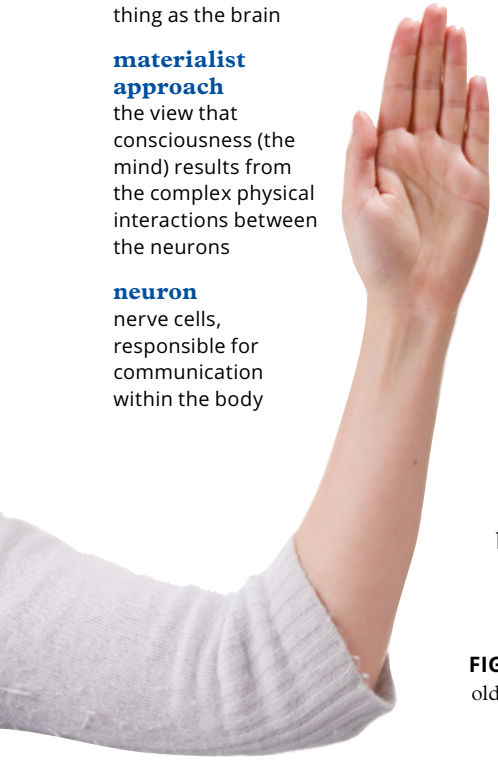


FIGURE 4 The "raise your arm" instruction is often used to introduce one of the oldest and most debated topics in psychology: the mind-versus-body problem.

Materialist approach

The view that the mind is the same thing as the brain (and hence the body) is known as **monism**. From a more biological perspective, the **materialist approach** to monism views consciousness (the mind) as a result of complex physical interactions between **neurons**. Hence, according to the materialist approach, we are simply "complicated physiological organisms" governed by the biological processes of our nervous systems (McLeod, 2007).

Claudius Galen completed experimental surgeries on animals in order to support his argument that the mind and body were one entity. He operated on live, squealing pigs to demonstrate that speech was controlled by the brain, even though the sounds seemed to come from the chest. When Galen tied off the pig's vocal cords, the squealing stopped but started again when the tie was released. However, when he cut the laryngeal nerve to the muscles controlling the vocal cords, the pig was no longer able to squeal and remained silent. Galen concluded that the brain controls all muscle movement as it has connections to the spine and peripheral nerves.

FIGURE 5 Claudius Galen viewed the mind and body as one entity.

Dualistic approach

The view that the mind is a separate entity from the body is known as dualism. According to the **dualistic approach**, the mind is our subjective experience (conscious awareness) and is non-physical or non-material. The mind is not composed of matter and cannot be physically measured in the same manner as the body (including the brain). The mind is therefore metaphysical and tied up with moral values, conscience and cultural experience, whereas the body is the physical aspect of the individual that can be observed and measured.

Dualism raises some fundamental questions:

- How can something non-physical (the mind) be related to something with physical characteristics (body/brain)?
- How can something non-physical (the mind) influence or produce changes in something that is physical (body/brain)?

dualistic approach the view that the mind is a separate entity from the body and that our conscious awareness is not physical

René Descartes and the dualistic approach

René Descartes (1595–1650) was one of the first thinkers to offer a systematic description of the relationship between the mind and brain. You may have heard of Descartes's famous philosophical conclusion: "Cogito ergo sum" (I think therefore I am).

Descartes attempted to explain the mind-versus-body problem in a dualistic way: he viewed the mind and body as two quite distinct systems. The mind is non-physical and responsible for our self-awareness, our ability to reflect, think and reason about ourselves and the world; in essence, our consciousness. An interaction exists between the mind and the body. The mind creates our real experience of the world and interacts with our body, and therefore our behaviour. In order to study the mind, one's thoughts and feelings ("I think") must be observed because they make us exist in our world ("therefore I am").

FIGURE 6 René Descartes viewed the mind and body as two distinct systems.

Descartes was deeply religious and never questioned our actual existence in this world. He believed that it is our non-material mind (or soul) that constructs our reality and causes us to "exist" – not our physical body. He believed that the body was controlled by the soul, something that only exists in humans, and that the mind and soul were synonymous. Indeed, the French word for "soul" *(ame)* is the same word for "mind". Hence, when a person dies, the physical body dies, but the "soul" continues to exist (McLeod, 2007).

Descartes was also a pioneering mathematician. He created the system of Cartesian coordinates, which ultimately led to the development of the statistical scientific methods that are used today in experiments to examine how one event can influence another; in other words, how one variable (cause – independent variable) can influence another variable (effect – dependent variable).

Study tip

You must be able to discuss the materialist and dualistic approaches to the mind-versus-body problem. Construct a table to contrast the approaches and deepen your understanding.

Check your learning 2.1

Check your learning 2.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the Greek anatomist who first researched the brain in detail. (1 mark)
2 **Describe** the mind-versus-body problem. (1 mark)
3 **Identify** the scientist who contributed to the materialist approach to the mind-versus-body problem. (1 mark)
4 **Describe** the mind-versus-body debate with reference to René Descartes. (1 mark)
5 **Explain** key ideas of the materialist approach to the mind-versus-body problem. (2 marks)

Analytical processes

6 **Contrast** Descartes' and Galen's views on the mind-versus-body problem. (1 mark)

Knowledge utilisation

7 **Evaluate** the usefulness of the materialist and dualistic approaches to the mind-versus-body problem. (4 marks)

Lesson 2.2
Early investigative techniques

Learning intentions and success criteria

Key ideas

→ Early brain investigative techniques include the pseudoscience phrenology, developed by Franz Gall in the late eighteenth century.
→ Experimental neurosurgery was pioneered by Pierre Flourens in the nineteenth century, with his ablation technique.
→ In the twentieth century, Roger Sperry and Michael Gazzaniga successfully used the corpus callosotomy to treat patients with epilepsy.
→ Also in the twentieth century, Wilder Penfield developed electrical stimulation of the brain and used it to map the functions of different regions of the brain.

Introducing early investigative techniques

Understanding the connection between brain structure and function remained a challenge up until the nineteenth century. Indeed, there were some very interesting and unusual approaches based on rather dubious notions about brain structure and function that gained support, despite the lack of scientific proof.

In this lesson, we will learn about early brain investigative techniques, including phrenology, case studies, autopsies and experimental neurosurgery.

Phrenology

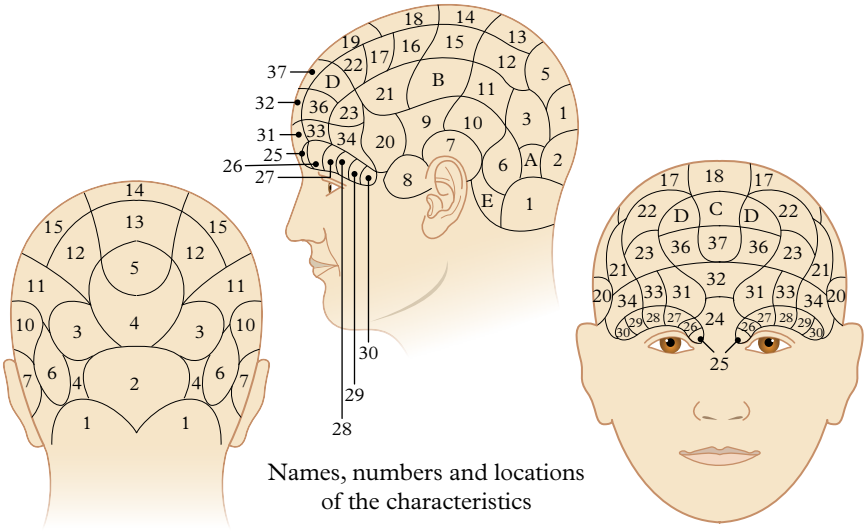
Originally known as "cranioscopy", phrenology was first developed in 1796 by Franz Joseph Gall (1758–1828). It was considered a legitimate science during the nineteenth century, despite the lack of empirical evidence (controlled experiments). Gall believed that mental abilities and personality were controlled by 27 specific brain organs, each corresponding to a different mental ability or personality trait, and which were supposedly located on the surface of the brain. The size of each brain organ was determined by how much it was used. Phrenologists strongly believed in the concept of "use it or lose it": areas of the brain that were used became larger, and areas that were not used shrank. The shape and size of the skull were also thought to change to accommodate the brain changes. By carefully examining the lumps, bumps and indentations of the skull, the phrenologist claimed to be able to determine a person's character, intelligence and a range of other traits responsible for a variety of behaviours and functions.

In 1800, Gall acquired a research assistant by the name of Johann Christoph Spurzheim (1776–1832), who was instrumental in changing the name "cranioscopy" to "phrenology", and added a further 10 brain organs to Gall's original 27, making a total of 37.

Figure 1 shows the locations of the 37 faculties or characteristics associated with phrenology, and Table 1 describes some of them.

Study tip

Try creating a visual timeline of the developments in psychology using images and/or key words.



Names, numbers and locations of the characteristics

1. Amativeness	13. Self-esteem	26. Size
A. Conjugal love	14. Firmness	27. Weight
2. Parental love	15. Conscientiousness	28. Colour
3. Friendship	16. Hope	29. Order
4. Inhabitiveness	17. Spirituality	30. Calculation
5. Continuity	18. Veneration	31. Locality
E. Vitativeness	19. Benevolence	32. Eventuality
6. Combativeness	20. Constructiveness	33. Time
7. Destructiveness	21. Ideality	34. Tune
8. Alimentiveness	B. Sublimity	35. Language
9. Acquisitiveness	22. Imitation	36. Causality
10. Secretiveness	23. Mirth	37. Comparison
11. Cautiousness	24. Individuality	C. Human nature
12. Approbativeness	25. Form	D. Suavity

FIGURE 1 In phrenology, certain areas of the brain are thought to be linked to specific characteristics.

TABLE 1 Some of the faculties or organs associated with phrenology

Faculty/Organ	Character	Associated behaviours
Friendship	Love of friends – disposition to associate	• Excess: excessive desire for company • Deficiency: neglect of friends and society; the hermit disposition
Inhabitiveness	Love of home – desire to live permanently in one place; adapted to the necessity of a home	• Excess: prejudice against other countries • Deficiency: a nomadic/roving disposition
Continuity	Ability to focus and complete a task/story	• Excess: excessive focus on a task/story until completion • Deficiency: excessive fondness for variety; cannot finish one task before moving on to another; impatient
Vitativeness	Love of life – youthful vigour even in advanced age	• Excess: extreme tenacity to life; fear of death • Deficiency: lack of interest in a long life, letting go despite good health and reason to live
Alimentiveness	Good appetite – pleasure in food and drink	• Excess: gluttony; lack of self-control with food/drink • Deficiency: poor appetite and enjoyment of food/drink
Acquisitiveness	Ability to save and accumulate savings/property	• Excess: miserly; greedy; theft; extreme selfishness • Deficiency: spend thrift, wasteful, inability to save
Calculation	Ability to calculate by mental arithmetic – to add, subtract, divide, multiply, etc.	• Excess: propensity to count everything • Deficiency: inability to add, subtract, divide or multiply any figures; complete lack of aptitude in this area
Causality	Ability to use reason – ability to understand cause and effect, originality	• Excess: excessive focus on theory with an inability to see the practical result; a philosophical mind that is neither practical nor scientific • Deficiency: inability to comprehend dependencies between cause and effect and to act accordingly

Phrenology and the psychograph

psychograph
an electric-powered device that uses the principles of phrenology to measure a person's head to provide an assessment of their personality

In 1931, Henry C. Lavery and Frank P. White invented the **psychograph**. It was an electric-powered device with 32 probes that automatically measured the lumps and bumps on a person's head (Figure 2). The device provided a printed assessment of the individual's personality based on the principles of phrenology, and included advice for self-improvement. Those who underwent the test and received their report claimed that it was "amazingly accurate".

Were the results really accurate, or did people just like what was said about them in the report? Could these people be objective? These questions point to the problem with many pseudosciences (beliefs and practices incompatible with the scientific method). If a personality description is worded in a positive and general manner, a person is more likely to believe it. After all, who wouldn't prefer to be described as "kind" than as "nasty"? This phenomenon is often referred to as the Barnum Effect (or Forer Effect), which was named after American showman and businessman Phineas T. Barnum (1810–91). Barnum made a fortune promoting hoaxes and human "curiosities" such as the Bearded Lady and Tom Thumb (Forer, 1949), and is reported (perhaps falsely) to have remarked, "There's a sucker born every minute."

Significance of phrenology

Despite the doubt about phrenology's status as a science, phrenology furthered the idea that the human brain is responsible for personality, emotions, perception and intelligence, and that different areas of the brain are responsible for different functions. Interestingly, more recent research has found that areas of the brain that are not used do indeed deteriorate. However, we now know that the shape and size of the skull remain the same, no matter what changes take place in the brain. Even though phrenology maintained its popularity up until the early 1930s, the thirst to understand the brain continued through more scientific means.

FIGURE 2 The psychograph was a device that measured the size and shape of the skull and provided a printout describing the person's personality.

Case studies

Case studies are in-depth studies of behaviour or events through observation, diagnostic tests, interviews and analysis of medical records. The relationship between the brain and behaviour became increasingly obvious when doctors began observing patients with severe head injuries in this way. Dramatic changes in personality, difficulty with memory tasks, and problems with language comprehension and using grammatically correct speech led to the development of hypotheses (predictions) about which areas of the brain were damaged.

Cases such as that of Phineas Gage (which you will learn about in Module 3), who survived after a metal rod was accidentally thrust through his skull in 1848, gave scientists the opportunity to explore brain function by assessing the impact of damage on living people. However, it was only possible to confirm the area of damage through surgery or after the person died, during an autopsy.

Autopsies

An autopsy involves surgically opening up the body of a deceased person to examine organs and body systems. Autopsies have been used for centuries to determine the cause of death and to confirm hypotheses.

For example, Pierre Paul Broca (1824–80) conducted an autopsy of his patient to determine the location of damage in the brain. He found that this particular patient had a deep hollow on the left **frontal lobe**, close to the lower part of the primary motor cortex (located across the top middle part of the brain). When Broca saw a second patient with similar symptoms, he hypothesised that this patient would also have damage to what became known as **Broca's area**. Of course, Broca was only able to confirm his hypothesis after the patient died and he was able to conduct an autopsy.

frontal lobe
the largest lobe of the brain; has several functions, including initiating movement of the body, language, planning, judgment, problem-solving, aspects of personality and emotions

Broca's area
part of the left frontal lobe; the speech production centre of the brain

Introducing experimental neurosurgery

Now we will investigate three types of experimental neurosurgery:

- ablation, pioneered by Pierre Flourens in the 1820s
- corpus callosotomy, pioneered by Roger Sperry and Michael Gazzaniga in the 1960s
- electrical stimulation of the brain, pioneered by Wilder Penfield in the 1930s.

Ablation

ablation
the damaging or removing of sections of the brain

Pierre Flourens (1794–1867) was a French physiologist. He was the founder of experimental brain science and also had an interest in anaesthesia. In the 1820s, Flourens began localising and **ablating** (removing) areas of the brain in living animals, mostly rabbits and pigeons, and observing the effects on their behaviour and cognition. He intended to determine if brain localisation (as suggested by Franz Joseph Gall) existed (Yildirim & Sarikcioglu, 2007).

From these experiments, Flourens found evidence that the main areas of the brain were responsible for different functions. He found that by removing the cerebral hemispheres (located at the top and front of the brain), all perceptions, motor controls and judgment also appeared to be removed (Yildirim & Sarikcioglu, 2007). Flourens also showed that removing the cerebellum (located at the back of the brain) caused a loss in balance and motor coordination.

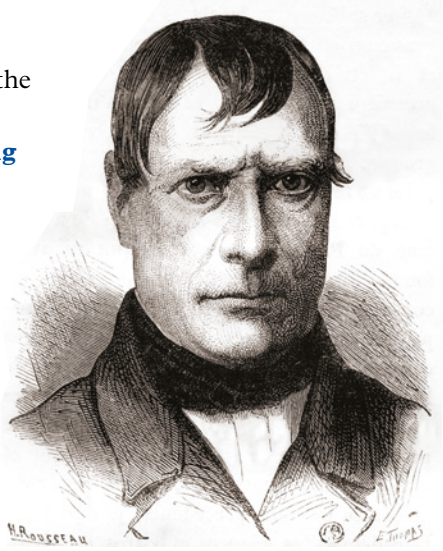


FIGURE 3 Pierre Flourens is considered the founder of experimental brain surgery.

Significance of Flourens' work

From his results, Flourens was able to conclude that the cerebral cortex (the outer layer of the cerebral hemispheres) was responsible for higher order thinking and that the cerebellum was implicated in regulating movement. Flourens' work provided the first scientific evidence that challenged phrenology, and formed the basis of the knowledge about neuroanatomy and the workings of the brain that we rely on today.

Corpus callosotomy

corpus callosotomy
a surgical procedure that severs the corpus callosum

corpus callosum
the thick band of about 200 million nerve fibres connecting the right and left hemispheres of the brain

nerve
bundle of axons running together in the peripheral nervous system

Hemispheric specialisation, or brain lateralisation, is the tendency for particular brain functions to be carried out by one side, or hemisphere, of the brain. An important source of knowledge about hemispheric specialisation is the experiences of "split-brain" patients who have undergone a **corpus callosotomy**. This is a surgical procedure that severs the **corpus callosum**, a thick band of **nerve** fibres that connects the two hemispheres of the brain and allows the hemispheres to communicate with each other. In people with epilepsy, the corpus callosum allows seizures that originate in one hemisphere to travel across to the other hemisphere, potentially making the seizures more severe.

During the early 1960s, Roger Sperry and Michael Gazzaniga trialled the corpus callosotomy on monkeys, and in 1966 began using the procedure to treat their epileptic patients, with great success. All the patients showed a significant reduction in the number of epileptic seizures experienced, which enabled the patients to lead relatively normal lives with little evidence of impairment. This technique is still used to manage severe epilepsy that does not respond to other methods.

Significance of Sperry and Gazzaniga's work

The unique function of each hemisphere was revealed when patients, under laboratory conditions, had images flashed to either their right or left visual fields while they looked at a dot in the middle of a screen. The severing of the corpus callosum allowed Sperry and Gazzaniga to discover that the left hemisphere of the brain is dominant for verbal tasks while the right hemisphere is dominant for non-verbal tasks.

Further research into hemispheric specialisation was later conducted on people with typical brains using sophisticated neuroimaging equipment, to be discussed later in this module.

Electrical stimulation of the brain (ESB)

As we have learnt, examining the brain wasn't possible until a patient died, and doctors and researchers could perform an autopsy. This changed with Wilder Graves Penfield (1891–1976), an American-Canadian neurosurgeon who is best known for his work on mapping the brain. Penfield covered new territory in exploring the nervous system, believing that it was the key to explaining the mystery of the mind (Kumar & Yeragani, 2011).

Penfield had a great interest in epilepsy, and dedicated much of his research to finding a cure. Penfield used a different approach to studying the brain, creating a map of the brain and documenting the functions of the body controlled by different brain segments (Kumar & Yeragani, 2011). He used an **electrical stimulation of the brain (ESB)** device that sent a mild electrical impulse through a probe to map the functions of various regions of the brain.

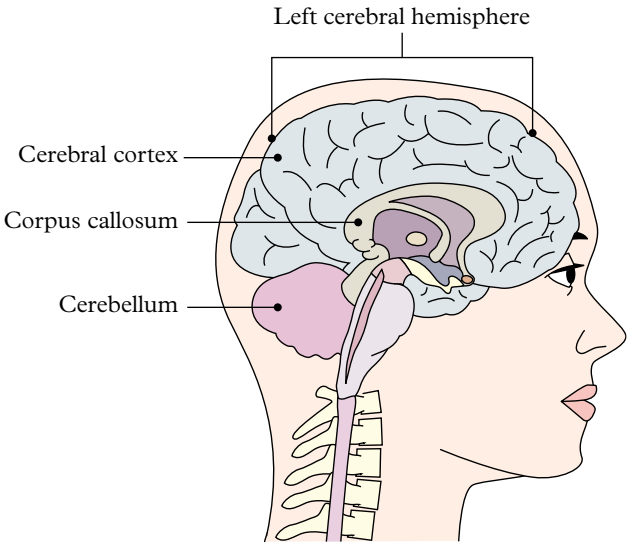


FIGURE 4 The cerebral hemispheres, cerebral cortex, cerebellum and corpus callosum are all discussed in this lesson. You will learn much more about brain structure and function in Module 3.

electrical stimulation of the brain (ESB) a technique that sends mild electrical impulses through a probe to map the brain

The Montreal procedure

Penfield's new method of treating patients with severe epilepsy was known as the "Montreal procedure". This involved opening up the patient's skull (while only using a local anaesthetic), and destroying (lesioning) the neurons in the brain where the seizures originated. As no two brains are identical, Penfield would systematically map the brain using the ESB device while patients were awake on the operating table to make sure that he did not accidentally damage unaffected areas. During surgery and after requesting the permission of his wakeful patients, he proceeded to probe the exposed brain and ask his patients what they felt. He would carefully number each section until he eventually mapped the primary somatosensory and primary motor cortices of the brain (the parts responsible for sensations felt by and movements of the body). Penfield discovered that the right somatosensory cortex controlled sensation on the left side of the body and the left somatosensory cortex controlled the sensation on the right side.

Significance of Penfield's work

Penfield's work contributed significantly to our understanding of brain structure and function and the **contra-lateral** nature of the human brain. Penfield's research also led to the mapping of the cortical homunculus, a distorted representation of the areas of the brain and the body parts they control. The homunculus maps the areas of the brain dedicated to motor or sensory functions for different areas of the body. Penfield and his team were the first to identify that there is a difference between sensory and motor function, and to map these separately.

contra-lateral the physiological nature of how one side of the brain controls the opposite side of the body

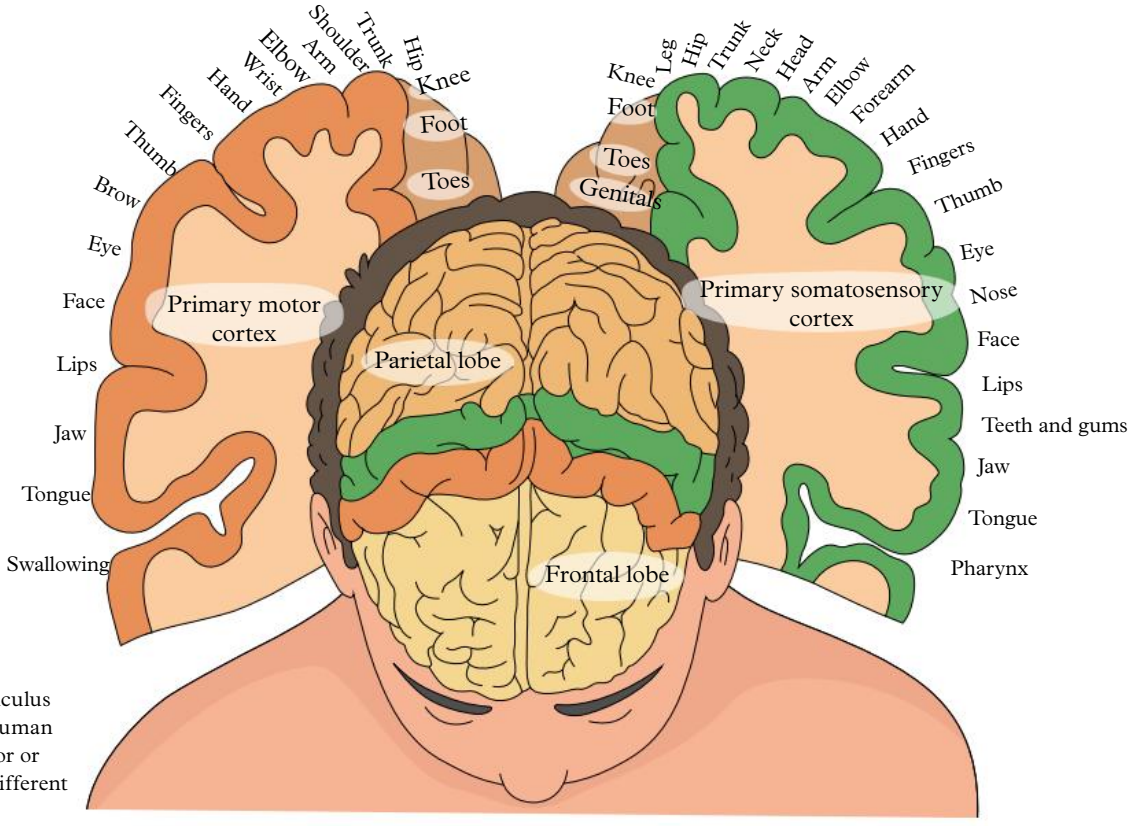


FIGURE 5 The homunculus maps the areas of the human brain dedicated to motor or sensory functions for different areas of the body.

Challenge

Awake during surgery

Penfield was able to operate on the brain using only local anaesthetic because there are no pain receptors in the brain – even today, surgery on the brain is carried out using only a local anaesthetic on the skull.

Consider the advantages and disadvantages of having a patient awake during brain surgery.

Check your learning 2.2

Check your learning 2.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** phrenology. (1 mark)

2 The following questions relate to the work completed by Franz Gall in the late eighteenth century.

- **a** **Explain** what is meant by "brain organ". (1 mark)
- **b** **Recall** how many brain organs were thought to exist. (1 mark)
- **c** **Describe** the nature and characteristics of one of these organs. (2 marks)

3 **Describe** the type of neurosurgery used by Flourens in his work. (1 mark)

4 **Summarise** Penfield's contribution to psychology. (1 mark)

Analytical processes

5 **Critique** the practice of phrenology. (3 marks)

Knowledge utilisation

6 **Evaluate** the risks of experimental neurosurgery against any benefits of the knowledge gained about brain structure and function. (3 marks)

Lesson 2.3
Brain research and neuroimaging techniques

Key ideas

- → Neuroimaging techniques can be used to examine the brain without invasive procedures.
- → Electroencephalography (EEG) uses electrodes to detect electrical activity in the brain.
- → Positron emission tomography (PET) uses blood flow and glucose consumption to track the brain's activity.
- → Magnetic resonance imaging (MRI) uses magnetic fields and radio waves to produce an image of the structure of the brain.
- → Functional magnetic resonance imaging (fMRI) works the same way as MRI and also uses blood flow and oxygen consumption to track the brain's activity.

Learning intentions and success criteria

Introducing brain research and neuroimaging techniques

Historically, mapping of human brain function was based on locations of brain damage or brain stimulation that resulted in functional change. Over time, direct electrical stimulation of cortical areas and the advent of more sophisticated neuroimaging devices have allowed researchers to build their understanding of typical as well as damaged brains. In most instances, this can be done without using invasive procedures. Some devices have been applied directly to actual brain tissue, while others produce highly detailed images of the structures in the brain.

The history of neuroimaging

Brain neuroimaging was first practised by Italian physiologist Angelo Mosso (1846–1910) in the late 1800s. He began recording the "pulsations" (of blood) of the human cerebral cortex following surgical procedures. He noticed that these pulsations changed during cognitive tasks and he concluded that blood flow to the brain increases during mental processing. He developed a technique known as "human circulation balance" that enabled the researcher to determine how blood travelled through the brain as a person experienced a range of emotions or while undertaking cognitive tasks. To some extent, this procedure was the precursor to today's PET (positron emission tomography) and fMRI (functional magnetic resonance imaging) scans.

By the early 1900s, a brain-imaging technique known as the "pneumoencephalograph" gained attention. Pneumoencephalography involved draining the patient of cerebrospinal fluid (the fluid found in the brain and **spinal cord**) and replacing it with oxygen. This allowed researchers to obtain a clearer image of the brain using X-rays. However, it was a painful and risky procedure that patients did not tolerate well.

Since then, the CT (computed tomography) scan was developed in 1972, followed by the MRI (magnetic resonance imaging) in 1977, while the fMRI made its appearance around 1990.

spinal cord
part of the central nervous system that carries sensory and motor signals between the peripheral nervous system and the brain

Subsequently, sharper, clearer images of the brain and nervous system, as well as the ability to monitor and track mental processes in real time, have emerged, enabling researchers to obtain a better understanding of which brain structures are activated during mental and motor activities.

We will now examine several neuroimaging techniques that are used not only by doctors and neurosurgeons, but also cognitive, biological, behavioural, social and neuropsychological researchers studying the brain and nervous system.

Electroencephalograph (EEG)

electroencephalograph (EEG)
a device that detects, amplifies and records electrical activity in the brain in the form of brainwaves

Electroencephalography preceded all the current neuroimaging techniques and has been around since the 1920s. Hans Berger (1873–1941) first measured electrical impulses from the human head (Giles, 2005). He placed two sheets of tin foil (which served as electrodes) around his son's scalp and recorded a pattern of electrical activity from the boy's brain. He was the first to measure the brain in action and in "real time" – as it occurs. This device became known as the **electroencephalograph (EEG)**. During the 1950s, the tin foil was replaced with small electrodes, and hospitals began using the EEG to detect abnormalities in brain function caused by head injuries, epilepsy and a range of other conditions. Today, the EEG detects, amplifies and records the electrical activity of the brain and portrays this as brain waves, displayed on a computer, although it cannot show exactly which area of the brain is active. This device has also played an important role in the study of consciousness and sleep. EEG recordings are used in sleep studies to learn when a person enters and leaves different stages of sleep, and how this matches typical patterns. You will learn more about the use of EEG to study consciousness and sleep in Lesson 7.6.

FIGURE 1 By attaching electrodes to a patient's head, an EEG records electrical activity from different parts of the brain as it reacts to external visual or auditory stimuli.

Positron emission tomography (PET)

positron emission tomography (PET)
a technique that measures the volume and location of blood flow in the brain by tracking a radioactive substance (e.g. glucose) that has been injected into the person's bloodstream

Positron emission tomography (PET) is a technique based on the understanding that there is increased blood flow and glucose consumption when particular areas of the body are active. The early designs of the scanners used in this neuroimaging technique date back to the 1970s. The high-performance scanners today can produce whole-body scans in under 10 minutes, with some PET scanners specifically designed for organs such as the brain, prostate and breast. The initial stimulus for PET was for human brain studies, given the organ's anatomical and biological complexity.

PET measures the volume and location of blood flow in the brain by tracking a radioactive substance called a radiopharmaceutical (or radionuclide or radioactive tracer) such as fluorodeoxyglucose (FDG) that has been injected into a person's bloodstream. FDG is a glucose with a radioactive atom applied. The radioactive substance gives off positrons (minute particles with a positive charge) and a radiation detector camera surrounding the person's head monitors the areas of the brain from which these "positrons" are emitted. The blood flow to areas of the brain activated during cognitive processing will produce more positrons, given increased blood flow and glucose consumption.

PET scans are a valuable tool in monitoring functional and, to a lesser extent, structural changes in patients with degenerative conditions such as Alzheimer's disease, Parkinson's disease and schizophrenia. Scans are colour coded, showing red in highly active areas and green/blue in less active areas.

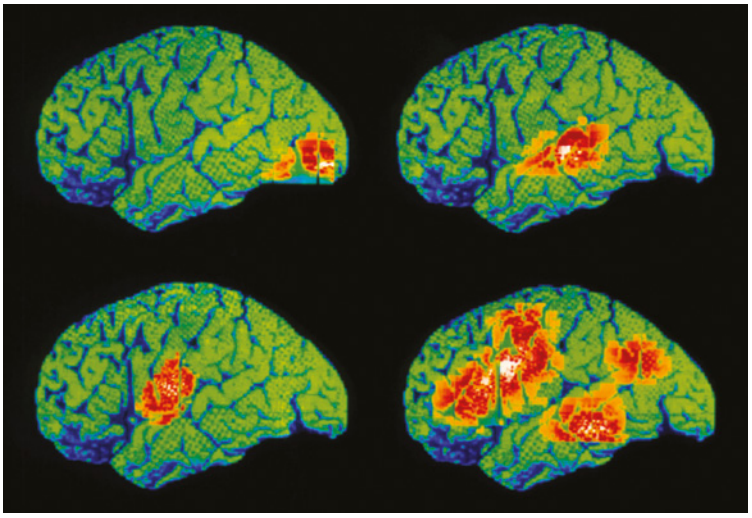


FIGURE 2 This coloured positron emission tomography (PET) scan shows the areas of the brain involved in processing vision, sound and speech. Active areas on the left side of the brain are in red and yellow.

Magnetic resonance imaging (MRI)

Magnetic resonance imaging (MRI) uses harmless magnetic fields and radio waves to produce a computer-enhanced image of the structure of the brain. The person lies in a chamber that houses a large magnet. The magnet creates a strong magnetic field that organises the protons of hydrogen atoms in the body into parallel lines. The aligned protons produce a faint signal, which is processed by a computer that enhances them to a highly detailed 3D image that can be manipulated to view different angles and areas of the brain. The MRI shows structures 1 mm apart. The magnetic field produced is safe for most people, so the technique can be used multiple times close together. However, the technique is not suitable for people with some internal metal devices, such as some pacemakers, as they can be damaged by the magnetic field.

magnetic resonance imaging (MRI) a neuroimaging procedure that uses harmless magnetic fields and radio waves to produce a computer-enhanced image of brain structure

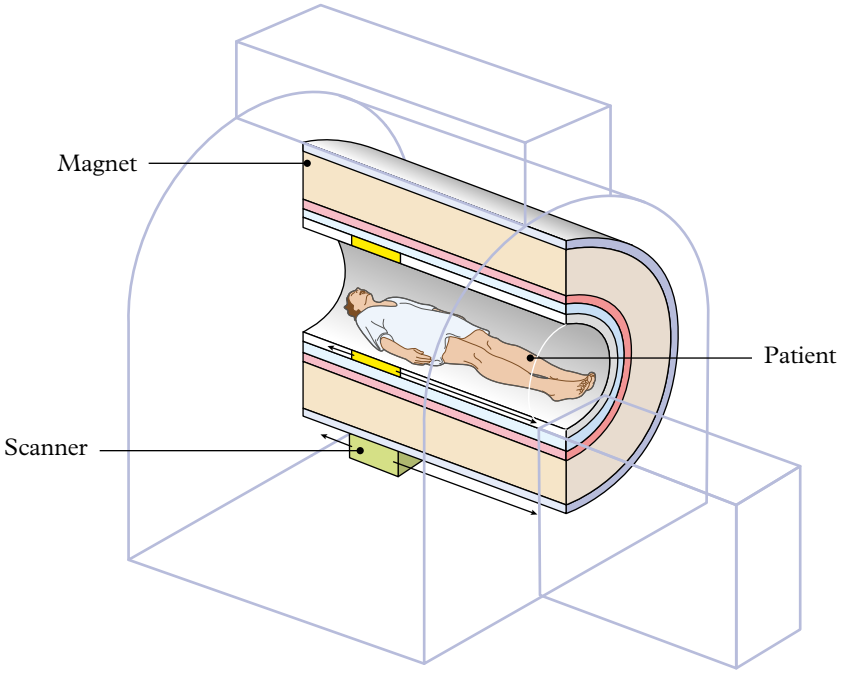


FIGURE 3 An MRI scanner

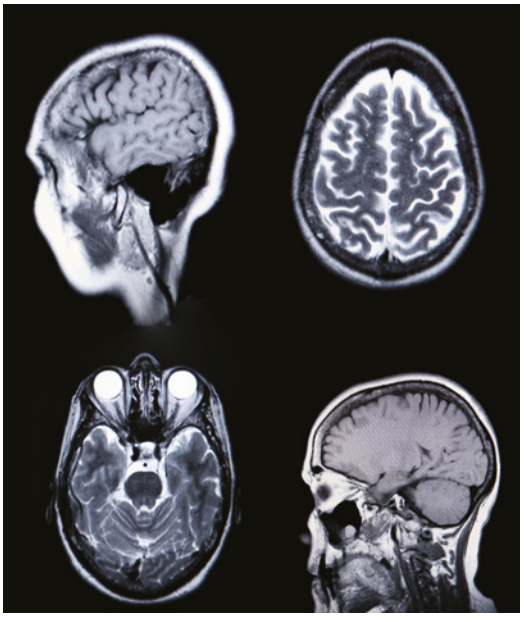


FIGURE 4 The MRI provides a highly detailed 3D image of the brain that can be examined in cross-sections. It shows the structure of the brain and is powerful in enabling the detection of small tumours or changes in the brain.

Skill drill

Identifying variables and formulating hypotheses

Science inquiry skills: Understanding the scientific method (Lesson 1.3); Planning investigations (Lesson 1.4)

A lucky school was granted access to an MRI scanner at a local university to help them with their student experiment. The psychology class decided to perform MRI scans on adult brains to measure the size of the hippocampus (the area of the brain responsible for transferring short-term memory to long-term memory) before and after learning a map of Brisbane.

They decided to see if their results would support previous research completed by Maguire et al. (2006) on London taxi and bus drivers.

This study found that years of navigation experience by London taxi drivers resulted in parts of the hippocampus becoming larger, compared to London bus drivers, who tend to follow the same route. Students thought that learning a map of Brisbane for 1 hour per day for 3 days could change the connections in the brain and the size of the hippocampus. The university, upon finding out about the research, offered to help with participants by allowing the psychology students to recruit from their campus.

Practise your skills

1. **Determine** the best type of investigation to be used for this study and **justify** your choice. (2 marks)
2. **Suggest** the type of data that would be collected by this student experiment. (1 mark)
3. **Formulate** a null hypothesis and an alternative hypothesis. (2 marks)
4. **Discuss** the extraneous variables that could impact this experiment. (2 marks)

functional magnetic resonance imaging (fMRI)
special imaging technology used to see which parts of the brain are active

Functional magnetic resonance imaging (fMRI)

Functional magnetic resonance imaging (fMRI) works on the same basis as the traditional MRI with the distinction that it also monitors blood flow and oxygen consumption to reveal areas of greater brain activity and, hence, function. We are now able to compile a comprehensive brain profile that helps us to determine which areas of the brain are active during mental processes such as thinking, calculating, watching a video or completing a Sudoku puzzle. As the person is performing a mental task, the functional aspect of this technology produces an image every second to show the location(s) and level of brain activation as it happens in "real time". This allows the researcher to accurately monitor which brain regions become active as this occurs. As for MRI, fMRI is not suitable for people with some internal metal devices.

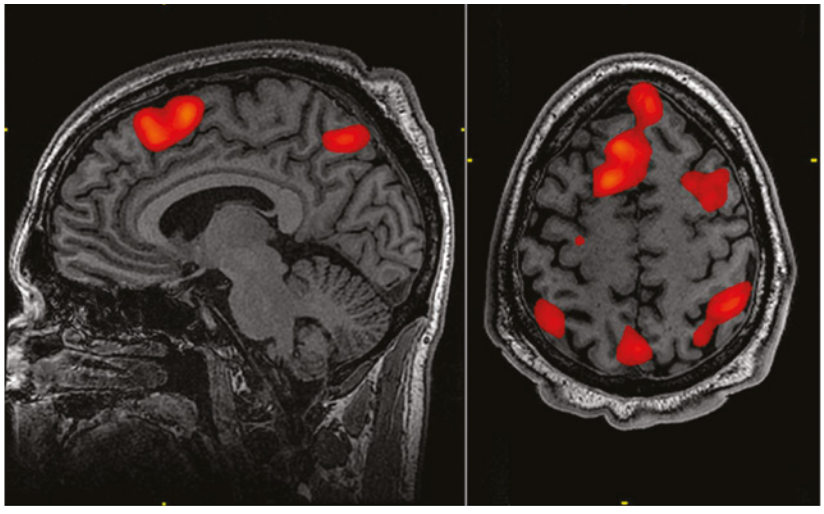


FIGURE 5 These fMRI images show the activity patterns of the brain while listening to music.

Summary of neuroimaging techniques

Table 1 summarises how neuroimaging techniques can enhance our understanding of the structure and function of the brain.

TABLE 1 How neuroimaging techniques enhance our understanding of the brain

Neuroimaging technique	Type of imaging (structural and/or functional)	Applications
Electroencephalograph (EEG)	• Shows brain function by detecting electrical activity in the brain in real time (brain wave patterns)	• Detects change in brain function related to: – head injuries – epilepsy – consciousness and sleep
Positron emission tomography (PET)	• Primarily shows brain function during functional and cognitive activity • Measures volume and location of blood flow in the brain • Produces a coloured image of the working brain	• Assesses functional change in the brain for diseases such as: – Alzheimer's and Parkinson's disease (neurodegenerative diseases) – schizophrenia • Shows the brain in action when influenced by drugs
Magnetic resonance imaging (MRI)	• Produces a 3D, computer-enhanced image of the structure of the brain • Detects abnormalities in brain tissue	• Detects: – structural differences in the brain associated with cognitive difficulties – changes in brain volume associated with neurodegenerative diseases • Assesses impact of: – traumatic experiences on brain structure – behavioural interventions or treatments on brain structure
Functional magnetic resonance imaging (fMRI)	• Provides information on both the structure and function of the brain • Produces a 3D, computer-enhanced image of the structure of the brain (structures) • Monitors blood flow and oxygen consumption in the brain in real time (function)	• Shows which areas of the brain are active during mental processes such as: – thinking – calculating – watching a video or film

Real-world psychology

Neuroimaging techniques predict recovery from brain injury

Traumatic brain injury (TBI) typically results from a violent blow or knock to the head or body. It can also be caused by an object that goes through the brain tissue (such as what happened to Phineas Gage). TBI can have a range of physical and psychological effects, such as headaches and/or concentration problems, respectively. This sort of injury can affect your brain temporarily, but lasts longer in some situations. Each year, approximately 300–550 children per 100,000 sustain a mild traumatic brain injury (mTBI) (Stein et al., 2023). Most mTBIs such as concussion occur in young people aged five to 14, because they have weaker necks and torsos than adults, hence less force is needed to cause a brain injury. In children and adolescents, the two most common causes are sporting and cycling accidents.

Neuroimaging techniques play an important role in the evaluation of patients with TBI and mTBI. The first line of imaging is non-contrast computed tomography (CT scan) with an MRI recommended in specific settings. There are exciting advancements in neuroimaging technology; for example, neurite orientation dispersion and density imaging (NODDI), a practical diffusion MRI technique. This technique estimates the microstructural complexity of dendrites and axons in vivo (living) on clinical MRI scanners and provides a more in-depth view of neuron structures in the brain. Techniques like this are being investigated to determine what is the best (or potentially better) tool to use by clinicians to help predict and inform management of TBI and mTBI. This technique (and others) was used in a study by researchers at the Queensland Brain Institute that showed evidence of ongoing microstructural reorganisation (or neuroinflammation) in the brain between one and three months post-injury, further supporting delayed return to play in children who remain symptomatic.

Other exciting research is looking at biomarkers (e.g. neurofilament light protein or Tau protein) that can be detected through blood analysis as indicators of brain injury. The big challenge for researchers now is to refine these tests for biomarkers and use them in combination with neuroimaging techniques to better diagnose mTBI and assess when it is safe for a child to return to play.

FIGURE 6 A concussed soccer player seeks help from her doctor.

Apply your understanding

1 **Identify** a neuroimaging technique used in diagnosis of a TBI. (1 mark)
2 **Describe** an advantage of the use of the NODDI technique in management of TBI. (1 mark)
3 **Consider** if the NODDI technique should be used in management of all TBI. (3 marks)
4 **Discuss** the importance of using neuroimaging technology in the management of TBI. (4 marks)

Check your learning 2.3

Check your learning 2.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** what these acronyms stand for, and whether the techniques measure brain structure or function, or both.
   a PET (2 marks)
   b MRI (2 marks)
   c fMRI (2 marks)
   d EEG (2 marks)
2 **Identify** which of the neuroimaging techniques tracks oxygenated blood to determine brain activity. (1 mark)
3 **Identify** the neuroimaging technique used to produce a scan showing coloured images of brain structure. (1 mark)
4 **Explain** whether you would use PET or MRI to investigate structural changes in the brain of a person with a neurodegenerative disease. (2 marks)

Analytical processes

5 **Compare** the MRI and fMRI techniques. (2 marks)

Knowledge utilisation

6 A patient is experiencing frequent seizures. **Propose** the most appropriate neuroimaging technique for the patient's doctor to use to establish the location and timing of seizure-related electrical activity in the brain. **Justify** your response. (2 marks)

MODULE 2

Lesson 2.4
Review: Brain investigations

Summary

2.1
- Attempts to understand the brain date back to prehistoric times.
- The mind-versus-body problem considers the relationship between the mind and the body (which includes the brain).
- Claudius Galen championed the materialist approach to the mind-versus-body problem, which says that the mind is the same thing as the body.
- René Descartes championed the dualistic approach to the mind-versus-body problem, which says that the mind and body are separate.

2.2
- Early brain investigative techniques include the pseudoscience phrenology, developed by Franz Gall in the late eighteenth century.
- Experimental neurosurgery was pioneered by Pierre Flourens in the nineteenth century, with his ablation technique.
- In the twentieth century, Roger Sperry and Michael Gazzaniga successfully used the corpus callosotomy to treat patients with epilepsy.
- Also in the twentieth century, Wilder Penfield developed electrical stimulation of the brain and used it to map the functions of different regions of the brain.

2.3
- Neuroimaging techniques can be used to examine the brain without invasive procedures.
- Electroencephalography (EEG) uses electrodes to detect electrical activity in the brain.
- Positron emission tomography (PET) uses blood flow and glucose consumption to track the brain's activity.
- Magnetic resonance imaging (MRI) uses magnetic fields and radio waves to produce an image of the structure of the brain.
- Functional magnetic resonance imaging (fMRI) works the same way as MRI and also uses blood flow and oxygen consumption to track the brain's activity.

Review questions 2.4A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 **Identify** the person who introduced the experimental neurosurgery that involved ablation.
- **A** Pierre Flourens
- **B** Wilder Penfield
- **C** Franz Gall
- **D** Claudius Galen

2 Trephination is a procedure where a hole is made in the skull of a living person to relieve headaches, epilepsy and other physical and mental symptoms. When was this procedure practised?
- **A** Only in prehistoric times
- **B** In prehistoric times, and today with more sophisticated surgical tools
- **C** Only in ancient Greek times
- **D** The Middle Ages

3 Which philosopher is referred to when discussing the dualist approach to the mind-versus-body problem?
- **A** Plato
- **B** Aristotle
- **C** Descartes
- **D** Galen

4 Psychology uses a number of neuroimaging techniques. What does an fMRI show?
- **A** X-rays with detailed information about the structure of the brain and body
- **B** Highly detailed 3D images of the brain's structure that can track the flow of oxygen when a person is asked to perform a mental task such as recalling a song title
- **C** Brightly coloured pictures of the brain at work after injecting radioactive glucose
- **D** Highly detailed 3D images of the brain's structure

5 In phrenology, how many brain organs exist that influence personality and character?
- **A** 27
- **B** 52
- **C** 13
- **D** 37

6 The view that we consist of two separate entities (mind and body) and that these two interact is known as
- **A** the mind-versus-body problem.
- **B** the materialist approach.
- **C** the dualist approach.
- **D** a subjective problem.

7 Wilder Graves Penfield contributed significantly to our understanding of the brain. He used a probe that delivered a weak electrical charge to different locations on the surface of the brains of his patients undergoing surgery. Which of these structures did Penfield map?
- **A** Primary somatosensory and primary motor cortices
- **B** The auditory cortex
- **C** The primary somatosensory cortex and Broca's area
- **D** The primary motor cortex and the visual cortex

8 What is one advantage of using an MRI?
- **A** It's cheap to run.
- **B** It produces highly detailed 3D images of the brain.
- **C** It shows which areas of the brain are active during mental tasks.
- **D** It's very quiet.

9 What does PET do?
- **A** It tracks radioactive glucose that is injected into the patient to show which areas of the brain are active during mental processes.
- **B** It uses X-ray technology to show the structures of the brain.
- **C** It tracks oxygenated blood in the brain during thinking tasks and produces a detailed computer-generated image.
- **D** It uses infrared technology to detect the concentration of oxygenated blood during mental tasks.

10 Which of these neuroimaging devices is the most effective in detecting and tracking activity in the brain in real time?
- **A** PET
- **B** MRI
- **C** EEG
- **D** MEG

11 Dinesh fell off a ladder while trying to paint the outside of his house and hit his head. Which of these neuroimaging techniques would a doctor recommend to provide the clearest images of the brain?
- **A** PET
- **B** EEG
- **C** MRI
- **D** fMRI

12 Which of these neuroimaging techniques would provide the most accurate information on brain functioning during a cognitive task?
- **A** fMRI
- **B** PET
- **C** MRI
- **D** EEG

13 A corpus callosotomy is when
- **A** a patient has their corpus callosum severed to separate the two hemispheres.
- **B** a patient has their corpus callosum reconnected after brain damage.
- **C** a doctor learns about the functions of each hemisphere by connecting different areas.
- **D** nerves are severed in the brain.

Review questions 2.4B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

14 **Describe** how electrical stimulation of the brain (ESB) can be used as a method of brain research. (1 mark)

15 **Describe** phrenology. (1 mark)

16 **Identify** two problems with using phrenology to determine reasons for a person's behaviours and functional capacity. (2 marks)

17 **Describe** the investigations that Pierre Flourens conducted. (1 mark)

18 **Describe** Wilder Graves Penfield's research and its contribution to understanding the relationship between brain and behaviour. (2 marks)

19 **Summarise** the neuroimaging techniques by copying and completing the table. (8 marks)

	Type of imaging	Application example
PET		
MRI		
fMRI		
EEG		

20 **Identify** what type of neuroimaging technique was used if a brain scan showed detailed information about the physical structure of the brain in action (function) in real time. (1 mark)

21 **Summarise** the mind-versus-body debate. (1 mark)

Analytical processes

22 **Contrast** the materialist and dualist approaches to the mind-versus-body problem. (1 mark)

23 **Compare** a PET and a fMRI scan. (2 marks)

24 **Distinguish** between phrenology and ablation. (1 mark)

Knowledge utilisation

25 Researchers wish to identify which areas of the brain are active while a person is completing a puzzle. **Propose** which two neuroimaging devices they should use. **Justify** your reasoning. (3 marks)

26 **Evaluate** the claim: "fMRI scans provide superior knowledge compared with EEG recordings." (4 marks)

27 A researcher wants to gain information about the activity of the brain during different activities and states of consciousness. **Justify** why using a combination of neuroimaging techniques would be beneficial. (2 marks)

Data drill

Relationship between brain structures and behaviours

Raine et al. (1997) investigated the relationship between brain structures and behaviours, specifically violent behaviours committed by murderers. The researchers performed PET scans on murderers and matched controls. They suggested that as the amygdala processes emotion, it was possible that murderers may have less activity in their amygdala (on the left hemisphere) and therefore feel less remorse for their violent acts compared with controls.

The researchers hypothesised the following:

- Null hypothesis: Convicted murderers will have the same amount of activity in their amygdala as the control participants.
- Alternative hypothesis: Convicted murderers will have a lower amount of activity in their amygdala compared with control participants.

Figure 1 shows the mean activity results of the PET scans. The researcher also calculated the standard deviations of each of the groups. The results are displayed in Table 1 and in Figure 1. An inferential test was conducted and the *p*-value was found to be 0.034.

TABLE 1 Standard deviations in mean glucose amygdala activity (left hemisphere side) in both the control and murderer groups

	Control group	Murderer group
Mean	0.97	0.94
Standard deviation	0.14	0.17

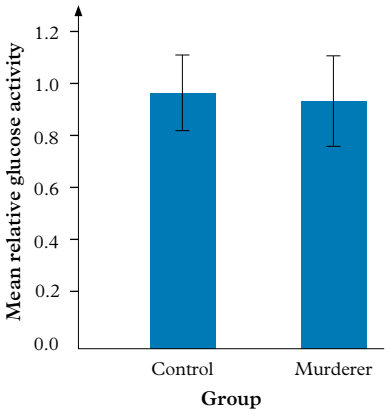


FIGURE 1 Mean and standard error of measurement for relative glucose activity in the amygdala (left hemisphere) as measured by PET scans between the Control and Murderer groups

Apply understanding

1 **Identify** which of the groups had the highest mean relative glucose activity in the amygdala. (1 mark)

Analyse data

2 **Distinguish** between the standard deviation scores in Table 1. (1 mark)

Interpret evidence

3 With reference to the error bars in Figure 1, **deduce** whether the result for the control condition is different from the result for the murderer condition. (1 mark)

4 **Draw a conclusion** based on the inferential statistics. Give a reason for the conclusion. (2 marks)

Module 2 checklist: Brain investigations

Quizlet: Revise key terms online to test your understanding

MODULE 3

The brain

Introduction

The brain is one of the most important organs in the human body. This module outlines the basic structure and function of the hindbrain (medulla, pons and cerebellum), midbrain (reticular formation) and forebrain (hypothalamus, thalamus and cerebrum). You will also learn about the role of the cerebral cortex in the processing of complex sensory information and the interacting roles of specific brain regions.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to the brain before you start.

Subject matter

Science understanding

→ Explain that the brain can be viewed as discrete areas, including the hindbrain, midbrain and forebrain.

→ Describe the interacting roles of specific brain regions including Broca's area, Wernicke's area and Geschwind's territory.

Science as a human endeavour

→ Recognise that understanding localisation of brain function can be used to predict cognitive and behavioural effects of localised damage.

Science inquiry skills

→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  - descriptive statistics
  - parametric inferential statistics

→ acknowledge sources of information with standard scientific referencing conventions

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Lesson 3.1
The hindbrain, midbrain and forebrain

Key ideas

- → The hindbrain supports bodily functions, such as breathing, digestion and voluntary movement.
- → The midbrain supports consciousness and the coordination of movement, and is the connection between the forebrain and the hindbrain.
- → The forebrain supports higher order thinking and is the largest part of the brain.

Learning intentions and success criteria

Introducing the brain

The brain is the organ at the centre of all our mental faculties. It is the largest part of the human nervous system, containing between 10 and 100 billion nerve cells. It is responsible for regulating the body's physiological processes, controlling behaviour and processing sensory information from the environment, as well as higher order processes such as memory, perception, consciousness, learning and language. It is also responsible for those functions that are vital to basic survival, including our heartbeat, body temperature, respiration and digestion. This lesson outlines the basic structure and function of the hindbrain (medulla, pons and cerebellum), midbrain (reticular formation) and forebrain (cerebrum, hypothalamus and thalamus).

hindbrain
the primitive parts of the brain comprising the medulla, pons and cerebellum; adjacent to the spinal cord and mainly supports bodily functions such as breathing, digestion and voluntary movement

midbrain
connects the hindbrain with the forebrain and controls arousal levels, attention and consciousness

forebrain
part of the brain responsible for higher order thinking processes; includes the cerebral hemispheres

Components of the brain

The brain can be viewed as three discrete areas: the **hindbrain**, the **midbrain** and the **forebrain**. The hindbrain is the primitive part of the brain comprising the medulla, pons and cerebellum, adjacent to the spinal cord. The midbrain connects the hindbrain with the forebrain and controls arousal levels, attention and consciousness; it essentially comprises the reticular activating system (RAS). The forebrain is responsible for higher order thinking processes and includes the cerebral hemispheres. These structures interact and work together to enable our body to behave and function in accordance with our thoughts and feelings.

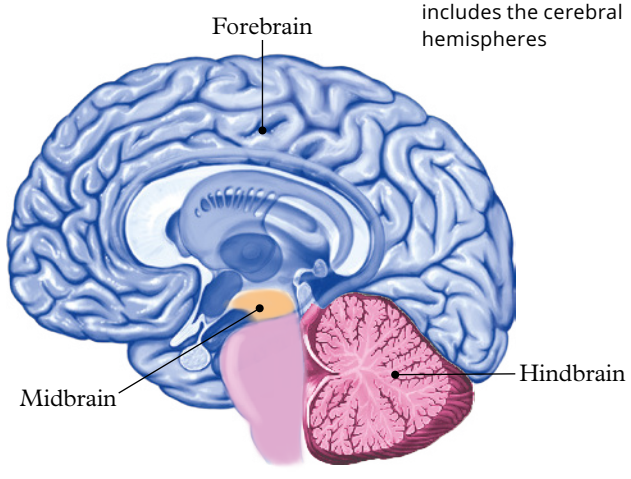


FIGURE 1 This is a cross-section of the human brain showing the three discrete areas: the hindbrain, the midbrain and the forebrain.

The hindbrain

The hindbrain is often referred to as the "lower brain". It mainly supports bodily functions, and it is the link between the spinal cord and the brain (these two components make up the central nervous system, which is discussed in Module 4). It includes most of the brain stem, the medulla, pons, cerebellum, and part of the reticular formation, a network of neurons that connects the hindbrain and forebrain. The hindbrain is important for movement and balance.

The medulla

The first major component of the hindbrain is the medulla (also known as the medulla oblongata). The medulla is a continuation of the spine transitioning to the brain. It is a 3-cm-long nerve tract controlling our autonomic vital functions such as breathing, heartbeat and digestion.

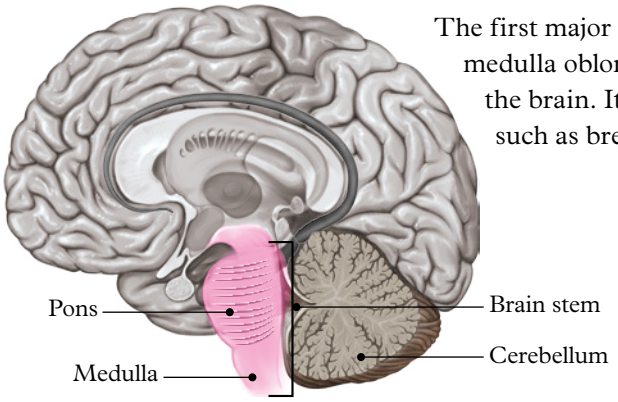


FIGURE 2 Structures of the hindbrain

The pons

The pons sits above the medulla, right underneath the midbrain. It receives information sent from visual areas to control eye and body actions, and acts as a coordinating centre for communication between the spinal cord and the two brain hemispheres.

The cerebellum

The **cerebellum** is a walnut-shaped area that receives information from the pons. It has two hemispheres, just like the cerebral cortex (which is a part of the forebrain). The cerebellum's role is to control most of our voluntary movements by coordinating our sensations to produce sequences of body movement.

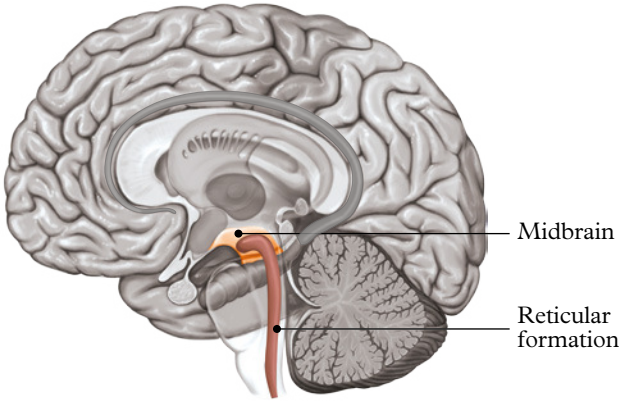


FIGURE 3 Structures of the midbrain

The midbrain

The midbrain is the topmost part of the brain stem and sits above the hindbrain and below the forebrain (Figure 1). It is responsible for the regulation of sleep, motor movement and arousal. It also includes part of the **reticular formation**.

cerebellum
a component of the hindbrain that coordinates the sequence of body movements

reticular formation
a network of neurons that sits across both the midbrain and hindbrain and connects the hindbrain and forebrain; plays an important role in the control of arousal and the "sleeping and waking" cycle

Reticular formation

Although the reticular formation is mostly situated as part of the midbrain, it is in fact a network of neurons that is part of both the midbrain and hindbrain, as well as connecting the hindbrain and forebrain (Figure 3). The reticular formation is important in the control of arousal and in the sleeping and waking cycle. (You will learn about the sleeping and waking cycle in Module 8.)

The forebrain

The forebrain is the largest area of the brain and includes a number of important brain structures, including the entire cerebrum and several structures within it, including the hypothalamus and the thalamus.

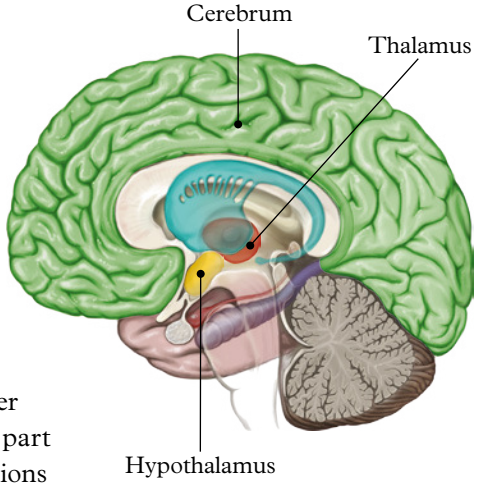


FIGURE 4 Structures of the forebrain

The cerebrum

The cerebrum is the biggest and most recognisable part of the forebrain, making up approximately 85 per cent of the brain. The cerebrum is the "intellectual" part of the brain where most of the important brain functions occur, such as interpreting and processing inputs from

our senses, thinking, planning, reasoning and language processing. It is covered by a thin layer known as the cerebral cortex (or cortex) and divided into the left and right cerebral hemispheres. These are separated by the longitudinal fissure – a deep groove that runs from the front to the rear of the cortex. Each cerebral hemisphere is divided into four lobes: frontal, parietal, temporal and occipital (you will learn more about the lobes in Lesson 3.2).

The hemispheres are almost symmetrical in appearance and are joined by the **corpus callosum**, a set of neural fibres that connect the two brain hemispheres (Figure 5). Each hemisphere has a central fissure that runs from the top of the hemisphere and down the sides, separating the front (anterior) of the cerebral cortex from the rear (posterior).

Later in your psychology studies, you will learn about the functions of two structures – the **amygdala**, located in the medial temporal lobe of the brain that is central to emotion, aggression and implicit learning, and the **hippocampus**, located in the medial temporal lobe and involved in the transfer of information from short-term memory to long-term memory. The hippocampus and amygdala are important in the formation of memories and emotions.

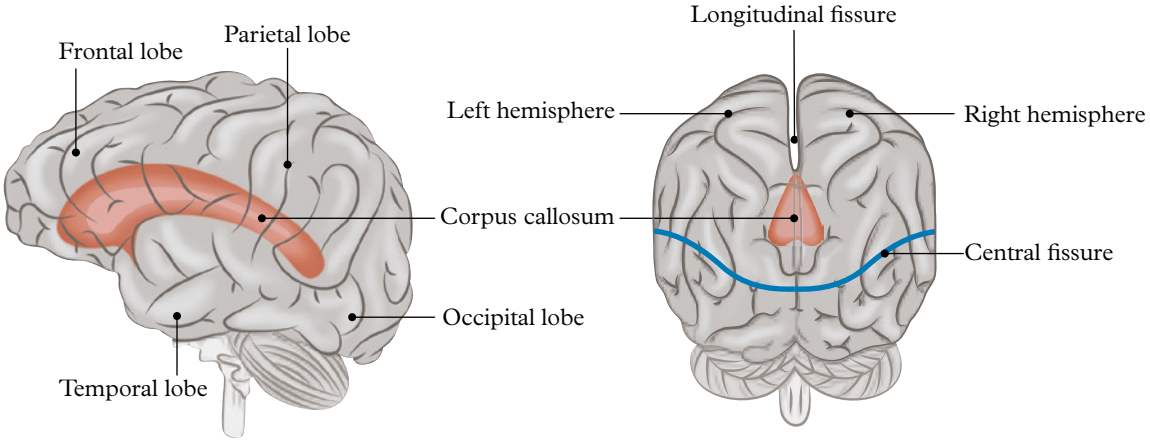


FIGURE 5 The longitudinal fissure separates the left and right cerebral hemispheres and the corpus callosum connects the hemispheres together. You can also see the location of the central fissure and lobes.

The hypothalamus

The **hypothalamus** is a small structure (the size of an almond) that has a very important role in the control of basic survival actions: sleep, regulation of body temperature, expression of emotions, and the four "F's": feeding, fighting, fleeing and fornication. It is also involved in maintaining **homeostasis**, by connecting the hormonal and nervous systems.

The thalamus

The **thalamus** is located beneath the cerebral cortex, deep within the cerebral hemispheres. It is divided into two egg-shaped parts that sit side by side, with one part located in each hemisphere. The thalamus is the "communications centre" of the brain and it receives information from the ears, eyes, skin and other sensory organs (with the exception of the nose). It also has an important role in regulating the overall activity in the cortex.

The thalamus has two important roles to play. First, it enables an organism to process sensory stimuli in the environment. When humans are in normal waking consciousness (Module 7), our senses are continually bombarded with information from the outside world. The thalamus receives the incoming information from all of our senses (except smell) and then relays this information to the relevant part of the cortex where it can be processed into meaningful information. For example, the sight of a colourful coffee mug would be received as sensations in the sensory receptors in our eyes; the information would then be conveyed to

corpus callosum
the thick band of about 200 million nerve fibres connecting the right and left hemispheres of the brain

amygdala
an almond-shaped structure, located in the medial temporal lobe of the brain that is central to emotion, aggression and implicit learning; it is vital in initiating and processing emotional responses and in forming emotional memories

hippocampus
located in the brain's medial temporal lobe and involved in the transfer of information from short-term memory to long-term memory

hypothalamus
structure in the forebrain that plays a major role in controlling emotion and motivated behaviours, such as eating, drinking and sexual activity

homeostasis
a self-regulating process by which the body maintains a stable internal balance while adjusting to a changing environment

thalamus
a structure shaped like two eggs beneath the cortex; it processes incoming sensory information and transmits it to other, higher parts of the brain for further processing; also directs attention to specific sensory systems

Study tip

Construct an annotated diagram of the brain to support recognition and understanding of the discrete areas. Visual aids can help you organise information to improve understanding.

the thalamus, which would then direct it to the primary visual cortex in both the left and right occipital lobes. The person would then interpret it as being a "colourful coffee mug".

The second role of the thalamus is to determine which of the incoming sensory information is the most important for us to pay attention to. Research using positron emission tomography (PET) scans has indicated that, when people pay attention to specific sensory information, specific parts of the reticular formation and the thalamus are active (Kinomura et al., 1996). The information is then transmitted to the relevant part of the cortex, which then communicates back to another part of the thalamus to indicate which parts of the sensory stimuli the person must pay attention to, and which parts they should ignore (Burton et al., 2015).

Check your learning 3.1

Check your learning 3.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the role of the corpus callosum. (1 mark)

2 **Identify** the location and a key function of the
   a thalamus (2 marks)
   b hypothalamus. (2 marks)

3 **Explain** the role of the midbrain. (1 mark)

4 **Describe** what the cerebrum is responsible for. (1 mark)

Analytical processes

5 Henry is lying on the sofa and watching television. He is feeling quite relaxed and is nodding off to sleep. **Determine** which area of Henry's brain would be active and **explain** its role. (2 marks)

6 A fire alarm sounds at school. **Determine** which areas of your brain would be active and **explain** what may be happening in each. (4 marks)

Knowledge utilisation

7 **Propose** the most likely area(s) of the brain that is affected if breathing were to stop. (1 mark)

Lesson 3.2
Structure of the brain

Learning intentions and success criteria

Key ideas

- → Each hemisphere of the cerebral cortex is divided into four lobes.
- → The frontal lobes are responsible for abstract thought, social skills and planning, and include the primary motor cortex.
- → The parietal lobes are responsible for touch, non-verbal thought and special orientation, and include the primary somatosensory cortex.
- → The temporal lobes are responsible for hearing and language, and include the primary auditory cortex.
- → The occipital lobes are responsible for vision and include the primary visual cortex.

Parts of the brain interact with each other

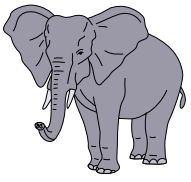
In studying the interaction between the cognitive processes of the brain and its structure, it is easier to consider each of the structures of the brain as being separate, with individual responsibilities. However, this is not really how the brain or nervous system operates.

With neuroimaging techniques (Lesson 2.3), scientists have been able to observe the parts of the brain that are active during different types of cognitive processes, and it is apparent that many parts of the brain are active at any given time. Therefore, it is important to remember that different parts of the brain interact with each other and are not discrete, isolated structures. In this lesson, you will learn about the cerebrum and its lobes, the role of the cerebral cortex in the processing of complex sensory information, and the interacting roles of specific brain regions.

The role of the cerebral cortex

As we learnt in Lesson 3.1, the brain comprises three discrete areas: the hindbrain, the midbrain and the forebrain. The outer layer of the forebrain's cerebrum is called the cerebral cortex (or cortex). It is responsible for receiving information from the environment, for controlling our responses, and for higher order thinking processes including problem-solving and planning. It is also very much involved in memory, language and the regulation of emotions. The cerebral cortex of humans is much larger in proportion to body mass than in any other animal; this is the point of difference between humans and animals in terms of intellectual functioning. It enables us to plan and carry out a series of body movements and use words to make intelligible conversation. The cortex allows us to undertake a range of tasks, from the simple (e.g. making toast) to the complex (e.g. constructing buildings and developing computers). It also allows us to detect the difference between pieces of information, to understand the meaning of this information and to think in abstract and symbolic ways, enabling creativity in art, writing, debating and the use of metaphor (Burton et al., 2015).

TABLE 1 Cerebral cortex size in humans and animals

	Capybara	Rhesus monkey	Western gorilla	Human	African elephant
Mammal	 	 	 	 	 
Mass of cerebral cortex	48.2 g	69.8 g	377 g	1232 g	2848 g
Number of neurons found in brain	0.3 billion	1.71 billion	9.1 billion	16.3 billion	5.59 billion

Structure of the cerebral cortex

The cortex is very thin (approximately 3 mm) and contains billions of neurons. Humans have the greatest number of cognitive abilities and this is why they also have the largest, most complex cortex of all organisms. Its convolutions – the many folds, grooves and bulges – make the surface area (and volume) of the cortex large enough to contain an enormous number of neurons and blood vessels. The blood vessels carry oxygen and glucose in the blood to supply a constant energy source to the brain's cells. The bulges are known as gyri (singular: gyrus), and the valleys are called sulci (singular: sulcus) (Figure 2).

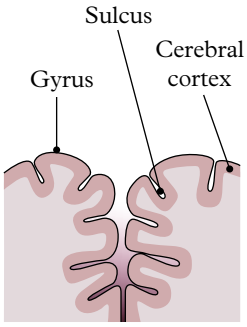


FIGURE 1 Convolutions in the cerebral cortex

Lobes of the cerebral hemispheres

Study tip

Constructing a table is a good way to organise and summarise information. This technique could be applied to identify and describe the key structures and functions of the lobes.

As we learnt in Lesson 3.1, the cerebrum is divided into two hemispheres, and each hemisphere comprises four distinct regions known as lobes. Each is named after the plate of the skull protecting it: frontal lobe, parietal lobe, occipital lobe and temporal lobe.

Visually, the lobes appear symmetrical for each hemisphere. Both hemispheres have one of each of the four lobes, making eight lobes in total. While the cerebrum is studied as a series of separate lobes, in reality the lobes work together, and the region of one lobe may have a similar or related function to the neighbouring region of another lobe. The sections of the cerebrum are given particular names to make the brain easier to study.

Challenge

Cortical area

Relative to their body size, animals have a smaller cortical area than humans and therefore do not have the same level of intellectual functioning. Try to imagine the cortex as a piece of fabric set out flat on a table, which is then scrunched up to fit inside a box. This is similar to what happens to the cortex to be able to fit inside the human skull; spread out, the cortex covers an area the size of a 70-centimetre television screen.

Consider why humans evolved to have a larger cortex.

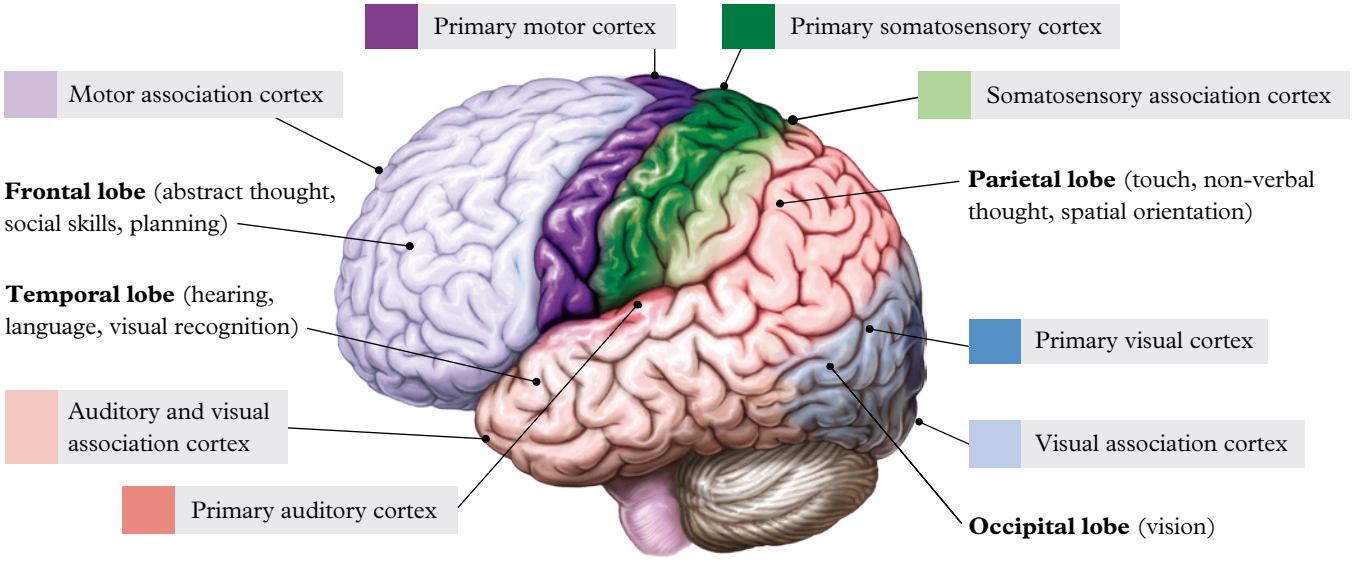


FIGURE 2 Lobes and functions of the left cerebral hemisphere. Note the location of the primary cortices and association areas.

The lobes and primary cortices

The primary areas of the cortex comprise approximately 25 per cent of the total cerebral cortex. When the senses first receive information from the environment, the information is sent to the thalamus, which then relays it to the primary cortex of the relevant lobe (Figure 2). The primary cortex begins processing and interpreting incoming sensory information. For example, the **primary visual cortex** in the occipital lobe receives visual information from the eyes; the **primary auditory cortex** in the temporal lobe receives sound information from the ears; and the **primary somatosensory cortex** in the parietal lobe receives information from touch receptors on the skin.

Note that there is no primary sensory cortex in the frontal lobe; rather, this contains the **primary motor cortex**, which controls our movements. The cerebral cortical areas that are not primary motor or sensory areas are known as **association areas**.

Role of the frontal lobes in cognitive processes

The **frontal lobes** are the largest of the lobes and the last part of the cerebral cortex to fully develop, with some major changes occurring throughout adolescence. Most of the frontal lobe is the association area. This is the part of the frontal lobe responsible for higher order cognitive processes such as attention, planning, decision-making and problem-solving, as well as aspects of personality, emotions and social skills. An association area located in the left frontal lobe (Broca's area, Lesson 3.3) is responsible for the production of speech.

People with frontal lobe damage may be unable to learn from experiences; for example, if they attempt a problem-solving task, they might be unable to evaluate which of their problem-solving strategies was previously most successful and will therefore have to go through a trial-and-error process of solving the problem every time they are confronted with it. This is known as "perseverating" (as opposed to perseverance). People with frontal lobe damage also are likely to make mistakes in planning because they lack foresight.

The frontal lobes also contain the primary motor cortex for each hemisphere, responsible for executing voluntary movement. It is situated at the rear of each frontal lobe, next to the central fissure. It is the part of the frontal lobe that is responsible for movement of the skeletal muscles. For example, when you want to message a friend, the primary motor cortex is activated and guides your fingers (arm and finger muscles) to press the letters on your phone. For this message to be sent, other areas of the brain are also activated. The prefrontal cortex plans the movement, the premotor cortex organises the movement sequence and then the primary motor cortex produces the specific movements.

The left primary motor cortex is responsible for the movement of the right-hand side of the body, and vice versa; this is called contralateral organisation. If the right primary motor cortex is damaged, a person will be unable to move parts of their body on the left side, such as their left hand and leg; the reverse will happen if the left primary motor cortex is damaged. Knowledge about brain lateralisation was first gained through split-brain patients, as discussed in Lesson 2.2.

FIGURE 3 The primary motor cortex guides your fingers when you send a text message.

primary visual cortex
located in the occipital lobe and involved in the processing of information from the eyes

primary auditory cortex
located in the upper part of the temporal lobe; receives sound information from the ears in the temporal lobe

primary somatosensory cortex
located at the front of each parietal lobe; processes sensations such as touch, pressure, temperature and pain from the body

primary motor cortex
located at the rear of each frontal lobe; responsible for movement of the skeletal muscles of the body

association area
region of the cerebral lobes that is not part of the primary sensory (visual, auditory, somatosensory) or motor cortices; integrates the information between the motor and sensory areas and higher order mental processes

frontal lobe
the largest lobe of the brain; has several functions, including initiating movement of the body, language, planning, judgment, problem-solving, aspects of personality and emotions

Role of the parietal lobes in cognitive processes

FIGURE 4
The primary somatosensory cortex located in the parietal lobes receives sensations such as pain from the body.

Much of the **parietal lobes** are taken up by the primary somatosensory cortex (Figure 2). They are situated at the front of each parietal lobe, just behind the central fissure, and receive sensations such as touch, pressure, temperature and pain from the body. Their other key functions are spatial awareness and spatial skills (e.g. map reading). They enable us to coordinate our movements in response to objects in our environment. For example, when you are driving, the parietal lobes help you to have a sense of where the exterior of your car is in relation to other cars and potential barriers.

As in the primary motor cortex of the frontal lobes, the primary somatosensory cortex functions in a contralateral organisation. If the primary somatosensory cortex of the right parietal lobe is damaged, a person will be unable to process sensation from parts of the body on the left side, and the relevant body part will be numb. The reverse will happen if the left primary somatosensory cortex is damaged.

Role of the temporal lobes in cognitive processes

The **temporal lobes** process auditory information – sensations received in the ears. They perform the complex auditory analysis that is necessary for understanding human speech or listening to music. They are also linked to connecting emotional content to episodic memories (which are your personal memories, such as when you did your driver's licence test, or the surprise party your friends threw for you), and facial and object recognition. You will learn more about memory in Unit 3.

FIGURE 5 The temporal lobe is responsible for the auditory analysis necessary for listening to music.

Parts of the lobes are especially sensitive to particular types of sounds. Patients whose temporal lobe is electrically stimulated are likely to report hearing sounds, even if there is no actual sound in the room for their ears to hear.

The primary auditory cortex is in the upper part of the temporal lobes (Figure 2). A person with a damaged primary auditory cortex is likely to experience forms of deafness. People with a damaged right auditory association cortex are unable to recognise the pattern of sounds that do not have words or to locate a sound in space; for example, finding a ringing mobile phone in a room. You will learn more about auditory sensation and perception in Unit 3.

parietal lobe
the location of the primary somatosensory cortex in the brain; it enables a person to perceive their own body and where things are located in their immediate environment

temporal lobe
the part of the forebrain beneath the temporal plate of the skull, at the side of the head above the ears; contains Wernicke's area and the primary auditory cortex; responsible for processing verbal sounds and connected to memory

Role of the occipital lobes in cognitive processes

The **occipital lobes** are entirely concerned with vision. Information from the left side of each retina (in each eye) is processed in the left occipital lobe, and information from the right side of each retina is processed in the right occipital lobe. Information from the centre of the visual field and the centre of each retina is processed in the occipital lobes (Figure 2).

Damage to the occipital lobes can result in visual impairments even if the eye(s) and/or their neural connections to the brain are undamaged. Different parts of the primary visual cortex of the occipital lobes process different types of visual stimuli. You will learn more about visual sensation and perception in Unit 3.

occipital lobe
the cerebral cortex at the rear of the brain; the location of the primary visual cortex and association areas involved with integration of visual stimuli

The lobes and association areas

While 25 per cent of the cerebral cortex is made up of the primary cortices, 75 per cent is made up of what can be described as the association areas. These regions of the cerebral lobes are involved in integrating the information between the primary motor and sensory cortical areas, organising the information into more complex forms to enable interpretation (perception) to support higher order mental processing. This includes complex cognitive processing such as decision-making, thinking, planning, initiating movement, analysis, synthesis and language.

Association areas of the frontal lobe

FIGURE 6 Social mammals like dolphins have more developed prefrontal cortices.

- **Language:** The association area of the left frontal lobe includes **Broca's area**. This area coordinates the movement of the lips, tongue and vocal cords for articulation of words. It also relies on other parts of the frontal lobe for planning sentences and the muscle movement necessary to produce meaningful speech. Broca's area is located near the primary motor cortex of the left frontal lobe. This close proximity of the language and motor areas enables these parts of the brain to communicate quickly with each other, enabling a person to engage in conversation and communication. You will learn more about Broca's area in Lesson 3.3.
- **Emotional regulation:** Most of our emotional responses are caused by the limbic system, especially the amygdala. This is a small almond-shaped set of neurons within the brain, rather than in the cerebral cortex; however, parts of the cerebral cortex are also involved through two-way communication with the amygdala.
- **Prefrontal cortex:** Located behind the forehead and above the eyes, it comprises the entire non-motor anterior region of the frontal lobe. The prefrontal cortex is involved in making plans and predicting outcomes, helping to regulate emotion and behaviour by anticipating the consequences of our actions. Additionally, it is involved in anxiety and brain functions such as working memory and our ability to focus our thoughts. This area developed prominently during the evolution of mammals; the same is true of some species of dolphins.

Broca's area
part of the left frontal lobe; the speech production centre of the brain

Wernicke's area
part of the left temporal lobe, responsible for language reception and interpretation and for creation of grammatically correct speech

Association areas of the temporal lobe

The left temporal lobe contains **Wernicke's area**, which is responsible for storing receptor codes that interpret the meaning of language and hence speech comprehension. You will learn more about Wernicke's area in Lesson 3.3. People with damage to their left temporal lobe are likely to have difficulty understanding both written and spoken language. People with a damaged right temporal lobe tend to be unable to recognise songs, faces or paintings. The association areas of the temporal lobe are also important for the processing of memory.

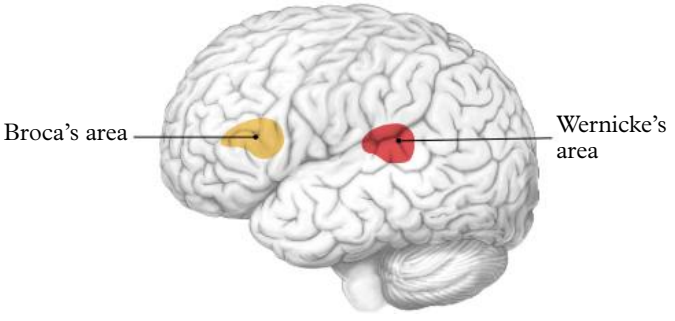


FIGURE 7 The location of Broca's and Wernicke's areas

Real-world psychology

The case of Phineas Gage

Phineas Gage was a railway worker who, in 1848, was involved in a workplace accident that resulted in a metal rod being thrust through the top of his skull, behind his left eye socket and through his left cheekbone. Miraculously, he survived the accident and was able to speak and move because the primary motor cortex and Broca's area had not been affected. However, Gage was left with permanent brain damage to his prefrontal cortex. The brain damage resulted in personality changes; he went from being a calm and responsible man (prior to the accident), to one who was emotionally volatile, impulsive, irresponsible and incapable of making good judgments or carrying out planned behaviours. Gage's unfortunate accident, while tragic for him, gave researchers valuable information about the functions of the prefrontal cortex.

Gage was 25 at the time of the accident, and went on to live a relatively normal life, considering his injuries, until he died at age 36. After the incident, his friends reported changes in his temperament, and his mother suggested that there may be some memory impairment. Despite this, most of the damage appears to have been temporary, and Gage was able to return to being a functional and socially normal person. His recovery took time. After approximately 2 months, Gage was able to return home from hospital to live with his parents and slowly began to complete small, relatively easy chores. Four years after the accident, doctors determined that he had recovered, though with some ongoing personality changes. He went on to work in Chile, until 1860 when he began to experience epileptic seizures, which ultimately caused his death. Gage's accident provided insight into the frontal lobe's involvement in personality.

Apply your understanding

1 **Identify** the area of Gage's brain that was affected by the metal rod that penetrated his skull. (1 mark)

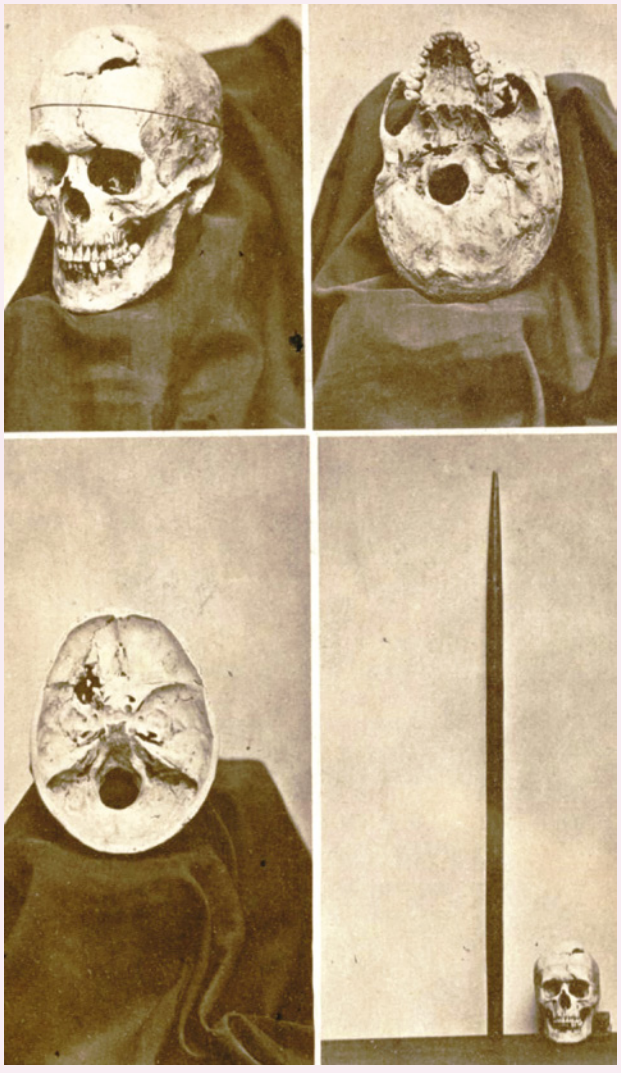


FIGURE 8 Phineas Gage was involved in a serious accident at work. A metal rod was thrust through his skull behind the eye socket, penetrating the prefrontal cortex of his frontal lobe.

2 **Explain** why the case of Phineas Gage is important in understanding localisation of areas of the brain. (1 mark)

3 **Describe** what might have happened to Gage's functioning if the metal rod had gone through his right eye socket rather than the left. (1 mark)

4 **Explain** why Gage was able to continue his life relatively normally. (2 marks)

Check your learning 3.2

Check your learning 3.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the eight lobes of the cerebrum. (4 marks)

2 **Describe** the structure of the cerebral cortex. (2 marks)

3 **Describe** a key function of the
   - **a** primary auditory cortex (1 mark)
   - **b** primary somatosensory cortex (1 mark)
   - **c** primary visual cortex (1 mark)
   - **d** primary motor cortex. (1 mark)

4 **Explain** two functions of the
   - **a** frontal lobe (2 marks)
   - **b** temporal lobe. (2 marks)

Analytical processes

5 **Compare** a primary cortex and an association area. (2 marks)

Knowledge utilisation

6 **Discuss** how localisation of brain function can be used to predict cognitive and behavioural effects of localised damage. (4 marks)

Lesson 3.3
Specific brain regions

Key ideas

- → Broca's area is an association area of the left frontal lobe, responsible for speech coordination.
- → Wernicke's area is an association area of the left parietal lobe, responsible for language reception and interpretation, and the formation of grammatically correct speech.
- → Geschwind's territory is also found in the parietal lobe and connects Broca's and Wernicke's areas via a bundle of nerve fibres.

Learning intentions and success criteria

Introducing specific brain regions and their interactions

In Lesson 3.2, the association areas of the frontal and temporal lobes were identified, and both of these regions were implicated in the role of language production and comprehension. This lesson will expand on the role of Broca's area and Wernicke's area. It will also introduce Geschwind's territory and the interactions of these areas.

Broca's area

As discussed already in Lesson 3.2, Broca's area is an association area of the left frontal lobe, responsible for the coordination of speech. In 1861, Pierre Paul Broca, a young surgeon, was working in a hospital at Bicêtre in Paris when a patient was transferred from the insane asylum to the surgical ward because of gangrene in his right leg. This patient had great difficulty speaking and was only able to make a few sounds, the most common being one that sounded like "tan". In fact, "tan, tan" was his answer to most questions and led to the hospital staff

FIGURE 1 Pierre Paul Broca (1824–80), French physician

nicknaming him Tan. Tan was able to communicate by gestures but occasionally would angrily blurt out the phrase, "Sacré nom de Dieu!" ("Holy name of God!") in extreme frustration.

Broca was fascinated with his new patient. Tan was 51 years old and had been in hospital for 21 years following a head injury that left him unable to speak. Apart from Tan's lack of speaking ability, he was otherwise intellectually normal. In addition, he was developing paralysis in his right arm and right leg.

Tan died just 6 days after becoming Broca's patient. Broca performed an autopsy on him and found significant damage to Tan's left hemisphere. The lesion (tissue damage) was centred in Tan's left frontal lobe near the motor cortex region that controls the muscles used in speech.

Broca pinpointed this specific location of the brain as being responsible for the function of speech production – an area of the brain now known as "Broca's area". Broca's case study led to an important breakthrough. While such case studies lack control, Broca was able to study Tan's case in detail because he had been a hospital patient for such a long time.

Broca went on to study another eight patients with similar language difficulties (people unable to speak fluently, but able to comprehend language) and found similar brain damage. This specific deficit in the brain destroyed speech in an otherwise healthy person (Broca's aphasia, which you will learn about in Module 5). Broca provided the first compelling clinical evidence that clearly connected a specific behaviour to a specific brain area, recognising that understanding localisation of brain function can be used to predict cognitive and behavioural effects of localised damage.

FIGURE 2 Tan's brain is on display at the Musée Dupuytren in Paris.

Wernicke's area

As discussed already in Lesson 3.2, Wernicke's area is an association area of the left temporal lobe and is responsible for language reception and interpretation, and for the creation of grammatically correct speech. For example, when you hear a word, Wernicke's area helps you to comprehend the meaning of the word after the primary auditory cortex processes the auditory message from the ear.

Broca's findings initially received some criticism because the idea of a single area of the brain being responsible for certain behaviours (location of function) had not been accepted. However, further support for Broca came just 12 years later: in 1873, a German physician named Carl Wernicke examined a patient with a different language difficulty that he attributed to damage in a different region of the brain – the area now known as Wernicke's area (this language difficulty is known as Wernicke's aphasia, which you will learn about in Module 5).

FIGURE 3 Carl Wernicke (1848–1905), German physician

Geschwind's territory

More recently, a third area of the brain that is important to language has been identified. British scientists have discovered that the inferior parietal lobule provides a connection between Broca's area and Wernicke's area via a bundle of nerve fibres. They have named this area **Geschwind's territory**, after the famous American neurologist Norman Geschwind, who had theorised that there might be such a connection (Geschwind, 1970).

Geschwind's territory
area of the brain that provides a connection between Broca's area and Wernicke's area; helps to process the multiple properties of words, and classify and label things, which is a prerequisite for developing concepts and thinking abstractly

Geschwind and other scientists had been puzzling over how humans internalise words – how we come to understand that a word has a particular meaning or an association with a particular object (Prpić, 2015). How do we hear a sound, understand that it represents a word, and that the word then represents a certain object or concept? We have known for some time that Broca's area and Wernicke's area are linked by the arcuate fasciculus, a bundle of curved neural fibres. The connection helps explain how we take the input from words we hear or read and link them to those areas of the brain responsible for speech production.

More recent research suggests that Geschwind's territory provides a parallel pathway connecting Broca's area and Wernicke's area, but that the connection does not develop until we reach 5 to 7 years of age (Bell, 2004). This is important because it suggests that there are some vital connections in the brain that do not form until well into childhood (Bell, 2004).

Geschwind's territory is located in an area in the brain where the neurons are multimodal – able to simultaneously process a range of stimuli, such as auditory and visual. As a result, it is the ideal area for processing the multiple properties of words – how they sound, how they look and what they represent. Therefore, Geschwind's territory enables the brain to interpret and classify things, which is a prerequisite for abstract thinking (Prpić, 2015). Thus, the discovery of Geschwind's territory is vital to our understanding of how humans developed higher order thinking and the ability to construct and maintain abstract concepts.

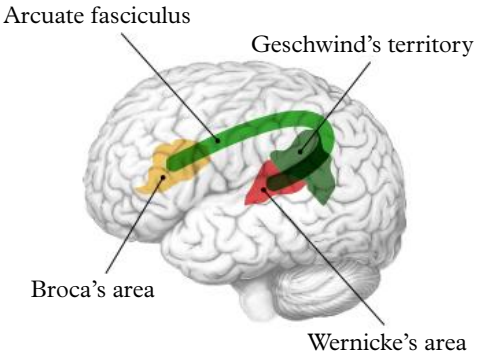


FIGURE 4 Geschwind's territory is located between Broca's area and Wernicke's area.

Skill drill

Acknowledging sources of information

Science inquiry skill: Communicating scientifically (Lesson 1.9)

Referencing is an important research skill that you will use throughout your psychology study. It is important to understand how to write a reference, but also how to read a reference. Each piece of research you read will have a reference list. A reference list is different from a bibliography in that it contains only the cited sources in the body of work (e.g. journal articles), whereas a bibliography includes all sources read as part of the background or further reading completed.

You can also use a reference list from an article to discover other research you might read and consider.

In Psychology, the American Psychological Association (APA) reference style (currently in its seventh edition) is used. Here is an example of APA, seventh edition, style for journal articles.

Punctuation and spacing is just as important as the information and the order of the information included.

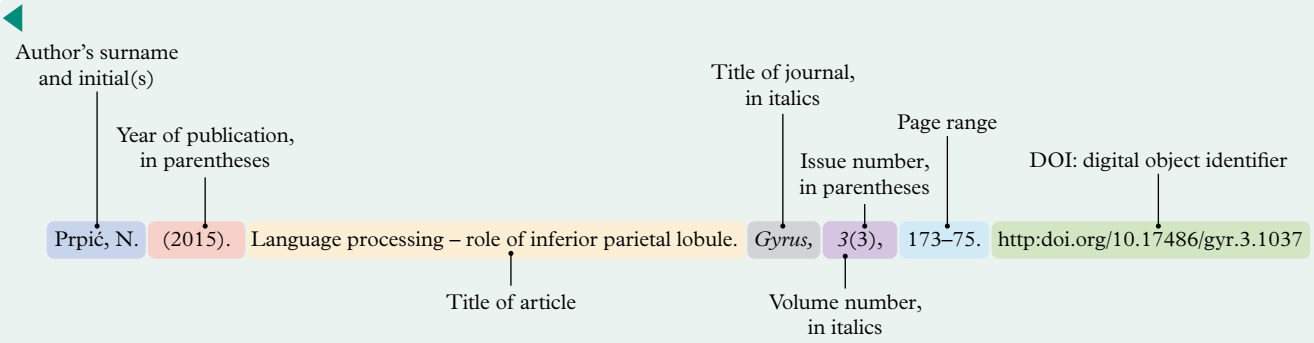


FIGURE 5 Example of APA, seventh edition, referencing style for a journal article

Practise your skills

1 Find one journal source that could be used to respond to the following research question: To what extent can localisation of function be supported using patients with brain injury?
Write the source using the APA, seventh edition, referencing style. (1 mark)
2 **Explain** how the source from Question 1 responds to (supports/refutes) the question. (1 mark)
3 **Use** the source you found for Question 1 and read its reference list. **Select** one of these references for further research and write the reference in APA style. (1 mark)

Check your learning 3.3

Check your learning 3.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the location of the following areas in the brain
   a Broca's area (1 mark)
   b Wernicke's area (1 mark)
   c Geschwind's territory. (1 mark)
2 **Describe** the function of the following areas
   a Broca's area (1 mark)
   b Wernicke's area (1 mark)
   c Geschwind's territory. (1 mark)
3 **Describe** the interacting roles of Broca's area, Wernicke's area and Geschwind's territory. (2 marks)

Analytical processes

4 Jason falls off his bike on the way to school and hits his head against the concrete gutter. Later that day, his teacher notices that Jason's speech is garbled. He can't answer basic questions such as, "What is your name?" **Determine** which area of the brain would most likely be affected. (1 mark)

Knowledge utilisation

5 **Comment** on the interacting roles of Broca's area, Wernicke's area and Geschwind's territory in language production. (3 marks)

MODULE 3

Lesson 3.4
Review: The brain

Summary

3.1
- The hindbrain supports bodily functions, such as breathing, digestion and voluntary movement.
- The midbrain supports consciousness and the coordination of movement, and is the connection between the forebrain and the hindbrain.
- The forebrain supports higher order thinking and is the largest part of the brain.

3.2
- Each hemisphere of the cerebral cortex is divided into four lobes.
- The frontal lobes are responsible for abstract thought, social skills and planning, and include the primary motor cortex.
- The parietal lobes are responsible for touch, non-verbal thought and special orientation, and include the primary somatosensory cortex.
- The temporal lobes are responsible for hearing and language, and include the primary auditory cortex.
- The occipital lobes are responsible for vision and include the primary visual cortex.

3.3
- Broca's area is an association area of the left frontal lobe, responsible for speech coordination.
- Wernicke's area is an association area of the left parietal lobe, responsible for language reception and interpretation, and the formation of grammatically correct speech.
- Geschwind's territory is also found in the parietal lobe and connects Broca's and Wernicke's areas via a bundle of nerve fibres.

Review questions 3.4A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 When asked to perform a number of actions in a specific order (e.g. touch your nose and then your toes), the part of the brain you are primarily activating is the

A cerebellum. **B** thalamus.
C corpus callosum. **D** hypothalamus.

2 Heart-rate activity and respiration are controlled by the

A medulla. **B** thalamus.
C corpus callosum. **D** reticular formation.

3 Which of the following is involved in coordinating skeletal body movement and balance?

A Motor cortex **B** Medulla
C Cerebellum **D** Frontal lobe

4 What is a particular behaviour typically controlled by?

A A single brain structure
B One or two structures
C A network of structures
D The motor cortex only

5 Damage to which of the following brain areas would have the most impact on humans?

A Corpus callosum
B Medulla
C Reticular formation
D Thalamus

6 **Identify** the primary advantage of the folding of the cerebral cortex.
- **A** It allows for a larger brain to fit into a smaller skull.
- **B** It decreases the brain's surface area for better protection.
- **C** It increases the distance between neurons, enhancing cognitive function.
- **D** It increases the surface area for more neural connections without increasing brain size.

7 Which of the following statements about hemispheric specialisation is true?
- **A** The right hemisphere controls all the language functions in all humans.
- **B** The left hemisphere controls all spatial interpretation in all humans.
- **C** Most functions are performed by the left and right hemispheres working together.
- **D** Most functions are performed by either the left or right hemispheres.

8 The left cerebral hemisphere generally controls the right side of the body and vice versa. **Recall** this type of organisation.
- **A** Unilateral
- **B** Contralateral
- **C** Ipsilateral
- **D** Bilateral

9 If your temporal lobe were electrically stimulated, what would probably be your experience?
- **A** You would hear sounds.
- **B** You would see visual stimuli.
- **C** You would feel sensations in your skin.
- **D** You would move parts of your body.

10 The largest part of the forebrain is the
- **A** medulla.
- **B** cerebrum.
- **C** pons.
- **D** thalamus.

11 Damage to which part of the cerebrum can result in deficits in the ability to plan, problem-solve and make sound judgments?
- **A** Temporal lobe
- **B** Occipital lobe
- **C** Thalamus
- **D** Association area

12 Geschwind's territory could be defined as
- **A** the area of the brain that connects Broca's and Wernicke's areas.
- **B** the area of the brain responsible for sending information to Broca's area.
- **C** the area of the brain next to Broca's area.
- **D** the area of the brain next to Wernicke's area.

13 The primary cortex found in the occipital lobe is
- **A** the primary motor cortex.
- **B** the primary auditory cortex.
- **C** the primary somatosensory cortex.
- **D** the primary visual cortex.

14 The cerebellum is part of the
- **A** midbrain.
- **B** temporal lobe.
- **C** hindbrain.
- **D** forebrain.

15 The hippocampus is implicated in
- **A** emotion and aggression.
- **B** memory.
- **C** connecting the two hemispheres of the brain.
- **D** balance and movement.

16 **Identify** which of the four lobes is primarily involved in hearing.
- **A** Occipital
- **B** Frontal
- **C** Temporal
- **D** Parietal

Review questions 3.4B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

17 **Describe** the structure and function of the brain areas in the table. (6 marks)

	Structure	Function
Hindbrain (medulla, pons and cerebellum)		
Midbrain (reticular formation)		
Forebrain (hypothalamus, thalamus and cerebrum)		

18 **Describe** the role of the thalamus in processing sensory information. (1 mark)

19 **Describe** the role of the hypothalamus in our survival. (1 mark)

20 **Explain** the role of the reticular formation in our daily life. (1 mark)

21 A patient experienced a head injury that resulted in the inability to move her left hand. **Identify** which part of her brain was most likely damaged. (1 mark)

22 Following a brain injury sustained in a car accident, Tao is unable to feel any sensation of touch or temperature in the cheek area on the right side of her face.

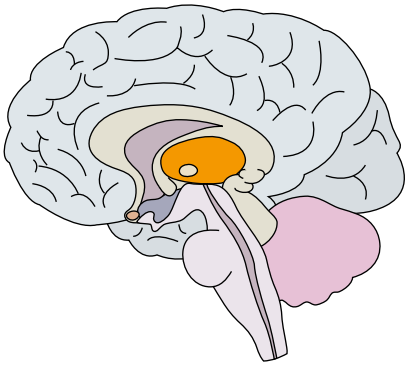
a **Identify** which brain area is likely to be affected. (1 mark)

b **Explain** your answer to **a**. (1 mark)

23 **Explain** the role of the cerebral cortex in each lobe in the table. (6 marks)

Lobe of the brain	Role of the cerebral cortex
Temporal lobe	
Frontal lobe	
Occipital lobe	

24 Label the diagram to **identify** the location of each of the lobes of the brain. (4 marks)



25 **Describe** the interacting roles of Broca's area, Wernicke's area and Geschwind's territory when a person verbally responds to a question. (3 marks)

Analytical processes

26 Sara had a car accident. After the crash, she was not able to speak fluently but she was able to write what she wanted to say. **Deduce** the area of the brain that is likely to be damaged. (1 mark)

Knowledge utilisation

27 The corpus callosum bridges the gap between the two hemispheres of the brain. Despite its importance in facilitating communication between the hemispheres, people are able to lead relatively normal lives when it is medically severed. **Discuss** why this is possible. (3 marks)

28 **Predict** what may happen to someone with damage to their occipital lobe. (2 marks)

29 Broca and Wernicke were able to study patients who had existing injuries. **Propose** another way that their research could have been conducted. (1 mark)

Data drill

Role of the hippocampus

Maguire (2006) investigated the role of the hippocampus by studying taxi drivers in London. This research found that taxi drivers, who had enhanced spatial memory due to their profession, had a higher volume in the hippocampus as measured by MRI, compared with the control group.

This study was extended by an independent research group in Queensland, who sought to discover if the same effect could be seen in Brisbane taxi drivers.

A two-sample unpaired *t*-test was used to establish if there was a statistically significant difference between the two groups. The *p*-value was found to be 0.06.

TABLE 1 Differences in hippocampus size between control group and taxi driver group

Hippocampus size of control group (cm)	Hippocampus size of taxi driver group (cm)
2.0	3.1
1.5	2.9
1.7	1.8
2.1	2.0
1.3	1.6
1.0	1.8
1.9	2.1
2.3	2.2
2.1	1.4
2.0	1.6
Mean = 1.79	Mean =

Apply understanding

1 **Calculate** the mean hippocampus size of the taxi driver group. (Show your working.)

Use the formula:

$$\bar{x} = \frac{x_1 + x_2 + \ldots + x_n}{n}$$

where x = raw data point and n = sample size. Round your answer to 2 decimal places. (2 marks)

2 **Identify** which group had the largest mean hippocampus size. (1 mark)

Analyse data

3 **Identify** two reasons why the two-sample unpaired *t*-test was used for the data analysis. (2 marks)

Interpret evidence

4 **Draw a conclusion** based on the inferential statistics. Give a reason for the conclusion. (2 marks)

Module 3 checklist: The brain

Quizlet: Revise key terms online to test your understanding

MODULE 4

The nervous system

Introduction

Think about how your body works. Right now you are reading this page, but you are not telling your eyes to read the text; more importantly, you are not consciously reminding your heart to keep beating or your lungs to keep breathing. These are automatic processes that your body completes without conscious thought or instruction. But how does this happen? Your body needs to coordinate communication between all of its organs, systems and muscles. This is where your central and peripheral nervous systems are involved.

When studying the roles of the central and peripheral nervous systems as communication structures between the internal and external worlds, it is easy to consider them separate entities with individual responsibilities. However, this is not how the human nervous system operates. The systems are connected.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to the nervous system before you start.

Subject matter

Science understanding

- → Describe the basic structure and function of the human nervous system, including the central (i.e. brain and spinal cord) and peripheral (i.e. somatic and autonomic) nervous systems.
- → Describe the structure of a neuron, including the axon, dendrites, cell body, myelin sheath and axon terminal.
- → Contrast sensory neurons, motor neurons and interneurons.

Science inquiry skills

- → identify, research and construct questions for investigation
- → distinguish between types of investigations
- → use appropriate equipment, techniques, procedures and sources to systematically and safely collect primary and secondary data
- → identify and use appropriate sampling procedures for selection and allocation of participants
- → identify errors, and extraneous or confounding variables that are likely to influence results; and implement strategies to minimise systematic and random error
- → use data and reasoning to discuss and evaluate the reliability and validity of evidence
- → judge the reliability and validity of the experimental process

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Lesson 4.1
The nervous system

Learning intentions and success criteria

Key ideas

- → The nervous system has two main branches: the central and peripheral nervous systems.
- → The central nervous system comprises the brain and the spinal cord.
- → The peripheral nervous system comprises the somatic and autonomic nervous systems.
- → The autonomic nervous system comprises the sympathetic and parasympathetic nervous systems.
- → The sympathetic nervous system is responsible for the fight-flight response.
- → The parasympathetic nervous system is responsible for homeostasis and the freeze response.

Introducing the human nervous system

The human brain does not act in isolation. It needs to receive information from the body's sense organs – the eyes, ears, skin, nose and tongue – which are constantly receiving information from the environment. The brain is also connected with the muscles and glands in the body so that an organism is able to respond to and act on its current environment.

The two major divisions of the nervous system are the **central nervous system (CNS)** and the **peripheral nervous system (PNS)**. The CNS comprises the brain and spinal cord. It controls the body by processing and responding to sensory input from the peripheral nervous system. The PNS is made up of the nerves and ganglia outside the brain and spinal cord that communicate information to and from the central nervous system.

The peripheral nervous system also has two subdivisions: the **somatic nervous system** and the **autonomic nervous system**. The somatic nervous system transmits sensory information into the central nervous system and carries motor commands from the CNS to the skeletal muscles. The autonomic nervous system is responsible for communications between the body's non-skeletal (visceral) muscles and the internal organs and glands that regulate bodily functions, such as heart rate, digestion, respiratory rate, pupillary response, urination and sexual arousal. It operates without voluntary control or conscious awareness and consists of two branches known as the **sympathetic nervous system** and **parasympathetic nervous system**.

The sympathetic branch of the autonomic nervous system serves an important adaptive function by helping prepare the body for intense physical activity, such as the fight-flight part of the fight-flight-freeze response. The parasympathetic branch of the autonomic nervous system serves to relax the body and inhibit, or slow, many high-energy functions, such as heart rate, breathing and some glandular functions. It is this branch that dominates in the freeze response.

Figure 1 shows the divisions and subdivisions of the nervous system and Figure 2 illustrates the nervous system and its divisions.

central nervous system (CNS)
comprises the brain and the spinal cord; controls the body by processing and responding to sensory input from the peripheral nervous system

peripheral nervous system (PNS)
comprises all the nerves and ganglia outside the brain and spinal cord that communicate information to and from the central nervous system

somatic nervous system
branch of the PNS that transmits sensory information to the CNS and carries motor commands from the CNS to the skeletal muscles

autonomic nervous system
branch of the PNS responsible for communications between the body's non-skeletal muscles and the internal organs and glands that carry out bodily functions

sympathetic nervous system
branch of the autonomic nervous system that changes the activity levels of internal organs, muscles and glands to prepare for increased activity during times of high physical or emotional arousal

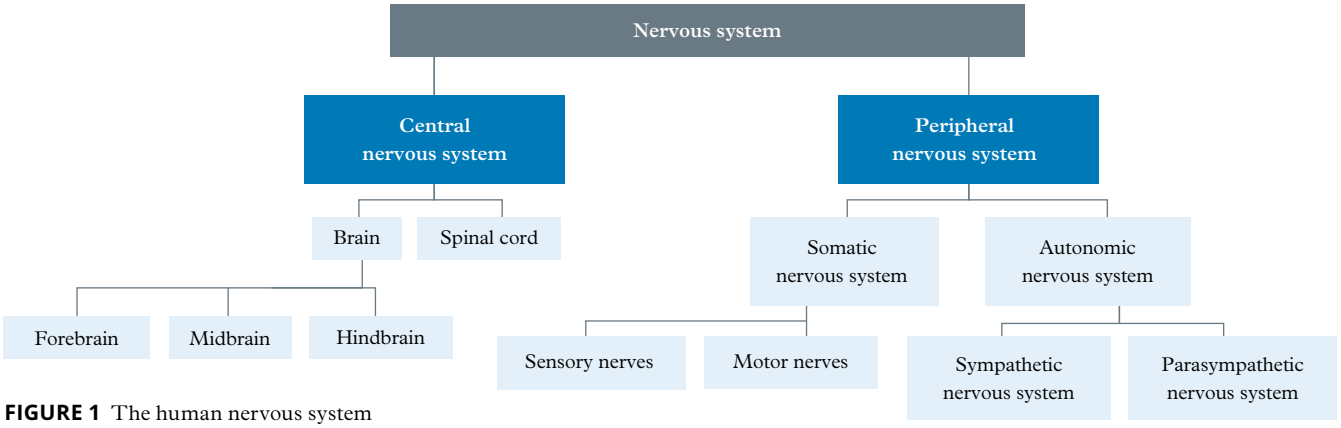


FIGURE 1 The human nervous system

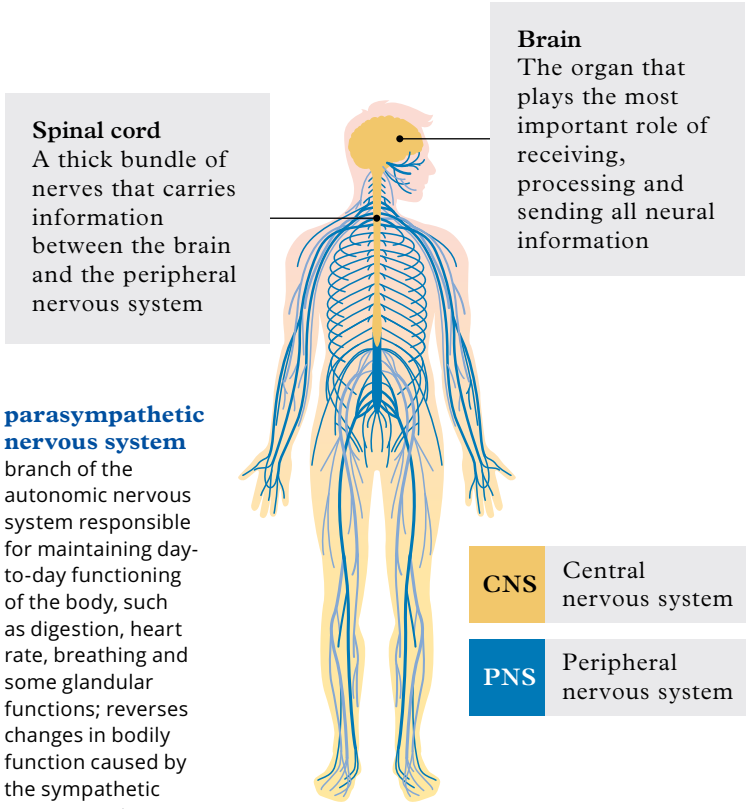


FIGURE 2 The human nervous system comprises the central nervous system (brain and spinal cord) and the peripheral nervous system (somatic and autonomic nervous systems).

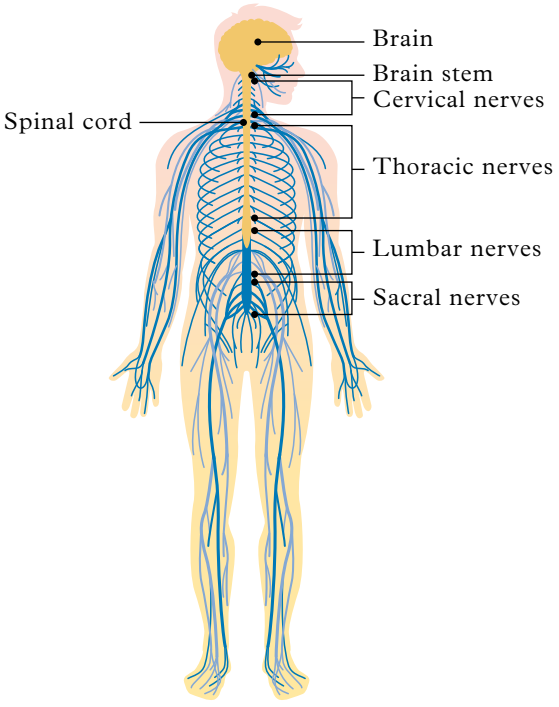


FIGURE 3 The upper section of the spinal cord is responsible for communication between the brain and upper parts of the body, while the lower section is responsible for communication between the lower parts of the body and the brain.

parasympathetic nervous system branch of the autonomic nervous system responsible for maintaining day-to-day functioning of the body, such as digestion, heart rate, breathing and some glandular functions; reverses changes in bodily function caused by the sympathetic nervous system

brain the main organ of the CNS that controls thinking, memory, emotion, vision and motor skills

spinal cord part of the central nervous system that carries sensory and motor signals between the peripheral nervous system and the brain

brain stem part of the brain that connects the brain to the spinal cord

Central nervous system

The CNS comprises the **brain** and the **spinal cord**. The spinal cord runs from the base of the brain (the **brain stem** connects the brain to the spinal cord) inside the bones of the spine (vertebrae) to the lower middle section of the spine. It enables the brain to communicate with the rest of the body by conveying messages from the brain to the PNS, and from the PNS to the brain (Figure 2). The spinal cord is segmented, with the upper section responsible for communication between the brain and the upper parts of the body, and the lower section responsible for the lower parts of the body, such as the legs, toes and feet (Figure 3). We will now look at the brain and spinal cord in more detail.

The brain

The brain weighs approximately 1.5 kilograms and contains approximately 100 billion neurons, which form circuits enabling the transmission of information (neurotransmission). There are also non-neuronal cells called glial cells that support, protect and nourish neurons in the nervous system. The brain is surrounded by protective fluid (cerebrospinal fluid), encased in three protective membrane layers (called the meninges) which are then encased in the 7-mm-thick skull (cranium). The brain has many functions, including attention and concentration (choosing what stimuli to attend to); memory; language skills; visual/spatial skills (knowing where you are in relation to the environment around you); and executive functions such as problem-solving, planning, logic and reasoning. The brain also receives the information from the PNS via the spinal cord.

FIGURE 4 The brain is the first component of the central nervous system.

FIGURE 5 The spinal cord is the second component of the central nervous system and runs from the base of the brain down the spine.

The spinal cord

The spinal cord consists of a cable-like column of nerve fibres (about 1 centimetre in diameter) that runs from the base of the brain (brainstem) to the lower back. It too is surrounded with protective cerebrospinal fluid and three layers of meninges, as well as 26 vertebrae. The spinal cord has three major functions:

- to transmit sensory information from the PNS to the brain (where this information is interpreted)
- to transmit nerve signals from the brain to the PNS, controlling how we use our muscles
- to provide rapid reflexive responses, hence providing a protective function. For example, if you accidentally touch a hotplate on the stove, a sensory message is sent to the spinal cord, which triggers a motor response, independently of the brain, of rapidly removing your hand from the hotplate. This is called the withdrawal **reflex**. Another well-known reflex that bypasses the brain is the knee-jerk reflex.

reflex
automatic, involuntary response to sensory information (stimulus)

Skill drill

Investigation design

Science inquiry skills: Planning investigations (Lesson 1.4); Evaluating evidence (Lesson 1.8)

When designing an experiment, you need to consider all of the variables that could affect your study before choosing a type of investigation design. Usually, you will have identified your independent and dependent variables in your research question, but you must also consider other factors that could influence results.

Choosing the type of investigation design can help you avoid some of these variables too. For example, if your results will be affected by participant variables, then a repeated-measures design would be more appropriate; but if order effects will be a problem, then an independent-measures design might be more suitable.

For example, Jabir wants to investigate whether reaction time can change depending on how well connected someone's nervous system is.

Our reaction time is the time it takes to respond to an external stimulus intentionally or voluntarily: from the time it is received by our sensory neurons, to the time we react or change our behaviour. He hypothesises that the more brain games (e.g. sudoku, brain teasers) you play, the more likely you are to have a faster reaction time compared to people who do not play brain games. Jabir decides to test this on adults, specifically a group of teachers.

Practise your skills

1 **Identify** two possible extraneous variables. (2 marks)
2 **Describe** how Jabir could conduct a randomised sample of 20 teachers from his school. (1 mark)
3 Jabir decides to use a repeated-measures design because this will eliminate the confounding variable of natural reaction time. **Decide** whether counterbalancing will reduce order effects. **Explain** your answer. (2 marks)
4 **Suggest** two improvements that Jabir could make to improve the reliability and/or validity of the experimental process that he currently has planned. (2 marks)

Peripheral nervous system

The peripheral nervous system has two functions:

- to communicate information from the body's organs, glands and muscles to the CNS, from both the outside world (such as environmental temperature and sensation on the skin, via sensory neurons) and the inside world (such as aches and pains)
- to communicate information from the CNS to the body's organs, glands and muscles, via motor neurons.

The peripheral nervous system has two subdivisions: the somatic nervous system and the autonomic nervous system, which we will look at in detail.

Somatic nervous system

The somatic nervous system (also known as the skeletal nervous system) is responsible for the voluntary movement of skeletal muscles (striated or "striped" muscles). It is a network of nerves that communicates sensory information to the CNS and motor information from the CNS.

The somatic nervous system receives sensory information from sites around the body, including the skin (e.g. thermoreceptor cells that detect temperature changes) and muscles. This sensory information is carried to the CNS by sensory neurons (sensory nerves). Motor information is carried from the CNS via motor neurons (motor nerves) to skeletal muscles in specific body regions so that we respond appropriately to the detected stimulus. You will learn more about neurons in Lesson 4.2.

Challenge

Fight, flight or freeze?

The autonomic nervous system serves an important adaptive function by helping prepare the body for the fight-flight-freeze response to emergencies. **Describe** some of the likely sympathetic responses activated when you experience a threat or intense anxiety.

Autonomic nervous system

The autonomic nervous system of the PNS is mostly responsible for the communication of information between the CNS and the body's non-skeletal muscles (also known as "smooth" or "visceral" muscles), as well as the internal organs and glands that carry out the basic bodily functions necessary for survival, such as digestion and heartbeat. Because the autonomic nervous system operates without voluntary control or conscious awareness, it enables the organism to have the cognitive resources to pay **attention** to other matters, such as responding to threats or other survival needs in the external environment. For example, you're going for a walk when suddenly, you hear a very loud dog bark, which frightens and startles you. Your heart rate accelerates, and you jump away from the noise. You did not consciously decide to increase your heart rate or jump; this is not a voluntary decision. This response is due to your autonomic nervous system.

attention
information you are actively processing, either consciously or unconsciously

The autonomic nervous system controls the function of internal organs (viscera) through the following:

- adrenal medulla (adrenal gland)
- blood vessels (smooth muscle)
- eyes (the iris; smooth muscle)
- gall bladder
- gastrointestinal tract
- glands
- heart (cardiac muscle)
- liver
- muscles
- pancreas
- skin (around hair follicles; smooth muscle)
- stomach, intestines and bladder (smooth muscle)
- sweat glands.

The activities controlled by the autonomic nervous system are mainly automatic, meaning that the vital organs and body systems work without our conscious effort, keeping us alive and leaving our mind free to focus on internal and external stimuli. Even though the actions of the autonomic nervous system are usually involuntary, some, such as breathing and blinking, can be voluntarily instigated. For example, you are generally unaware of each time you inhale and exhale, but you can deliberately hold your breath during a medical examination and breathe out on demand.

The autonomic nervous system is further divided into two branches: the sympathetic nervous system and the parasympathetic nervous system. These two systems work together in complementary ways but have different roles.

fight-flight-freeze response
a physiological response to stress that causes an organism to react in a combative manner (fight), remove themselves from the situation (flight) or not react at all (freeze)

The sympathetic nervous system

The sympathetic nervous system is like an emergency system that becomes active when an organism perceives itself to be in danger or is stressed. It readies the body in response to a threat by increasing heart rate, dilating pupils, stopping digestion, and redirecting blood away from the stomach to the muscles to ensure extra oxygen is available for an urgent response (Burton et al., 2015).

This is known as the **fight-flight-freeze response**, a physiological response to stress that causes an organism to react in a combative manner (fight), by removing themselves from the situation (flight), or by not reacting at all (freeze). It is more commonly known as the fight-or-flight response and this is where the sympathetic nervous system dominates. (The freeze response is dominated by the parasympathetic nervous system.)

FIGURE 6 During the fight-flight-freeze response, the threatened animal's sympathetic nervous system is activated.

The parasympathetic nervous system

In contrast, the parasympathetic nervous system operates in circumstances where it is relatively calm and dominates in situations when a person freezes. It is responsible for maintaining automatic day-to-day bodily functions, such as digestion, normal heart rate and normal breathing. This regular bodily functioning is also known as **homeostasis**.

homeostasis a self-regulating process by which the body maintains a stable internal balance while adjusting to a changing environment

Effects of the sympathetic and parasympathetic nervous systems

Both the sympathetic and parasympathetic nervous systems affect the same tissues and organs, but in the opposite way. While the parasympathetic nervous system allows us to go about our everyday tasks and keeps our bodily functions in a state of balance, the sympathetic nervous system prepares the same organs to deal with threats or stressors.

FIGURE 7 During homeostasis, the animal's parasympathetic nervous system maintains the body's metabolic balance during times of low arousal and no threat.

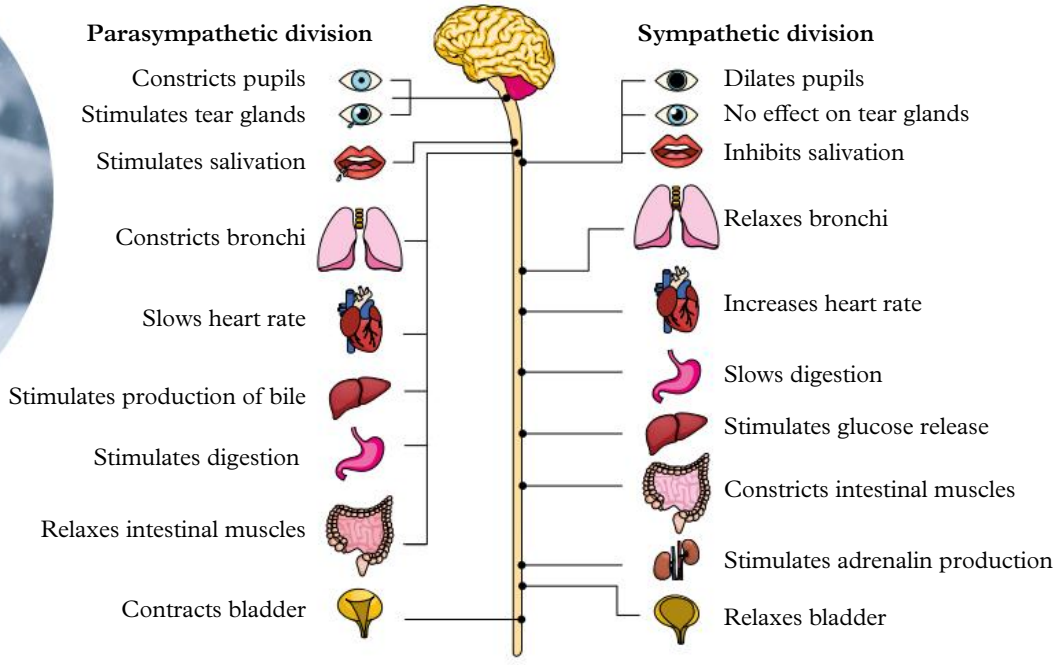


FIGURE 8 Responses of the sympathetic and parasympathetic divisions of the autonomic nervous systems, during fight-flight response and returning to normal levels, respectively

Check your learning 4.1

Check your learning 4.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the structures that make up the central nervous system. (2 marks)

2 **Describe** the basic structure and function of the peripheral nervous system. (4 marks)

3 **Describe** the functions of the spinal cord. (3 marks)

4 **Describe** the role of the somatic nervous system. (1 mark)

5 **Construct** a labelled diagram (similar to Figure 1) to illustrate your understanding of the structure and function of each component of the human nervous system. Make sure that you include

a the central nervous system, peripheral nervous system, somatic nervous system and autonomic nervous system (sympathetic; parasympathetic) (6 marks)

b the role of each system (you can use dot points). (6 marks)

Analytical processes

6 **Contrast** the sympathetic and parasympathetic nervous systems. (1 mark)

7 **Classify** the following responses according to the branch of the autonomic nervous system involved.

a Slowing the heart rate (1 mark)

b Constricting the pupils (1 mark)

c Stimulating glucose release (1 mark)

Knowledge utilisation

8 **Discuss** the roles of the CNS and PNS in regulating physiological processes. (3 marks)

dendrite
branch-like segments of a neuron that receive signals from other neurons or sensory receptors via the synapses and deliver these to the cell body

cell body
the largest part of the neuron containing the nucleus; controls metabolism and maintenance of the cell

Lesson 4.2
Structure of neurons

Key ideas

→ Neurons comprise dendrites, a cell body, an axon, a myelin sheath and axon terminals.

→ Glial cells are not part of neurons, but they produce myelin, which surrounds the axon in a sheath and increases the efficiency of transmission of nerve impulses.

Learning intentions and success criteria

Introducing neuron structure

Neurons (also called neurones or nerve cells) are specialised cells that make up the nervous system. Neurons receive information from other neurons, process this information and then communicate it to other neurons. In other words, neurons receive, process and transmit information between each other. Neurons are composed of the following elements: **dendrites**, **cell body**, **axon**, **myelin sheath** and **axon terminal**. Figure 1 shows the structure of a neuron. We will look at each of the elements.

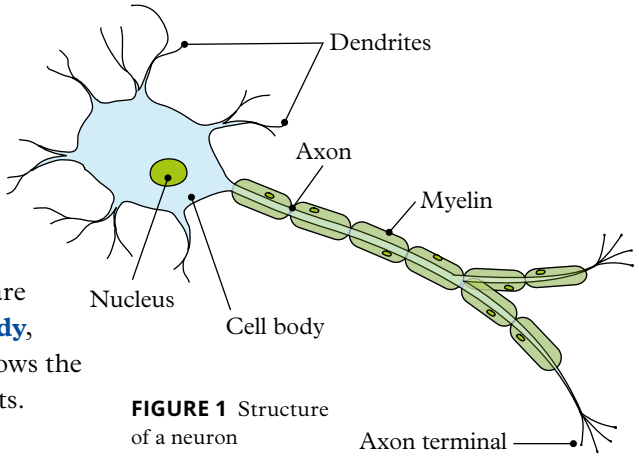


FIGURE 1 Structure of a neuron

Dendrites

A neuron can have hundreds or thousands of dendrites that look like branches coming off the cell body. Dendrites receive information from other neurons via neurotransmitters, which they carry from the **synapse** to the cell body. A synapse is the junction between two neurons.

Cell body

The cell body (or soma) is the largest part of the neuron and contains the nucleus of the cell. Cell bodies control the metabolism and maintenance of the neuron. In most neurons, the cell body receives messages from other neurons.

axon
the part of a neuron along which the electrochemical nerve impulse is transmitted

myelin sheath
an insulating fatty coating that helps facilitate the transmission of information to other neurons

Study tip

The terms "axon terminal" and "terminal button" should not be used interchangeably. Terminal buttons sit at the ends of axon terminals and secrete neurotransmitters.

Axon

The axon is a nerve fibre that extends from the cell body. Some axons have two or more offshoots, and some can be up to a metre long. Axons carry electrical impulses referred to as "action potentials" (information) towards the axon terminals that communicate with other neurons.

Myelin sheath

The axons of most neurons are covered in a myelin sheath, which is an insulating fatty coating that helps facilitate the transmission of information to other neurons. Axons with myelin are white rather than grey. The myelin sheath protects the axon from potential chemical and physical interference to the electrical impulses that travel along it. The insulation provided by the myelin sheath also enables information to travel much faster – up to 400 kilometres per hour.

axon terminal
located at the end of the axon branch and transmits messages to the next neuron by releasing neurotransmitters from terminal buttons

synapse
the junction between two neurons

terminal button
bulb-like structure at the end of the axon that releases neurotransmitters

neurotransmitter
chemical that helps the communication across nerve synapses

glial cell
type of cell that supports neurons by surrounding and holding them in place, supplying nourishment and oxygen, removing dead ones and insulating them

Axon terminals

Axon terminals are found at the end of the axon branch. Although they never actually touch, the axon terminals of one neuron link with the dendrites of the next neuron. They transmit messages to the next neuron, via the synapse.

Each axon terminal is capped with a **terminal button** that secretes chemicals called **neurotransmitters**, which help the communication across the synapse when an action potential is received by the terminal.

Glial cells

Glial cells are not part of the neuron but have an important role in supporting neurons. There are four identified functions of glial cells:

1. They surround neurons and hold them in place.
2. They supply nourishment and oxygen to neurons.
3. They remove dead neurons.
4. They insulate one neuron from another to increase the speed of transmission of nerve impulses. To do this, glial cells produce myelin.

Myelin and the myelin sheath

myelin
a white, fatty, waxy substance that covers the axon to insulate it from the surrounding fluid and from other neurons

node of Ranvier
a small gap occurring at regular intervals in the myelin sheath that speeds up the transmission of the electrical impulse along the axon

The myelin sheath is made from **myelin**: a white, fatty, waxy substance that covers the axon to insulate it from the surrounding fluid and other neurons, which protects it from electrical interference from other neurons. This increases the efficiency of transmission of nerve impulses. Only the axon is covered, not the cell body.

Myelin is produced in the brain and spinal cord by glial cells in a process called myelination. Myelinated neurons are faster in conducting messages moving through the nervous system. Small gaps in the myelin sheath surrounding the axon are called **nodes of Ranvier**. These nodes increase the speed of the electrical impulse (action potential) as the impulse can jump from one node to another rather than travelling the entire length of the axon.

Survival of an organism is dependent on how quickly messages can move through the nervous system; for example, processing spoken language quickly or pouncing on prey. Myelin and the myelin sheath are critical to the speed of transmission of these messages.

Check your learning 4.2

Check your learning 4.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** what the following parts of a neuron are responsible for.
   - **a** Dendrites (1 mark)
   - **b** Cell body (1 mark)
   - **c** Axon (1 mark)
   - **d** Myelin sheath (1 mark)
   - **e** Axon terminal (1 mark)

Analytical processes

2 **Compare** dendrites and axon terminals. (2 marks)

3 **Infer** what would happen if myelination did not occur around a neuron's axon. (1 mark)

Knowledge utilisation

4 **Predict** an effect on a person if their neurons were not insulated with myelin. (1 mark)

Lesson 4.3
Types of neurons

Key ideas

- → The three main types of neurons are sensory neurons, motor neurons and interneurons.
- → Sensory neurons are activated by sensory stimuli from the environment or body and carry this information to the central nervous system.
- → Motor neurons carry information from the central nervous system to skeletal and smooth muscles.
- → Interneurons carry information between sensory and motor neurons.
- → Neurons communicate with each other via a process called synaptic transmission. Neural pathways allow different parts of the nervous system to communicate with each other.

Learning intentions and success criteria

Introducing types of neurons

As you learnt in Lesson 4.2, neurons are made up of common elements; however, not all neurons look the same or perform the same function. In this lesson, we will look at three types of neurons and their roles, specifically in the somatic nervous system. We will also look more at communication between neurons.

Neurons and the somatic nervous system

Neurons are one of the specialised cells operating as a key part of the nervous system. In the somatic nervous system, they allow the body to receive information from the outside world and respond to this information with movement. Sensory neurons play an important part in our lives by transmitting sensory information from our environment to our brain.

Study tip

Remember neurons as SAME and I: Sensory Afferent, Motor Efferent, and Interneurons. The E for efferent is also for exit. The motor neuron "exits" the brain or spinal cord, carrying information to the muscles.

Our abilities to touch, taste, see, hear and smell all come from a process beginning with our sensory neurons registering an external stimulus, and then relaying that information to the central nervous system (CNS). Motor neurons can then carry signals from the brain and spinal cord to the muscle fibres so that our bodies can respond to the stimulus.

Figure 1 shows the three main types of neurons: sensory neurons, motor neurons and interneurons. We will look at each of these in turn.

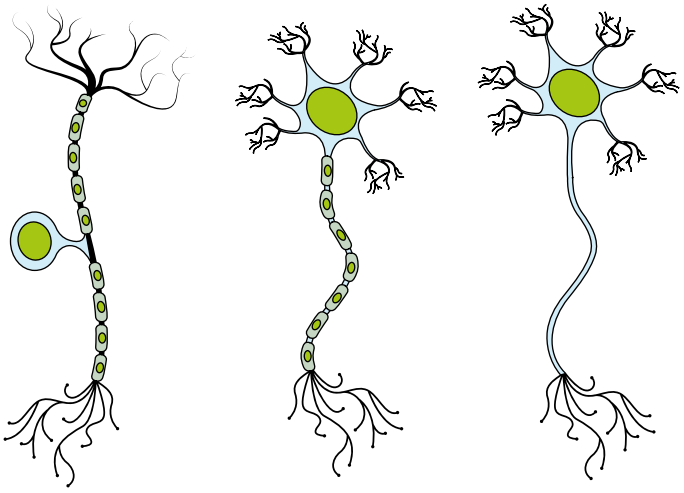


FIGURE 1 The three main types of neurons

sensory neuron neuron that carries sensory information from the body and the outside world into the CNS; described as afferent

motor neuron neuron that communicates messages from the CNS to the particular muscles that an organism intends to move at any particular moment; described as efferent

Sensory neurons

Sensory neurons carry sensory stimuli from the body and the outside world (such as sound, light and pressure) to the CNS. Sensory neurons that carry nerve impulses from sensory information towards the CNS are referred to as afferent neurons. Most sensory neurons are pseudounipolar, where the one axon splits into two branches (Figure 1). In Figure 2, you can see a child patting a dog. Sensory receptors on the skin of the child's hand detect the sensation of the dog's fur and convey that sensation to the brain. In this case, that sensation would be processed as feeling soft.

FIGURE 2 When this child pats the dog, the movement is initiated by motor neurons, while sensory neurons carry information about the feel of the dog's fur.

Motor neurons

Motor neurons of the spinal cord are neurons that communicate messages from the CNS to the particular skeletal muscles that an organism intends to move at any moment and to smooth muscle (such as that located in your stomach). Motor neurons that carry information from the CNS to the muscles are referred to as efferent neurons. The CNS and peripheral nervous system (PNS) work together to enable an organism to interact with the environment. In Figure 2, when the girl pats her dog, the motor neurons are responsible for initiating the movement. These neurons carry information from the child's brain to the muscles in their arm and hand that allow them to move to pat the dog. Motor neurons have one axon and several dendrites. This is referred to as a multipolar structure.

Interneurons

interneuron neuron that transmits information between motor and sensory neurons and the CNS

Interneurons carry information between the motor and sensory neurons in the CNS. They are multipolar, just like motor neurons (Figure 1). Most interneurons do not have a myelin sheath. Interneurons are especially important in transmitting impulses between other neurons as part of a reflex arc. For example, if a sensory neuron sends a message that a hand is touching a hotplate, the interneuron in the spinal cord will send the message to the motor neuron that the hand needs to move quickly away from the hotplate.

Real-world psychology

Motor neuron disease

Motor neuron disease (MND) is a debilitating illness that attacks nerve cells that are responsible for muscle control. It can affect a person's ability to move, speak, breathe and swallow. MND is fatal, with no known cure at this stage.

MND is the group name for several diseases that cause muscle degeneration. These diseases include amyotrophic lateral sclerosis (ALS), progressive muscular atrophy (PMA), progressive bulbar palsy (PBP) and primary lateral sclerosis (PLS). MND can be difficult to diagnose, as the symptoms are often mistaken for other conditions, and symptoms do not always present the same way in each individual. Diagnosis of MND is made through blood tests, nerve conduction studies, electromyography (EMG) and MRI scans.

The early symptoms may be mild and include:

- stumbling, or weakness of leg muscles
- weakness in hand muscles that makes it difficult to hold objects
- slurring of speech or swallowing difficulties.

Later symptoms may include:

- breathing difficulties
- fatigue caused by muscle exhaustion
- insomnia
- changes in cognition
- pain and discomfort.

Like many diseases that affect the nervous system or neurons, MND can affect anyone – even people who are incredibly fit and active.

A notable case is Australian Neale Daniher. Daniher played AFL football for Essendon in the 1980s and later went on to coach the Melbourne Demons AFL team. Through his public profile, Daniher has helped to bring attention to the disease through events such as The Big Freeze fundraiser, which is held at the MCG each year. The Big Freeze involves members of the AFL community sliding into a pool of icy water to raise money to help find a cure for MND. To date, The Big Freeze has contributed over $63 million to research and care for those diagnosed with MND, with their overarching goal to find effective treatments and ultimately a cure for MND.

Apply your understanding

1 **Identify** what is affected in the nervous system of a person who has MND. (1 mark)
2 **Describe** the impact of MND on the functioning of the body. (1 mark)
3 **Explain** why it is difficult to diagnose MND. (2 marks)
4 **Investigate** and **identify** three treatment options available for people diagnosed with MND. (3 marks)

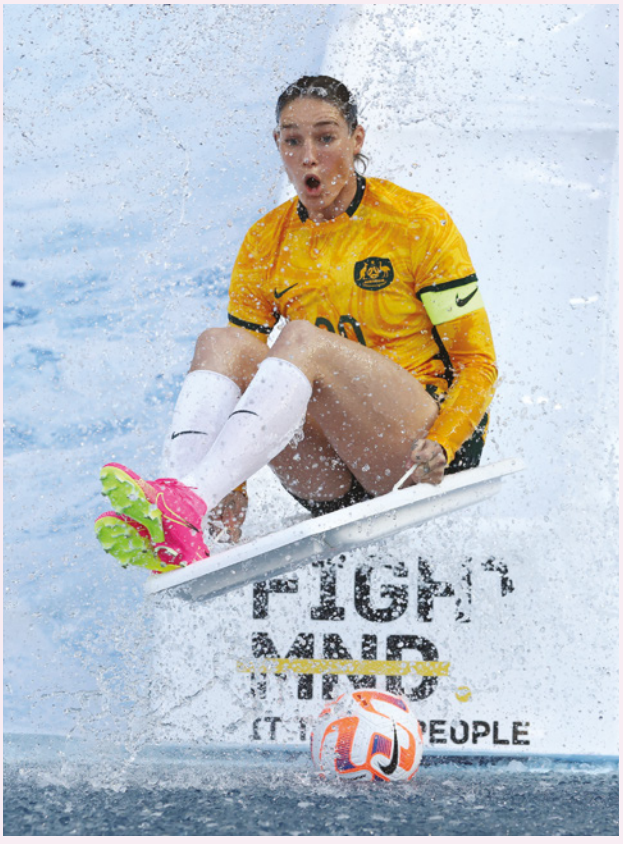


FIGURE 3 AFLW player Tayla Harris slides into icy water for The Big Freeze to help raise funds for MND research.

Skill drill

Credibility of resources

Science inquiry skill: Evaluating evidence (Lesson 1.8)

Things to consider when reading research include:

- the date of publication – older research may have been refuted or supported by newer research
- where the study was conducted and the sample size – the location of the study can influence whether the results can be generalised to the larger population, and the sample used may or may not be representative of the greater population (population validity)
- the author's credentials – research published in a journal will typically be peer reviewed, whereas a news article may be written by someone with no scientific background
- the methodology of the study (if supplied) – can you answer the following?
  - Is it possible to replicate the study? Why or why not? Has the study been replicated, and are the results consistent with the original findings? If the study was replicated today with different participants, would you expect the results to be the same?
  - Does the study have high ecological validity, meaning that the results from the study can be applied to understanding behaviour in real-life situations?

These considerations link to evaluating the reliability and validity of the evidence used in a research investigation. Remember that reliability refers to "the likelihood that another experimenter will obtain the same results (or very similar results) if they perform exactly the same experiment under the same conditions" (Taylor, 1982), and that validity refers to "the extent to which tests measure what was intended; the extent to which data, inferences and actions produced from tests and other processes are accurate" (Taylor, 1982).

Practise your skills

1 **Create** a research question for this claim: "Disorders that involve neuron degeneration will never have a cure." (1 mark)

2 Find one source related to your research question that is not credible. **Explain** why this source is not credible. (2 marks)

Communication between neurons

Information travels very quickly between neurons. A synapse is the junction between two nerve cells. The nerve cell before the synapse is called the presynaptic neuron, and the nerve cell after the synapse is called the postsynaptic neuron. The axon terminal of the presynaptic neuron, the minute gap between the pre- and postsynaptic neurons (called the **synaptic cleft**) and the dendrites of the postsynaptic neuron are all part of the synapse.

synaptic cleft the small gap between the presynaptic and postsynaptic neurons

Synaptic transmission

At the synapse, the axon terminal of a presynaptic neuron comes into close proximity with the receptor sites on the dendrites of a postsynaptic neuron. Neurons communicate with each other when a chemical messenger called a neurotransmitter is secreted from the terminal buttons of the presynaptic neuron, crosses the synaptic cleft and reaches the dendrites of the postsynaptic neuron. The secreted neurotransmitter affects the activity of the postsynaptic neuron with which it communicates. This process is called **synaptic transmission**.

synaptic transmission the process of neurons communicating with other neurons

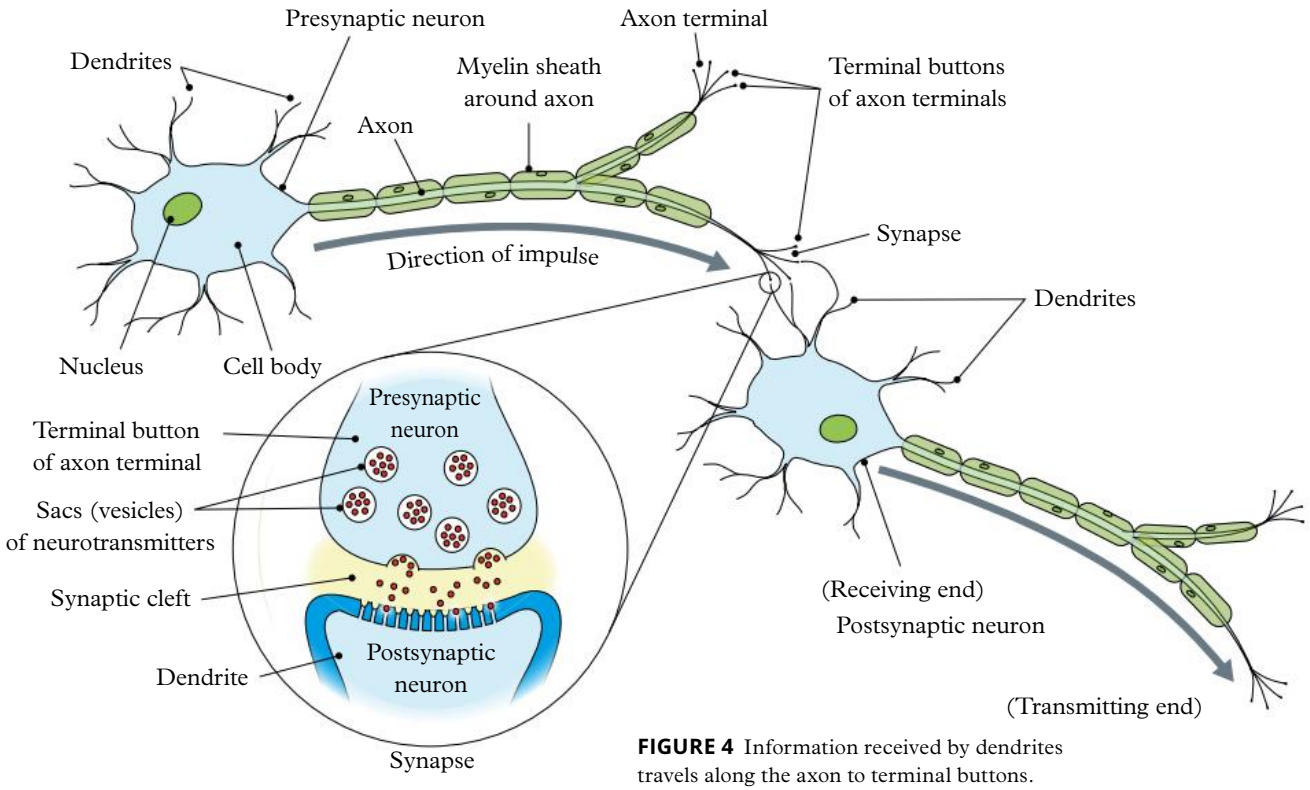


FIGURE 4 Information received by dendrites travels along the axon to terminal buttons.

It is important to remember that the neural structure of the brain is very complex. In reality, synapses can be located at several points along a neuron (at dendrites, the axon or the cell body), and many terminal buttons can form a synaptic cleft with a single dendrite.

However, it is easier to think of communication as starting with the dendrites receiving information (neurotransmitter) from the synaptic cleft, the information being passed as electrical impulses through the cell body along the axon, and a neurotransmitter being secreted from the terminal buttons to a synaptic cleft shared with the dendrites of another neuron.

These pathways are known as **neural pathways** and allow one part of the nervous system to communicate with another. A neural pathway can carry messages from the body to the brain (afferent pathways), from the brain to the body (efferent pathways) or within the brain itself.

neural pathway bundle of neurons that provides connections between one part of the nervous system and another

Check your learning 4.3

Check your learning 4.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** which type of neuron communicates messages from the CNS to the PNS. (1 mark)

2 **Describe** the function of an interneuron. (1 mark)

3 Alex picked up his sister's hair straightener when it was still hot. **Identify** the neurons that would be involved in his response. (1 mark)

4 **Explain** how neurons communicate with each other. (3 marks)

Analytical processes

5 **Contrast** a sensory neuron and a motor neuron. (1 mark)

6 **Discriminate** between sensory neurons and interneurons. (1 mark)

Knowledge utilisation

7 **Consider** human survival and what daily life would be like without interneurons. (2 marks)

MODULE 4

Lesson 4.4

Review: The nervous system

Summary

4.1
- The nervous system has two main branches: the central and peripheral nervous systems.
- The central nervous system comprises the brain and the spinal cord.
- The peripheral nervous system comprises the somatic and autonomic nervous systems.
- The autonomic nervous system comprises the sympathetic and parasympathetic nervous systems.
- The sympathetic nervous system is responsible for the fight-flight response.
- The parasympathetic nervous system is responsible for homeostasis and the freeze response.

4.2
- Neurons comprise dendrites, a cell body, an axon, a myelin sheath and axon terminals.
- Glial cells are not part of neurons, but they produce myelin, which surrounds the axon in a sheath and increases the efficiency of transmission of nerve impulses.

4.3
- The three main types of neurons are sensory neurons, motor neurons and interneurons.
- Sensory neurons are activated by sensory stimuli from the environment or body and carry this information to the central nervous system.
- Motor neurons carry information from the central nervous system to skeletal and smooth muscles.
- Interneurons carry information between sensory and motor neurons.
- Neurons communicate with each other via a process called synaptic transmission. Neural pathways allow different parts of the nervous system to communicate with each other.

Review questions 4.4A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 The central nervous system consists of
- **A** the brain and spinal column.
- **B** the autonomic and somatic nervous systems.
- **C** the brain and spinal cord.
- **D** the cerebral cortex and the spinal cord.

2 The peripheral nervous system consists of
- **A** the brain and spinal cord.
- **B** the automatic and somatic nervous systems.
- **C** the sympathetic and parasympathetic nervous systems.
- **D** the somatic and autonomic nervous systems.

3 Moving your leg is an action made by your
- **A** somatic nervous system.
- **B** autonomic nervous system.
- **C** sympathetic nervous system.
- **D** parasympathetic nervous system.

4 Motor neurons enable us to
- **A** feel the silky coat of a puppy.
- **B** smell the scent of a flower.
- **C** play the piano.
- **D** see a ball when it is thrown.

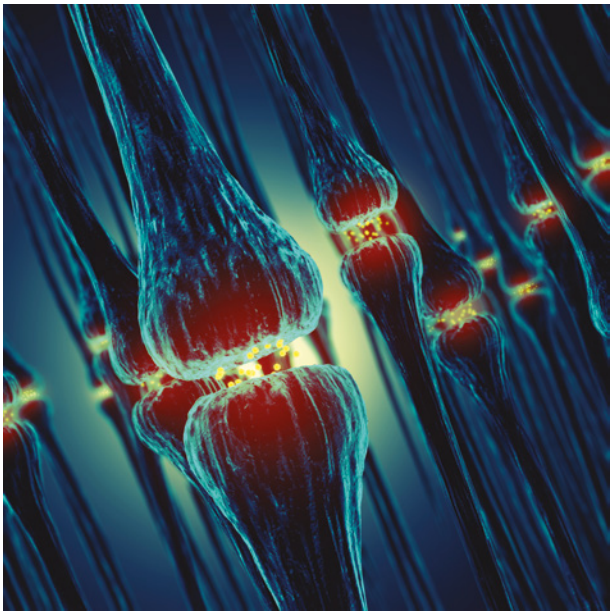
5 Sensory neurons in your toes are part of which nervous system?
- **A** Central
- **B** Peripheral
- **C** Autonomic
- **D** Sensory

6 Which of the following is true of the sympathetic nervous system?
- **A** In normal daily life, it has nothing to do; it is responsible for the fight-flight-freeze response when a person is confronted by a threat.
- **B** In normal daily life, it works all the time to ensure that the body's metabolic systems are in balance.
- **C** It operates at a level of conscious awareness.
- **D** It is part of the somatic nervous system that operates in the body.

7 Which of the following is a true statement about the parasympathetic nervous system?
- **A** In normal daily life, it has nothing to do; it is used to return the body functions to their normal levels after sympathetic arousal.
- **B** In normal daily life, it works all the time to ensure that the body's metabolic systems are in balance.
- **C** It operates at a level of conscious awareness.
- **D** It is part of the somatic nervous system that operates in the body.

8 A sensory neuron in the peripheral nervous system carries information to
- **A** interneurons.
- **B** motor neurons.
- **C** afferent neurons.
- **D** sense receptors.

9 To transmit nerve impulses, neurotransmitters are released into the
- **A** synaptic cleft.
- **B** cell body.
- **C** dendrite.
- **D** axon.



10 The molecules of neurotransmitters fit into receptor sites on the
- **A** terminal buttons of the postsynaptic neuron.
- **B** dendrites of the postsynaptic neuron.
- **C** cell body of the postsynaptic neuron.
- **D** axon of the postsynaptic neuron.

11 A neuron without myelin
- **A** delivers messages between neurons slowly.
- **B** delivers messages between neurons quickly.
- **C** is protected from chemical and physical interference.
- **D** is unable to function.

12 Interneurons would be responsible if
- **A** you stepped on something sharp and pulled your foot away before you realised.
- **B** you noticed that your hand was holding onto ice and you pulled it away because it hurt.
- **C** you were holding onto a hot tray, despite knowing it was too hot.
- **D** you felt rocks beneath your back while camping and chose to move your sleeping bag.

13 What are the two main functions of the peripheral nervous system?
- **A** To communicate information from the body's organs, glands and muscles to the CNS from both the outside world and the inside world; and communicate information from the CNS to the body's organs, glands and muscles via motor neurons
- **B** To communicate information from the body's organs, glands and muscles to the CNS from both the outside world and the inside world; and segment the spinal cord
- **C** To communicate information from the body's organs, glands and muscles to the CNS from both the outside world and the inside world; and communicate information from the CNS to the body's organs, glands and muscles via sensory neurons
- **D** To communicate information from the CNS to the body's organs, glands and muscles via motor neurons; and enable the brain to communicate with the rest of the body

14 Neurons communicate via
- **A** the myelin sheath.
- **B** a chemical process.
- **C** the cell body.
- **D** glial cells.

Review questions 4.4B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

15 **Recall** the name of the pathways that sensory neurons use to communicate. (1 mark)

16 **Recall** the name of the pathways that motor neurons use to communicate. (1 mark)

17 Mel was baking cupcakes for her friend's birthday on the weekend. She was distracted talking to her mother and picked up a hot tray. Before Mel had time to think about what she was doing, she had dropped the tray. **Describe** how Mel was able to react so quickly. (3 marks)

18 Rasmus has been bullied by people at school for a while. As soon as Rasmus sees the bullies, his heart starts to race, his pupils dilate and he feels the need to urinate. **Identify** which system is responsible for this reaction. (1 mark)

19 The following questions relate to the peripheral nervous system.

- **a** **Recall** which branch of the peripheral nervous system involves voluntary activity. (1 mark)
- **b** **Recall** which branch of the peripheral nervous system involves involuntary activity. (1 mark)

20 **Describe** why most neurons are myelinated**.** (1 mark)

21 **Describe** the two functions of the peripheral nervous system. (2 marks)

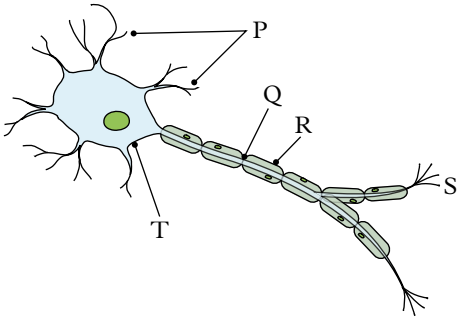
22 **Describe** a neural pathway. (1 mark)

23 **Identify** two characteristic features of someone who is experiencing the fight-flight-freeze response. (2 marks)

24 **Describe** each component of a neuron and their functions by copying and completing the table. (8 marks)

Structure	Description	Function
Dendrites		
Cell body		
Axon		
Myelin sheath		

25 **Identify** the components labelled P, Q, R, S and T of this neuron. (5 marks)



26 When Jeanna was feeding her fish last night, she realised that the water temperature was too warm when her hand touched the water. **Identify** how Jeanna knew this. Refer to the nervous system in your response. (1 mark)

Analytical processes

27 **Differentiate** between sensory neurons, motor neurons and interneurons. (2 marks)

28 Daniel has been outside for the last 3 hours. As the sun begins to set, Daniel realises it is getting colder.

- **a** **Determine** the neuron responsible for alerting Daniel to this. (1 mark)
- **b** **Determine** which part of the parasympathetic nervous system will be active to relieve this feeling. (1 mark)

29 People often emphasise the importance of the sympathetic nervous system as it is the survival system. **Consider** what may happen if the parasympathetic nervous system were malfunctioning. (2 marks)

Knowledge utilisation

30 Communication between neurons can be interrupted by substances, such as alcohol and pain relief medication. **Discuss** the implications of disrupting neuron communication. In your response, acknowledge the advantages and disadvantages. (4 marks)

31 **Discuss** the following statement: "Without functioning interneurons, humans would not be able to survive." (3 marks)

32 The parasympathetic nervous system maintains our general bodily functions, such as breathing, heart rate and digestion. **Assess** what the consequences may be if these processes were not automatically controlled. (3 marks)

33 **Evaluate** the following statement: "The peripheral nervous system is more important than the central nervous system." (3 marks)

34 **Predict** what may happen if a postsynaptic neuron were unable to receive the neurotransmitters that were released into the synaptic cleft. (1 mark)

Data drill

Virtual reality as rehabilitation

Dr Riley wanted to investigate the effectiveness of using virtual-reality glasses in helping stroke victims regain lost movement caused by damage to the motor areas of the brain.

- The experiment used a convenience sample of 20 patients recruited by four carers of stroke victims, all of whom work at the Cairns Hospital.
- Using a repeated measures experimental design, the 20 stroke victims (aged 50 to 75) were all given a series of baseline motor tests to evaluate their level of motor functioning; for example, completing five one-legged hops on each leg, catching a ball thrown at varying speeds from 10 metres away, completing five sit-ups.
- Then following the baseline tests, each of the 20 patients were provided with three 1-hour guided sessions (per week) of occupational therapy using virtual reality glasses. The glasses were tailored for each patient based on their level of motor deficiency as determined by the outcomes from their baseline testing. For example, a patient with limited left-hand movement would use the virtual reality glasses to picture and thus imagine their left hand picking up various objects such as a glass or an egg.
- Following 8 weeks of treatment, the patients repeated the series of baseline tests.
- The results for both phases of testing were scored out of 50, with 0 representing a total absence of motor control and 50 representing a high level of motor proficiency.

The scores for the tests are summarised in Table 1.

TABLE 1 Test results for stroke victims pre- and post-VR rehabilitation

Motor functioning test scores (out of 50)	Pre-test scores	Post-test scores
Patient 1	21.0	23.9
Patient 2	23.0	25.3
Patient 3	22.5	27.8
Patient 4	15.0	20.3
Patient 5	23.0	26.1
Patient 6	21.5	23.8
Patient 7	19.6	22.1
Patient 8	20.8	25.3
Patient 9	22.7	26.7
Patient 10	23.1	25.9
Patient 11	22.9	24.6
Patient 12	21.2	27.1
Patient 13	20.9	26.6
Patient 14	20.1	25.8
Patient 15	19.4	22.6
Patient 16	21.3	27.4
Patient 17	22.3	28.1
Patient 18	24.7	28.4
Patient 19	21.2	26.4
Patient 20	20.5	27.3
Mean	21.335	
Standard deviation	2.004541	2.142029
Standard error	0.448229	0.478972

A parametric test was performed and produced a p-value < 0.05.

Apply understanding

1 **Calculate** the mean post-test motor functioning score. Use the formula:

$$\bar{x} = \frac{x_1 + x_2 + \ldots + x_n}{n}$$

where x = raw data point and n = sample size. Round your answer to 1 decimal place. (2 marks)

2 **Calculate** the mean improvement in the post motor functionality scores for the 20 patients tested. Use the formula:

$$\frac{\text{mean post-test score} - \text{mean pre-test score}}{\text{mean pre-test score}} \times 100$$

(2 marks)

Analyse evidence

3 **Identify** which condition (pre-test or post-test scores) had the most variability. (1 mark)

Interpret evidence

4 **Determine** the type of inferential test used in the study. Provide a reason to justify your choice. (2 marks)

5 **Draw a conclusion** with reference to evidence about the effectiveness of using virtual reality glasses in helping stroke victims regain lost movement caused by damage to the motor areas of the brain. (2 marks)

Module 4 checklist: The nervous system

Quizlet: Revise key terms online to test your understanding

UNIT 1

Topic 1 review

Multiple choice

(1 mark each)

1 The region that makes up the largest part of the brain is the
- **A** hindbrain.
- **B** sidebrain.
- **C** forebrain.
- **D** midbrain.

2 The autonomic nervous system is made up of
- **A** the brain and spinal cord.
- **B** sensory nerves and motor nerves.
- **C** the somatic nervous system and parasympathetic nervous system.
- **D** the sympathetic nervous system and parasympathetic nervous system.

3 Dualism can be defined as
- **A** a view that the mind is separate from the body.
- **B** thinking that the mind and the body are the same.
- **C** the idea that the brain and the mind are the same.
- **D** the idea that our conscious awareness is physical.

4 The peripheral nervous system (PNS) is made up of the
- **A** brain and spinal cord.
- **B** somatic nervous system.
- **C** somatic and autonomic nervous system.
- **D** sympathetic and parasympathetic nervous system.

5 What is the main function of the parietal lobe?
- **A** Planning
- **B** Attention
- **C** Sensation
- **D** Memory formation

6 Phrenology
- **A** is an alternative word for bloodletting that was used in the early treatment of psychological disorders.
- **B** focuses on the measurement of the skull proportions to help explain behaviours.
- **C** was an early form of brain surgery where a hole was drilled into the skull.
- **D** suggests that the mind and body are two separate entities.

7 Neurons in your leg that carry messages to your spinal cord are part of the
- **A** central nervous system.
- **B** peripheral nervous system.
- **C** autonomic nervous system.
- **D** sympathetic nervous system.

8 Who introduced phrenology in the nineteenth century?
- **A** René Descartes
- **B** Pierre Flourens
- **C** Paul Broca
- **D** Franz Gall

9 The hindbrain is made up of the
- **A** cerebrum and cerebellum.
- **B** cerebellum, pons and medulla.
- **C** reticular formation and cerebrum.
- **D** cerebrum, hypothalamus and thalamus.

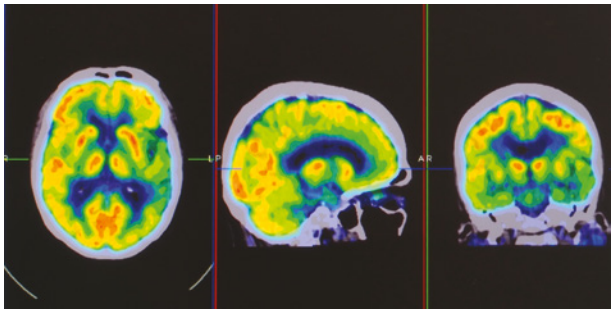
10 Positron emission tomography (PET)

A tracks oxygenated blood in the brain during thinking tasks and produces a detailed computer-generated image.

B tracks injected radioactive glucose to show which areas of the brain are active during mental processes.

C uses infra-red technology to detect the concentration of oxygenated blood during mental tasks.

D uses X-ray technology to show the structures of the brain.



11 What is the function of Wernicke's area?

A Coordinating comprehension and mouth movements

B Choosing the correct words for a sentence

C Articulating speech

D Moving the tongue

12 When asked to perform several actions in a specific order (e.g. touch your nose and then your toes), the part of the brain you are primarily activating is the

A thalamus.

B cerebellum.

C frontal lobe.

D corpus callosum.

13 Sylvia is 14 and often becomes very emotional and cries in response to stress. Jemma is 29 and can deal with stress calmly and rationally. Which structure in Sylvia's brain is less developed than in Jemma's and accounts for the different stress responses?

A Cerebellum

B Frontal lobe

C Temporal lobe

D Corpus callosum

14 Wilder Penfield contributed significantly to our understanding of the brain. He applied a probe that delivered a weak electrical charge to different locations on the surface of his patients' brains. Which of the following structures did Penfield map using this technique?

A Auditory cortex

B Primary motor cortex and visual cortex

C Primary somatosensory cortex and Broca's area

D Primary somatosensory and primary motor cortices

15 Rahul experienced a head knock in a rugby match that resulted in concussion. In the following weeks, he experienced loss of balance. Which area of Rahul's brain has most likely been affected and which neuroimaging technique is appropriate to use for diagnosis?

A Medulla; fMRI

B Cerebellum; MRI

C Frontal lobe; MRI

D Temporal lobe; PET

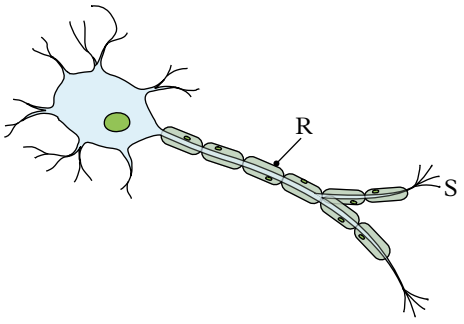
Short response

16 **Identify** two functions of the association areas of the brain. (2 marks)

17 **Describe** the function of myelin as a structural feature of a neuron. (1 mark)

18 **Distinguish** between the somatic and autonomic nervous system. (1 mark)

19 **Identify** the parts of the neuron labelled R and S, and describe the function of each. (4 marks)



20 A patient experiences a head injury that results in an inability to move her right hand. **Identify** the part of the brain that is most likely to have been damaged. (1 mark)

21 **Describe** the case of Phineas Gage, and **explain** how it is helpful in the field of psychology. (2 marks)

22 When someone is hit in or near the area where the brain meets the spinal cord, doctors are particularly worried.

- **a** **Identify** the area of the brain that is hit. (1 mark)
- **b** **Describe** two possible effects of damage to this area. (2 marks)

23 **Contrast** sensory and motor neurons by noting two differences. (2 marks)

24 Electroencephalography (EEG) and magnetic resonance imaging (MRI) are two neuroimaging techniques used today.

- **a** **Explain** how each technique enhances understanding of the brain. (2 marks)
- **b** **Identify** an application of each technique. (2 marks)

25 **Identify** which component of the brain (hindbrain, midbrain or forebrain) the following belong to

- **a** cerebrum (1 mark)
- **b** medulla. (1 mark)

26 **Describe** two functions of the frontal lobe. (2 marks)

27 The sympathetic nervous system is often highlighted for its role in the fight-flight-freeze response. **Describe** two potential consequences of the parasympathetic nervous system malfunctioning. (2 marks)

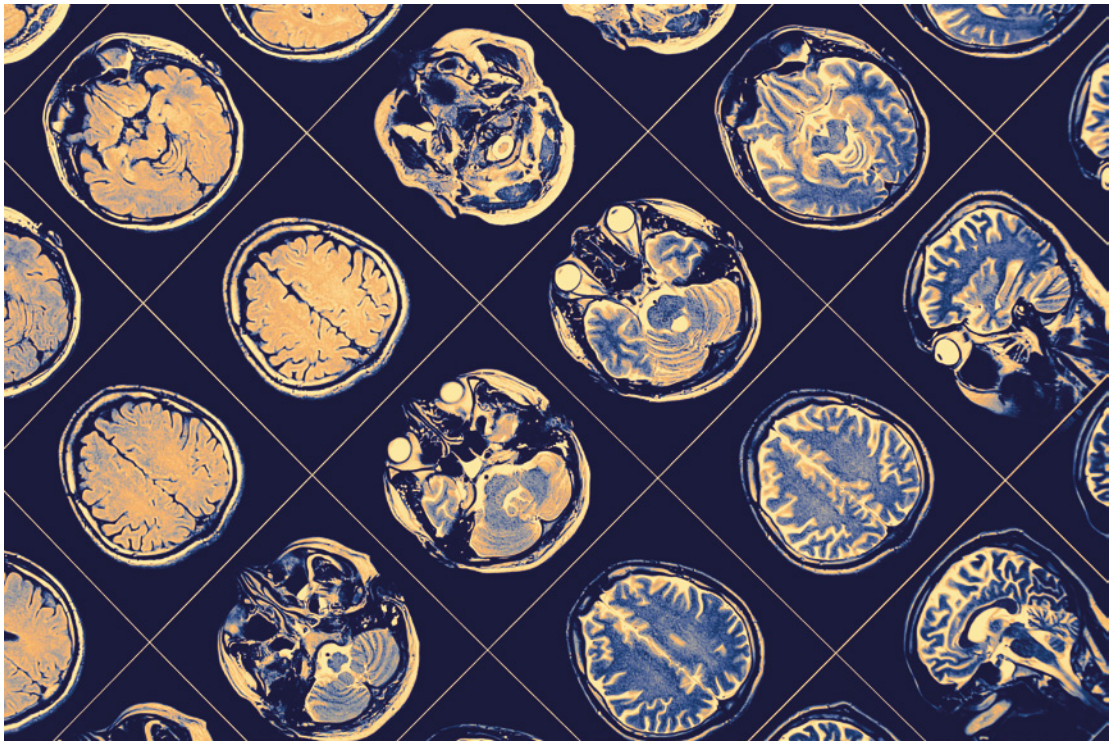
28 **Discuss** the mind-versus-body problem. (3 marks)

29 Aphasia is the impairment of language caused by damage to the brain. Broca's area and Wernicke's area are two parts of the brain that may experience such damage.

- **a** **Identify** the brain lobe where Broca's area is located. (1 mark)
- **b** **Identify** the brain lobe where Wernicke's area is located. (1 mark)
- **c** **Describe** two effects on language of damage in Broca's area. (2 marks)

30 **Describe** the relationship between Geschwind's territory, and Broca's and Wernicke's areas. (3 marks)

TOTAL MARKS
/51 marks



MODULE 5

Development and neural plasticity

Introduction

In recent years there have been significant advances in our understanding of the development of the human brain, from infancy through to adolescence and adulthood. Our brains grow and develop from the very earliest stage in life, beginning in the womb. While you were still a fetus, your brain started to function at 10 weeks – and continues to refine all the way into early adulthood.

These periods of rapid development from infancy to adolescence inform who we become. Even during the earliest period of development, our experience of our environment, along with predetermined genetic factors, play an important role in what scientists believe is an orderly process over time.

We can gain valuable knowledge about the way the human brain works from looking at the behaviour and functioning of individuals who have sustained a brain injury, or cases where the brain has been damaged and is not working in a typical way. Abnormalities may result from brain injury, invasive surgery, illness or unusual neural connections. All these situations affect cognitive processes, some of which occur without conscious awareness. Each situation offers insight into the way the brain works and provides us with a greater understanding of our conscious experience.

In this module, you will learn about brain development in infancy and adolescence. You will also examine neural plasticity with reference to brain development and brain damage.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to development and neural plasticity before you start.

Subject matter

Science understanding

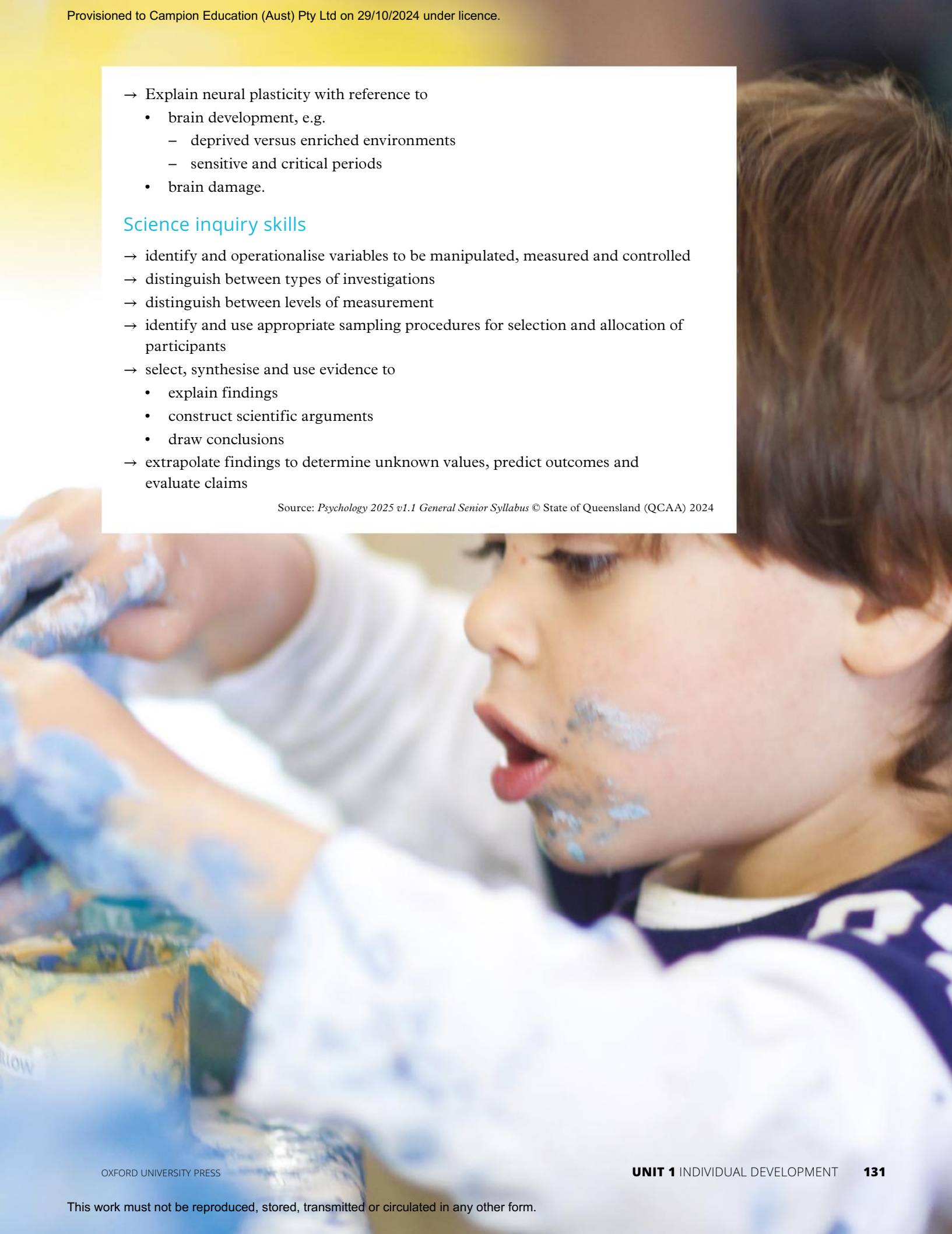
→ Describe infancy and adolescence as periods of rapid development and changes in brain structure and function, with reference to myelination, synaptic pruning and development of the forebrain.

→ Explain neural plasticity with reference to
  - brain development, e.g.
    - deprived versus enriched environments
    - sensitive and critical periods
  - brain damage.

Science inquiry skills

→ identify and operationalise variables to be manipulated, measured and controlled
→ distinguish between types of investigations
→ distinguish between levels of measurement
→ identify and use appropriate sampling procedures for selection and allocation of participants
→ select, synthesise and use evidence to
  - explain findings
  - construct scientific arguments
  - draw conclusions
→ extrapolate findings to determine unknown values, predict outcomes and evaluate claims

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024



Lesson 5.1
Brain development in infancy and adolescence

Key ideas

- → Brain development begins before birth with proliferation, migration and circuit formation. Circuit formation continues during infancy, and synaptic pruning and myelination begin. Myelination continues into early adulthood.
- → During adolescence, there is significant brain development in the cerebellum and forebrain region. The last part of the frontal lobe to develop is the prefrontal cortex, responsible for tasks such as critical thinking, risk management and impulse control.

Learning intentions and success criteria

Introducing brain development

infancy
a lifespan stage, between birth and childhood (approximately 0 to 2 years of age)

adolescence
a lifespan stage, between childhood and young adulthood (approximately 12 or 13 years to 18 or 19 years of age)

developmental plasticity
the development and consolidation of neural pathways in babies, children and adolescents

Infancy and **adolescence** are periods of rapid development of the brain, when many synapses between neurons are formed. The formation of these synapses between infancy and the end of adolescence is referred to as **developmental plasticity**. Although changes to the brain occur more frequently in the fetal stage, as well as during infancy, childhood and adolescence, these changes continue throughout life as learning takes place and do not diminish with age. In this lesson, we will look at the stages of brain development that occur during infancy and adolescence.

Brain development during infancy

Prior to birth and for the first years of life, a child's neurons are quite flexible in terms of their function. The development of the nervous system starts before birth when the brain and spinal cord are formed, and the stages of neuronal proliferation and migration occur. Circuit formation also begins before birth and continues during infancy and adolescence. Synaptic pruning and myelination also occur during these periods, with myelination continuing into early adulthood. We will look at each of these stages.

Proliferation

proliferation
the first stage in the development of the nervous system, where cells destined to become neurons divide and multiply

Proliferation is the division and multiplication of the unborn baby's cells that will become neurons, which creates approximately 250,000 cells per minute. This process marks the beginning of the development of the nervous system.

FIGURE 1 Developmental plasticity is evident during infancy.

Migration

During **migration**, newly formed neurons move outwards to their destined location. The role that a particular neuron has might be determined by where it is located at the time of its formation. Different brain structures form during different stages of development. However, before a baby is born and just after birth, the neurons are flexible. This is why brain tissue from a fetus can be transplanted into part of an adult brain and the transplanted neurons will adapt, form synapses and take on the function of the brain area into which they have been placed (Garrett, 2009).

migration
during developmental plasticity, the movement of newly formed neurons

Circuit formation

Circuit formation occurs when the axons of new neurons grow out to target cells and form synapses with them; for example, axons for motor neurons grow to the spinal cord where the neurons form synapses with other neurons in this location. Circuit formation requires ordered, multiple developmental events, finishing with synaptogenesis. **Synaptogenesis** is the process of forming new synapses.

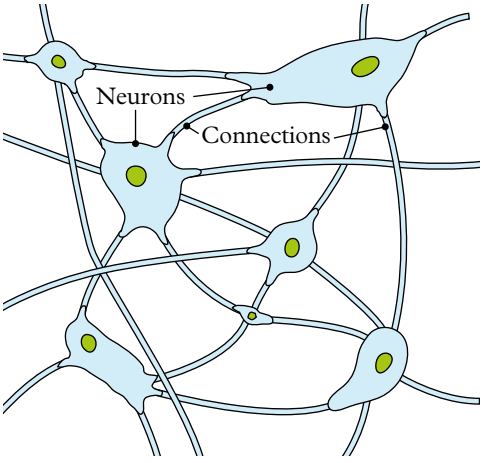


FIGURE 2 During development in childhood and adolescence, the brain develops many neural pathways and connections.

circuit formation
a process that involves axons of new neurons growing out to target cells, forming new synapses

synaptogenesis
the process of moulding or forming new synapses

Synaptic pruning

Synaptic pruning involves the elimination of excess neurons and synapses; that is, those that have not established a connection with a neighbouring cell will die. The nervous system also refines itself by eliminating excessive synapses and strengthening or weakening synapses according to whether their presynaptic and postsynaptic neurons fire together. A neuron that does not fire at the same time as its neighbouring neurons is probably a neuron that has found its way into an inappropriate area during synapse formation, and might be part of synaptic pruning.

Pruning occurs during infancy and childhood, but there is a second wave of pruning in early adolescence. During this entire process, the brain produces many more neurons than will ever be used; the excess will eventually be eliminated through pruning.

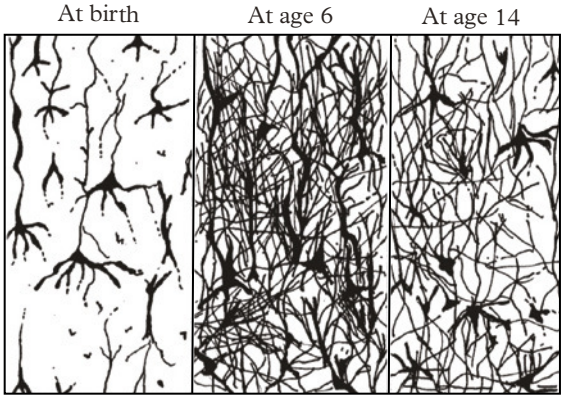


FIGURE 3 Synaptic connections at different stages during childhood and adolescence. You can see increased connections from birth to 6 years, and then a reduced number of connections from 6 to 14 years. Excess connections have been pruned.

synaptic pruning
the loss of excess neurons and synapses usually formed in infancy and childhood

Myelination

Myelination is the process where the axons of the neurons in a child's brain become insulated by myelin, and is the final stage of development before the brain becomes fully mature. As you learnt in Lesson 4.2, myelin is a white, fatty, waxy substance that coats some axons and protects them from electrical interference from other neurons. Myelin speeds up the rate of transmission of signals within the neuron. The myelination process begins before a baby is born and does not

myelination
the production of myelin, the white, fatty covering that insulates a neuron's axon, speeds transmission and aids coordination

finish until about 23 years of age (Sowell et al., 1999). The lower structures of the brain are the first to be myelinated. This is followed by the cerebral hemispheres, where myelination begins at the occipital lobes, followed by the temporal and parietal lobes and, finally, the frontal lobes.

Effects of developmental plasticity

Research has found that during this time of heightened brain plasticity, learning new skills, such as how to speak a second language or how to play a musical instrument, can be easier than in later life. A child could pick up how to play the cello, for instance, with much greater ease than an adult could. Because a child's brain has greater plasticity than an adult's, it is able to use other parts of the brain to form alternative neural connections. A child's brain is also able to compensate for any missing or damaged part of the brain as a result of this plasticity. For example, if a child experiences damage to the part of the brain responsible for language, it is more likely they will recover than if an adult received the same injury (Garrett, 2009).

FIGURE 4 Greater neural plasticity during development means that children can learn new skills, such as playing musical instruments, with more ease than adults.

Table 1 provides a summary of the stages of developmental plasticity.

TABLE 1 Stages of developmental plasticity

Stage	Description
Proliferation	Fetal neurons divide and multiply, creating about 250,000 neurons per minute between weeks 7 and 28 of gestation. The rate starts to slow from this point.
Migration	Once formed, neurons move to their final location in the central nervous system and the locations determine what their function will become.
Circuit formation	The axons of the new neurons move outwards, towards adjacent cells, and circuits are completed when synaptogenesis occurs.
Synaptic pruning	Pruning occurs in childhood and there is a second phase during adolescence. Far more neurons are created than will eventually be needed. During circuit pruning, extra neurons are removed.
Myelination	Gradually, throughout childhood and adolescence and into young adulthood (about age 23), myelin sheathing grows around the axons of many neurons, insulating them and making neural transmission more efficient.

Brain development during adolescence

During adolescence, there is a large amount of development in brain structures, particularly the cerebellum and forebrain region.

There is an increase in the number of neurons and synapses in the cerebellum, the part of the brain responsible for balance, muscle tone and the performance of motor skills. This might explain why some teenagers are more physically uncoordinated than older adults.

Development in the forebrain region occurs in the following structures:

- **Amygdala**: The amygdala becomes more active in adolescence. This is a key structure in the limbic system and is involved in emotion. (You will learn more about the limbic system and emotion in Module 16.)
- **Corpus callosum**: The corpus callosum thickens and there is an increase in the number of connections (or nerve fibres) between the two cerebral hemispheres.
- **Frontal lobe** (part of the forebrain and including the prefrontal cortex): The frontal lobe is responsible for motor movement and higher order thinking. It is one of the last structures to fully develop (continuing to the mid-20s). We will look at frontal lobe development in more detail.

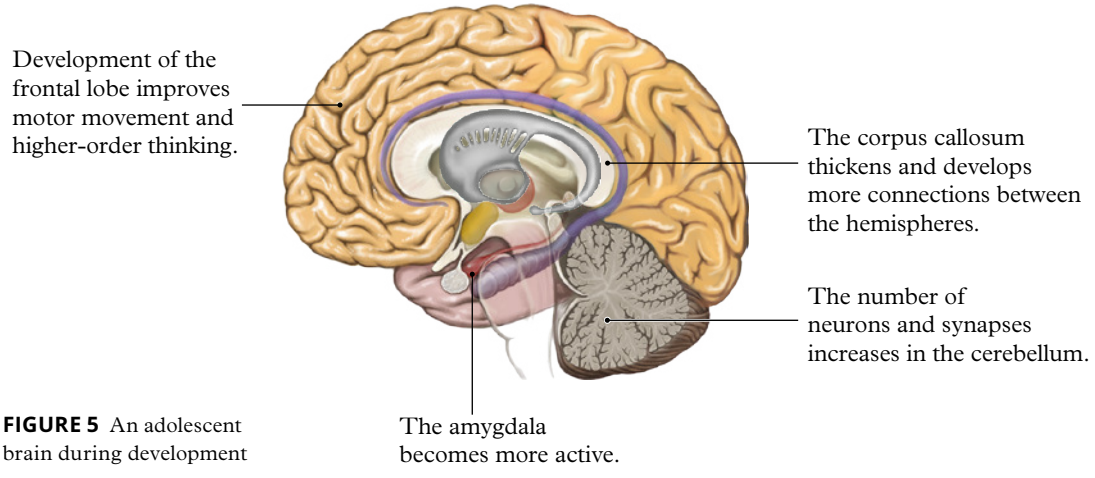


FIGURE 5 An adolescent brain during development

Frontal lobe development

The frontal lobe of the left hemisphere is the very last part of the brain to undergo the process of myelination. Studies of adolescents' brains show a huge amount of development during puberty. As unused connections developed throughout an adolescent's life so far are pruned, other useful connections are strengthened. The process of myelination continues through adolescence or longer, with the highest brain levels myelinating last.

Cortical grey matter

During early adolescence, there is a second burst of production of cortical grey matter. Cortical grey matter is the covering of the cerebral hemispheres – it looks grey in colour because the axons do not have myelin covering them. The brain prunes the connections as it did during infancy and only retains the connections that are used.

FIGURE 6 The teenage brain is still changing and developing, which may explain the differences in teenage emotion and behaviour.

FIGURE 7 Hyper-emotional states during adolescence might be attributed to reliance on the amygdala instead of the prefrontal cortex to process information.

Prefrontal cortex

The last part of the brain to develop is the prefrontal cortex, which is responsible for problem-solving, complex planning, impulse control, risk management and critical thinking – perhaps a possible reason why adolescents can be very impulsive!

Neuroscientists have found that during this time, when the prefrontal cortex is still in development, the adolescent brain may rely instead on the amygdala, a part of the limbic system, which plays an important role in processing our emotions. The hyper-emotional states we might experience and bad decisions we might make during our teenage years could therefore be attributed to our brain relying on our amygdala to process information, rather than our prefrontal cortex.

Practical implications of adolescent brain development

Our delayed ability to employ mature or rational thinking to make sensible or safe decisions is one of the reasons why some states in Australia, including Queensland, have increasingly strict rules in place for young, probationary licensed drivers. Certain restrictions apply when you drive using a P1 (red P plate) or P2 (green P plate) licence in Queensland. For example, P1 licence holders need to ensure that any passengers having a phone conversation do not use the loudspeaker, as this may distract the driver. Such restrictions are in place because statistics show that younger drivers (17 to 24 years of age) account for 25 per cent of all road deaths in Queensland, yet they account for only 14 per cent of licence holders (Queensland Government, 2023).

While teenagers are, of course, capable of critical thinking, it is a process that becomes easier in adulthood when the prefrontal cortex is fully developed. As our understanding of brain development increases, it is becoming clear that this final process of brain development can continue into our mid-20s. While society might say a person is an adult when they turn 18 and are given the right to vote and drive, our brains are not fully developed until much later.

As outlined in Real-world psychology, significant brain development during adolescence coincides with the important psychological process of individuation, increased social activity, part-time work and more demanding schooling, particularly in Year 12. Fortunately, families and carers (and schools) can support their students during the final years of school with a proven strengths-based approach.

FIGURE 8 Restrictions are applied to new drivers, who are typically younger, to account for brain development that is yet to occur.

Real-world psychology

Strength-based approaches to parenting in late adolescence

By the age of ten, the human brain has grown to adult size, but it takes another 15 or so years before it is fully operational, and securely under the control of its owner-operator, as any parent whose household is living through the occasional storms of adolescence and emerging adulthood will be well aware.

There are several strategies for survival parents can adopt, however, with the principles of positive psychology being among the best, according to psychologist Lea Waters.

Professor Waters leads the Centre for Positive Psychology at the University of Melbourne, and says "pos psych" can help everyone build optimism and resilience to help them face life's tests and challenges, especially during the period of adolescence into young adulthood.

Brain development from ages 10–25

"Science has now shown the brain is not fully formed until the mid-20s," Professor Waters explains. "After the initial growth period of childhood, the adolescent brain begins to re-organise itself at around age 10, roughly coinciding with the onset of puberty."

"It builds new systems and creates greater interconnections between the prefrontal cortex (where behaviour and personality are controlled) and the limbic system (where the emotional life and memory is controlled) and keeps doing this until the brain's neural architecture is fully formed at full adulthood around the mid-20s.

"But because of social and environmental effects, we're noticing two things. Puberty is occurring earlier, meaning adolescence is starting in pre-teen years, and the transition from adolescence into adulthood has been elongated into the early 20s. Professor Waters says psychologists have identified a new model of life pattern development. Interestingly, most of the neural development occurring through the period of emerging adulthood takes place in areas of the brain that relate to relationships and regulator systems in the brain.

"While the early adolescent brain develops the reward systems (situated in our limbic system) which are responsible for motivation and action – thus explaining the sensation-seeking and risk-taking behaviour of young people this age – in late adolescence to emerging adulthood, brain development moves to focus on the prefrontal cortex," Professor Waters says.

"The prefrontal cortex is responsible for our higher order, executive functions such as planning, problem-solving and decision-making. The development of the prefrontal cortex, which builds our regulatory system (being rational), allows young people at this age to gain better impulse control over their reward system (being emotional) and this is why we start to see behaviour that is more adult-like by this age."

Driving the brain

Professor Waters says using the metaphor of how a car works is useful.

"The limbic system is the accelerator and the prefrontal cortex is the brake. By the time a young person matures into adulthood (mid-20s) they know how to drive their brain. They know when to use their emotions to motivate themselves into action, and they know how to use their rationality to plan future actions and curb unhelpful impulses.

"But this ability to 'drive their brain' in a mature way really doesn't occur until the mid-20s."

The psychological process occurring during this time is called "individuation" and it reflects the process of the young person becoming aware of who they are as separate from their parents and peers, according to Professor Waters.

The process of individuation can be exhilarating and liberating, but it can also be fear-provoking … If young people are participating in senior secondary or tertiary study, they are also likely to be experiencing the further challenges of balancing study commitments with part-time work, social life, romantic partnerships and down-time, the latter of which Professor Waters says is very necessary, and which Year 12 students in particular don't get enough of.

"Stress results from the imbalance of the demands made upon a person from the environment and the resources that person has to meet those demands," she says.

A strength-based parenting approach

"My own research with final year school students shows that parents who take a strength-based approach with their teenaged sons and daughters have children who report higher levels of life satisfaction."

Strength-based parenting is a style of parenting that seeks to deliberately identify and cultivate positive states, positive processes and positive qualities in one's children.

"When parents seek to identify and amplify their son or daughter's strengths this builds confidence in teenagers and helps to buffer them against the stressors of teenage life.

"Parenting in ways that connect an adolescent/emerging adult with their inherent strengths is energising for both the child and the parent. These strengths then form inner resources that a young person can draw upon to get a better balance between the demands/resources equation."

Source: Katherine Smith (*The Age*, 2015)

FIGURE 9 Strength-based parenting is built on encouraging children's abilities and qualities to cultivate a positive state.

Apply your understanding

1 **Describe** the brain development that occurs during early adolescence. (1 mark)
2 **Describe** the brain development that occurs during late adolescence. (1 mark)
3 **Discuss** the benefits of a strength-based approach to parenting. (2 marks)

Check your learning 5.1

Check your learning 5.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** two changes in brain structure and function that occur in infancy. (2 marks)
2 **Describe** what is meant by synaptic pruning. In your response, reference the development of neurons in children and adolescents. (2 marks)
3 **Describe** three changes that occur in the development of the forebrain during adolescence. (3 marks)

Analytical processes

4 **Consider** the importance of myelination in neuron functioning. (2 marks)
5 **Infer** two consequences of disrupted development of the prefrontal cortex. (2 marks)

Lesson 5.2
Brain development and neural plasticity

Key ideas

- → Neural plasticity is the way the brain adapts and changes over time in response to the environment.
- → The brain is very plastic before birth and in infancy, childhood and adolescence. This is also when critical and sensitive periods for learning through experiences occur.
- → Being in an enriched or deprived environment during this period can affect whether learning occurs, and whether it will occur in the future when the brain is less plastic.

Learning intentions and success criteria

Introducing neural plasticity

The brain is capable of learning throughout the lifespan because of its **neural plasticity**. Neural plasticity of the brain refers to the structural and functional way it changes in response to stimulation from the environment. The process of plasticity occurs at the synaptic connections in the brain and is necessary for learning to take place. The brain is very adaptive during infancy, childhood and adolescence, and less adaptive later in adulthood, when neural pathways are more fixed. Nevertheless, neural plasticity is present throughout a healthy person's lifetime and allows for continued learning.

neural plasticity the ability of the brain's synapses to be modified where neural networks change through growth and reorganisation

As we have learnt, the plasticity present during infancy and childhood, where neural pathways develop and consolidate, is referred to as developmental plasticity. In this lesson we will explore the relationship between plasticity, the critical and sensitive periods during these periods of rapid development, and the long-term impacts of enriched and deprived environments during these periods.

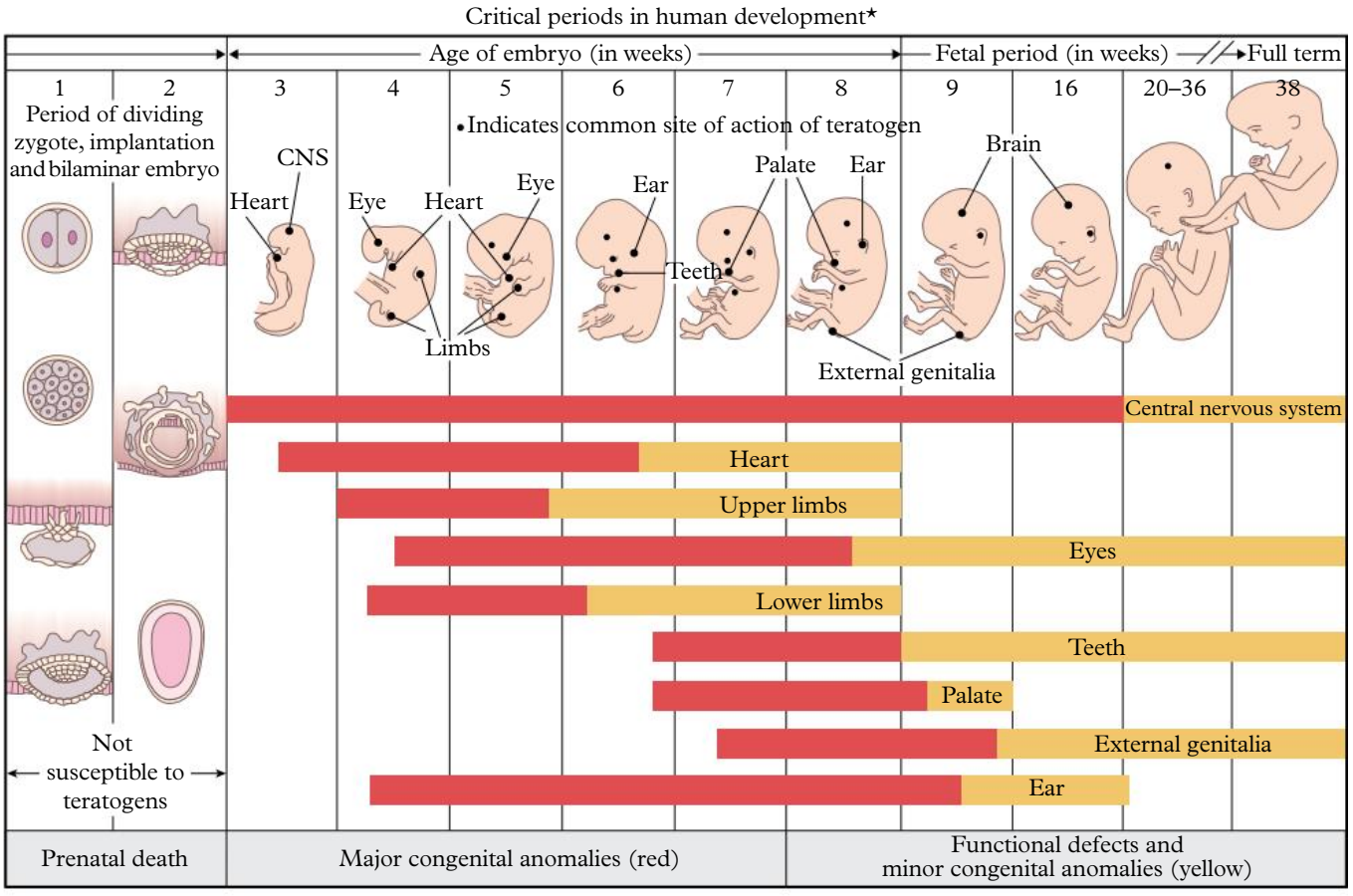
Critical periods

Critical periods in development are times of special sensitivity to certain environmental factors that can shape an individual's capacity for future typical development.

The concept of critical periods in development was formed as researchers started to find clear links between toxic substances and the development of the unborn child. These toxic substances, known as **teratogens**, are environmental agents capable of harming the embryo or fetus (Burton et al., 2015). They will affect an unborn child's development if there is exposure at specific times in development. The impacts of teratogens on an embryo or fetus are shown in Figure 1. Their effects can be tragic and cause serious lifelong consequences, as seen in the case of rubella and other related birth defects.

critical period a period in development when certain experiences must happen for typical development to proceed

teratogen an environmental agent or toxin that harms the embryo or fetus



*Red indicates highly sensitive periods when teratogens may induce major anomalies.

FIGURE 1 Critical periods in development of the unborn child

Rubella and birth defects

In 1940 in Australia, there was an outbreak of rubella (German measles). An Australian ophthalmologist, N. Gregg, reported a link between this outbreak and the number of babies born afterwards with eye problems. A rubella outbreak in the United States in 1964–65 resulted in more than 30,000 prenatal and neonatal (newborn) deaths and 20,000 babies born with malformations.

If a pregnant woman is not immunised against rubella and comes into contact with the disease during the first three months of pregnancy, the baby is more likely to be born with a congenital abnormality, such as a heart defect, deafness or intellectual disability. Routine vaccinations for children have helped decrease the incidence of this disease and women who are planning a pregnancy are often advised to be tested to determine if they are immune to the disease.

Critical periods after birth

In humans, there are few critical periods after we are born, but one example is the critical period for the development of vision. Human babies must receive exposure to light in the first few days of life so that the sensory neurons in the retina develop. If this does not happen, the baby may experience permanent vision impairment.

FIGURE 2 The first few days of human life are a critical period for the development of vision.

Critical periods in animals

In some animals, there is a critical period – a very narrow period of time in an animal's development – when it must have a particular experience in order for something very specific to be learnt. Essentially, there is a specific period in a particular species' lifespan in which the animal is pre-programmed to learn something. For example, ethnologist Konrad Lorenz studied how young birds **imprint** (form an immediate attachment) to the first moving object they see after they hatch from the egg. In most cases, this is likely to be the chick's parent. Lorenz found that greylag goose hatchlings imprinted on him and followed him wherever he went. For these goslings, the critical period was the first few moments of life (Lorenz, 1937).

imprint
an immediate attachment that is formed soon after birth

Critical periods tend to begin and end abruptly, and beyond this period, the phenomenon will not appear. For instance, if a greylag goose does not imprint to a moving object within the first 36 hours after hatching, it will never imprint. If a chaffinch does not hear an adult singing before it sexually matures, it will never be able to sing the highly intricate song required to attract a mate. A monkey deprived of sight in its first 12 months will have difficultly using vision to explore its environment for the rest of its life.

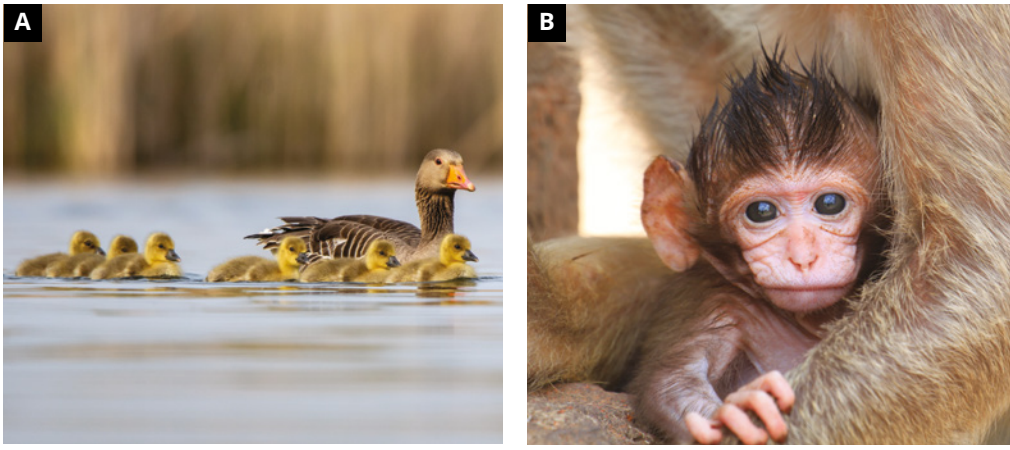


FIGURE 3 The critical period for (A) a greylag goose to imprint on a moving object is the first 36 hours after it hatches, and (B) a monkey to use its sight is its first 12 months of life, otherwise it will have difficulty using vision for the rest of its life.

Sensitive periods

The concept of critical periods in humans is controversial, especially after the child is born. Humans tend to be more flexible in their development than other animals. We tend to have **sensitive periods**, which are optimal times for psychological development in certain areas, such as learning to speak in the first years of life. These periods of maximal sensitivity are seen to begin and end more gradually than critical periods. Sensitive periods coincide with times when the brain's nervous system is undergoing rapid growth, such as forming new synapses between neurons or, equally importantly, pruning neurons that have not been used or activated by the environment. That is, they coincide with developmental plasticity.

sensitive period
the best or optimal time for an individual to learn new things due to the nature of the growing brain

Sensitive periods allow for the possibility that, given the right circumstances, individuals can still experience psychological development, even if the individual began with deprived conditions. A British study showed that severely deprived children who were adopted before the age of 2 years from a Romanian orphanage improved dramatically once they left the orphanage. However, while great improvement was seen in children adopted after 2 years of age, the longer the time spent in the orphanage, the more likely they were to have severe cognitive impairments 6 years later (O'Connor et al., 2000).

FIGURE 4 Human infants need to be exposed to language early in life to allow them to use and understand it.

Experience-expectant learning during sensitive periods

As we have learnt, neural plasticity relates to the extraordinary ability of the brain to change throughout life as a result of experience. During sensitive periods, the growing brain needs specific types of stimulation so that neural pathways are established. Usually, this stimulation occurs as part of a person's natural development. However, it is vital that the individual is exposed to the necessary experiences to allow for the changes through learning. This is **experience-expectant learning** (involving experience-expectant synaptogenesis). These are situations in which a species' typical experience (that all members of a species experience in normal conditions) plays a necessary role in the developmental organisation of the nervous system.

experience-expectant learning
experiences necessary for learning to occur, most often during sensitive periods

Normal brain growth relies on these forms of environmental exposure. For example, the visual cortex "expects" exposure to light and patterned visual information, and is genetically programmed to use these inputs for normal development. Absence of these expected forms of environmental input can have permanent effects, so it is important to detect and treat sensory deficits in children (for example, visual or hearing deficits) to ensure that these expected experiences take place. An example is young children learning to talk. If the opportunity is missed in infancy and early childhood, it is much more difficult to achieve fluency.

FIGURE 5 This baby is undergoing auditory (hearing) tests. Hearing impairment can prevent a child from learning to talk if the impairment exists during a sensitive period.

FIGURE 6 These adults are having an art lesson. Learning continues throughout life due to the adaptive plasticity of the brain.

Experience-dependent learning

Experience-dependent learning (involving experience-dependent synaptogenesis) is a form of learning that can occur as a result of experiences at any time during an individual's life. It refers to adaptive plasticity, encoding new experiences that occur throughout life, fostering new brain growth and refining existing brain structures. These vary for every individual according to their unique set of life experiences. For example, learning to read and write is a form of experience-dependent learning.

experience-dependent learning
learning that occurs at any time during an individual's life as a result of experience

If an individual misses out on the appropriate experience-dependent learning opportunities during a sensitive period, it does not necessarily mean that learning will never occur. A person learns throughout life, so the missed learning can take place outside of the sensitive period, but it will require more time and cognitive energy, and sometimes the learning might not be as efficient or strong.

Challenge

Bilingual children

Learning additional languages is much easier in early childhood than in adulthood. Adults can still learn a new language, although they will most likely speak with an accent, unlike those who learnt the language by the age of 6.

Propose why adults may develop a different accent from the one children develop.

Skill drill

Investigation questions

Science inquiry skills: Understanding the scientific method (Lesson 1.3); Planning investigations (Lesson 1.4)

Tekisha wants to know if the timeline in Figure 7 applies to her village in New Guinea. She is interested because, as a child, she was never put down in the first year of her life. She remembers being passed from relative to relative and, therefore, her milestones were very different from those shown in Figure 7.

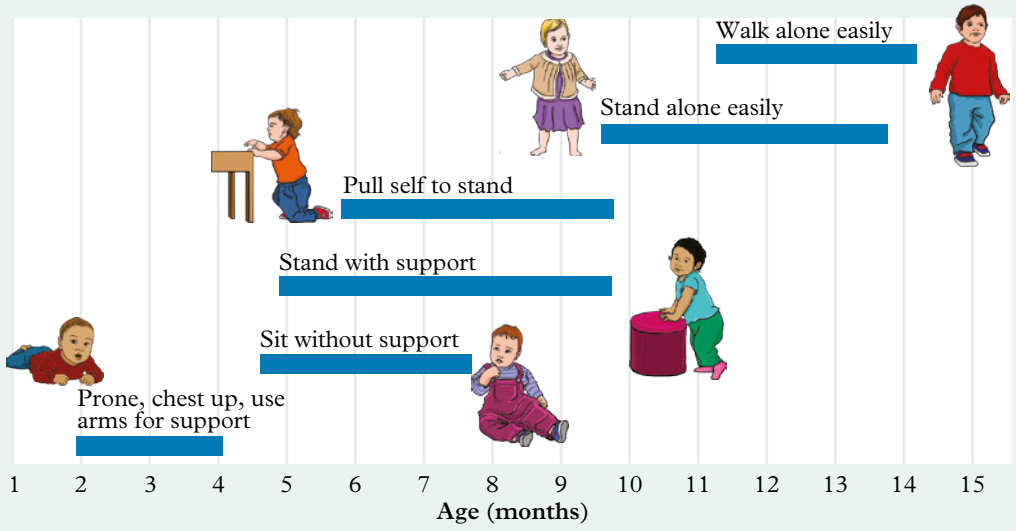


FIGURE 7 Milestones in infant motor development

Practise your skills

1 **Propose** a type of investigation Tekisha could conduct to find out the cultural differences between developmental milestones in children aged 5 months. (1 mark)
2 **Identify** and **operationalise** variables to be manipulated, measured and controlled. (3 marks)
3 **Determine** the level of measurement used as a possible dependent variable. (1 mark)
4 **Identify** an appropriate sampling procedure for selection of participants. (1 mark)

Enriched versus deprived environments

enriched environment an environment that provides social and physical brain stimulation

deprived environment an environment that lacks brain stimulation

Just as experience influences neural development, so too does the environment in which an individual finds themselves during development. When we refer to the environment, we can refer to either an enriched environment or a deprived environment. An **enriched environment** is one where there is opportunity for stimulation of the brain by social and physical surroundings; a **deprived environment** is one where there is an absence or depletion of things to encourage development.

The influence of the environment begins from conception, or even earlier. There are times during pregnancy when an unborn baby (embryo/fetus) can be highly susceptible to environmental factors. In fact, the effect of the environment can be more obvious during the early stages of life than at any other time. While the unborn child is in the relatively safe and protective environment of the womb, there are still some risks. A mother's healthy diet and lifestyle can be of significant assistance to the development of the unborn child. Alternatively, damage can be done to the unborn child if the mother's diet and lifestyle are unhealthy. For example, fetal alcohol syndrome is a condition in a child that results from excessive alcohol exposure during the biological mother's pregnancy.

Table 1 lists some examples of enriched and deprived environments.

TABLE 1 Examples of enriched and deprived environments

Enriched environments	Deprived environments
A safe and healthy living environment, including adequate diet and regular sleep	Extreme poverty and poor diet during childhood
Good educational opportunities	Inadequate or very limited educational opportunities
Family and community who talk and actively interact with children and support each other	Little or no basic parental instruction or talking in the home during early childhood, or family or community social support
A pregnancy free of toxins and serious illness	During pregnancy, the mother had an inadequate diet or ingested drugs, alcohol or other toxins or sustained a severe illness that affected the development of the baby

Several studies have suggested that neural plasticity can change brain structure depending on the type of environment where development occurs.

Impact of a deprived environment: Genie Wiley

In 1970, community-care workers in Los Angeles rescued a 13½-year-old girl, Genie, who had been raised in appalling conditions (Curtiss, 1977). Genie had spent much of her life in a dark isolated room, strapped to a child's potty chair for most of the day and fed only baby food. She had virtually no contact with people, apart from minimal contact with her parents, and was punished if she ever made any sounds. When Genie was found, she had the appearance of a 6-year-old girl, was painfully thin, was barely able to walk and made hardly any sounds. Curtiss described her as unsocialised, primitive and hardly human.

Genie had never learnt to talk and had been deprived of social contact, including language. After she was rescued, she spent time with psychologists who both cared for her and studied her behaviour. Genie had to learn her first language at the age of 13½ years. She was able to learn vocabulary, but was unable to construct grammatically correct sentences.

Genie never adjusted socially after her rescue. She had difficulties with her placements in foster families, including one where she was abused, and was eventually placed in a nursing home.

Implications of Genie's case

FIGURE 8 Genie Wiley, aged 13

Cases of extreme deprivation such as Genie's suggest that we may be genetically programmed to learn the rules of language within a sensitive period of our lives – we must be exposed to language early in life to be able to learn it properly. Genie failed to master language after being deprived of exposure to it during childhood. Once the sensitive period has lapsed, we may be able to learn some aspects of language, such as vocabulary, but it is harder to acquire outside this period.

This highlights the interplay between nature and nurture. Nature allows the development of language (an innate ability) during the sensitive period, and nurture allows the development to occur in the right environment.

Limitations of Genie's case

There are difficulties in drawing inferences from Genie's case because there are many complicating factors. Genie's father believed that she was intellectually disabled, and Genie also suffered extreme emotional and physical abuse. Both of these factors could have affected language development, and neither psychological nor physiological testing could determine whether or not they had. Separating such complex issues is impossible.

Extreme deprivation cases can provide useful examples of very sensitive areas where it is not ethically or morally correct to undertake experiments. Inferences can be drawn from these extreme cases, but these inferences are limited because it is difficult to understand the complete story. Many complex and interrelated factors, some of these unknown or difficult to pinpoint and study, are at play. This is when studies are completed on animals to explore the effect of environment on neural plasticity at various developmental points.

Challenge

Victor, the wild boy of Aveyron

Victor, the "wild boy of Aveyron", is a well-documented case from the early 1800s. Investigate his story, and his work with Jean Marc Gaspard Itard, a young medical student, who tried to "civilise" Victor and help him learn a language.

Compare Victor's case with Genie's case. **Discuss** what they suggest about psychological development.

Neuroplasticity in rats

In 1972, Rosenzweig, Bennet and Diamond conducted research to determine if a change in the level of stimuli in the environment could lead to physical changes in the brain. The study was a breakthrough in suggesting that the brain could continue to change after childhood development ended.

The study used rats that were randomly allocated into either an impoverished condition, where each rat was placed in an individual cage; an enriched condition, where a group of rats were placed in a cage that contained objects that could be used for exploration; or a control group, where there were three rats in a cage.

FIGURE 9 This image shows rats with both social and play stimulation.

Each group's basic survival needs were met (food and water) and they were typically in their cage for 1 to 2 months.

The study found that there was a difference in brain anatomy between the impoverished and enriched groups at the end of the study. The rats that were in the enriched cage showed increased weight of the cortex, and increased neuron activity in the cerebral cortex compared to the impoverished rats.

Implications of Rosenzweig, Bennet and Diamond's study

Like many studies in psychology, Rosenzweig, Bennet and Diamond's (1972) study used rats instead of people for ethical reasons. While it can be difficult to generalise results between rats and people, the 1972 study supported the idea that the human brain can continue to develop and change beyond childhood, and that this change can be facilitated by neural plasticity. The study also confirmed that exposure to enriched or deprived environments can significantly affect brain development.

Limitations of Rosenzweig, Bennet and Diamond's study

The study has been criticised for not being able to demonstrate if it was the social stimulation or the toys that led to the difference in brain structure. The results from this study have been generalised to also apply to human brains, which suggests that because of neural plasticity, people are able to continue to change depending on what type of environment they find themselves in (i.e. a person in an impoverished environment may find themselves without social interaction or adequate nutrition).

Summary

During the lifespan, neural plasticity is greatest prior to birth and during infancy, childhood and adolescence. This means that the brain has the greatest capacity to develop and consolidate neural pathways. Plasticity at this time of life is called developmental plasticity.

Some neural pathways are genetically programmed to form at specific times. These times are called critical periods. Some neural pathways can form more easily during particular time periods. These times are called sensitive periods. Critical and sensitive periods occur during the period of developmental plasticity.

Whether neural pathways develop and consolidate during critical and sensitive periods is influenced by the experiences an individual has and the environment in which they find themselves during these periods. Enriched environments provide brain stimulation to allow the development and consolidation of neural pathways, and deprived environments do not.

If a neural connection does not develop and form during a critical period, it will struggle to form, or may never form. If a neural connection does not develop and form during a sensitive period, it can still form at another time, but it will be more difficult to achieve.

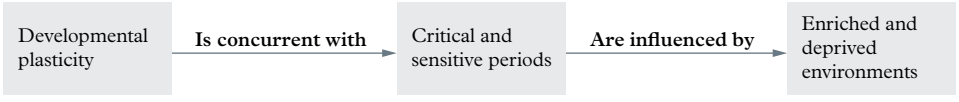


FIGURE 10 The relationships between the concepts discussed in this lesson

Check your learning 5.2

Check your learning 5.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Explain** what is meant by the term "neural plasticity". (1 mark)

2 **Explain** neural plasticity with reference to sensitive and critical periods in brain development. (3 marks)

Analytical processes

3 **Compare** critical and sensitive periods. (2 marks)

4 **Distinguish** enriched and deprived environments. (1 mark)

Knowledge utilisation

5 **Consider** Rosenzweig, Bennet and Diamond's 1972 study and **discuss** the results. In your discussion, refer to the different groups, the sample and the applicability to humans. (3 marks)

6 **Discuss** this claim: When people are exposed to negative environments in childhood, they will undergo brain changes. (3 marks)

Lesson 5.3
Neural plasticity and brain damage

Key ideas

→ Structural plasticity is the ability of the brain to change and adapt throughout life.

→ Functional plasticity is the ability of the brain to alter the location of functions to compensate for brain injury.

→ Sprouting and rerouting of neurons allows functional plasticity to occur.

→ Broca's aphasia arises from damage to the left frontal lobe, and Wernicke's aphasia arises from damage to the left temporal lobe. Both forms of aphasia can be improved by the effects of functional plasticity.

Learning intentions and success criteria

Introducing the relationship between neural plasticity and brain damage

Investigating how the damaged brain works can help researchers find out how the typical, undamaged brain functions. In this lesson, we will consider the effects on the functioning of people who have had significant injury to specific parts of their brain, such as those who suffer from particular types of language difficulties (including Broca's aphasia and Wernicke's aphasia) as a result of brain damage, and the effect of neural plasticity on recovery.

Structural plasticity

structural plasticity
the ability of the brain to change and adapt throughout life

Although the developmental plasticity of a young person's brain will diminish with age, the areas of the cerebral cortices remain plastic throughout life; this is known as **structural plasticity**, where the brain changes and develops as a result of new experiences. In other words, these parts of the brain can be shaped by learning and experience (Kandel & O'Dell, 1992; Katz & Shatz, 1996; Singer, 1995).

Structural plasticity enables older brains to be modified through experience or learning (Garrett, 2009). Stem cells in some parts of the brain continue to create neurons throughout life, enabling the brain to adapt and cope with new experiences. This means that stimulating experiences and environments shape the construction and remodelling of a person's brain throughout the lifespan. The more different cognitive activities a person undertakes and the more active the brain remains, the more plastic it stays.

Functional plasticity

functional plasticity
the ability of the brain to alter the location of functions to compensate for brain injury

sprouting
when a neuron forms new branches

rerouting
when a neuron removes existing connections and forms new connections with other neurons

A shift in connections between different synapses that alters the function of a particular area of the brain (Garrett, 2009) is known as **functional plasticity**. Functional plasticity allows the brain to compensate for serious injury.

The mechanisms of functional plasticity are sprouting and rerouting. Both can occur when an existing neural connection is damaged or no longer effective. **Sprouting** is when a neuron grows new branches so that it can connect with another neuron. **Rerouting** is when a neuron stops connecting with a damaged neuron and starts connecting with another, healthy neuron to establish a new communication pathway.

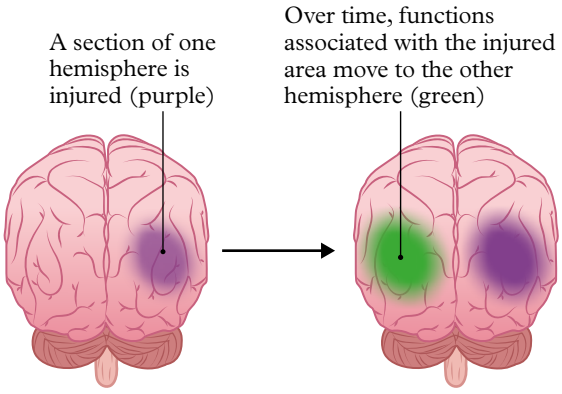


FIGURE 1 Example of functional plasticity

Injury to the frontal and temporal lobes

aphasia
the impairment of language caused by damage to the brain

Broca's aphasia
a result of damage to Broca's area that leads to difficulty in expressing messages in words or sentences, but the ability to comprehend speech is largely unaffected

Wernicke's aphasia
results from damage to Wernicke's area that causes difficulty in understanding written and spoken language that makes sense to others

Aphasia (pronounced *a-FAZE-yuh*) is the impairment of language caused by damage to the brain (usually by stroke). The Stroke Foundation estimates that around 140,000 Australians have aphasia as a result of stroke. Aphasia can affect talking, reading, writing and understanding others, but it does not affect intelligence. It is also likely that a person with aphasia can experience problems with relationships and self-identity.

There are several types of aphasia. The two most common are Broca's aphasia and Wernicke's aphasia. We were introduced to Broca's area and Wernicke's area in Lesson 3.3. **Broca's aphasia** is a result of damage to Broca's area (located in the left frontal lobe), and often surrounding areas. It is often referred to as expressive aphasia because it leads to difficulty in expressing messages in words or sentences. **Wernicke's aphasia** results from damage to Wernicke's area, located in the left temporal lobe near the parietal lobe boundary. Wernicke's aphasia causes difficulty in understanding written and spoken language that makes sense to others.

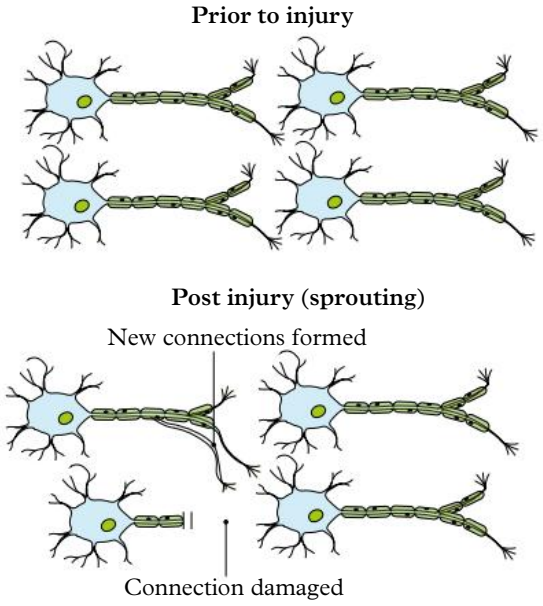


FIGURE 2 Sprouting after a neural connection is damaged

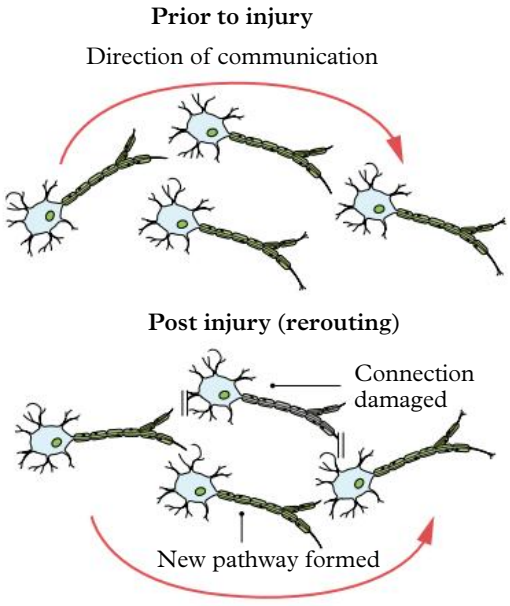


FIGURE 3 Rerouting after a neural connection is damaged

FIGURE 4 (A) Broca's aphasia affects the ability to produce speech. (B) Wernicke's aphasia affects the ability to produce written language.

Broca's aphasia

Recall that in 1861, Pierre Paul Broca, a young surgeon working in a hospital in Paris, pinpointed a specific location of the brain as being responsible for the function of speech. A person with Broca's aphasia has difficulty expressing messages in words or sentences, but their ability to comprehend speech is largely unaffected. Typically:

- little speech is produced and what is produced tends to be slow
- words are generated with considerable effort and are poorly articulated
- speech lacks syntax (grammatical structure) and is similar to the basic speech used by children at 24 months of age; for example, "Give toy"
- the ability to recall names for words is partially or completely lost (anomia).

Occasionally, comprehension is impaired and, in these cases, it is usually in relation to complex sentences, such as those constructed in the passive voice. For example, the question, "Is it hot in summer?" is understood but, "Brisbane Broncos were beaten by Gold Coast Titans" can present difficulties as only the words "Brisbane", "beat" and "Gold Coast" may be recognised and interpreted as "Brisbane beat Gold Coast". Sometimes, writing can be difficult.

Challenge

Dance

Dance is a language of gestures. The area that corresponds to Broca's area in the right frontal lobe is involved in dancing. **Propose** why a person with damage to Broca's area would find dancing hard.

Effect of functional plasticity on recovery from Broca's aphasia

Within the first 12 months after the brain trauma leading to Broca's aphasia, a few people may get back some words or even recover spontaneously. Until recently, recovery from Broca's aphasia was seen as extremely unlikely if there was no improvement during the first year following the damage. However, a recent study on patients with long-term Broca's aphasia found some improvement after therapy that focused on relearning the rules (syntax) of language (Pulvermüller, 2005).

Despite irreversible damage to Broca's area, there was improvement in these participants' ability to communicate using language because different areas of the brain took over the task of communicating language. This shows that function can develop in a different region of the brain following injury, because of the functional plasticity of the brain.

Wernicke's aphasia

Recall that in 1873, a German physician named Carl Wernicke examined a patient with a different kind of aphasia from that occurring in Broca's aphasia patients. Wernicke attributed the difficulty to damage in the left temporal lobe near the parietal lobe boundary. This area became known as Wernicke's area.

A person with Wernicke's aphasia has difficulty understanding written and spoken language, and in producing written and spoken language that makes sense to others. It is often referred to as receptive aphasia, a misleading term because the difficulty is not just limited to understanding language. In Wernicke's aphasia:

- speech is fluent, but does not make sense; nonsense words are used
- there is partial or complete loss of the ability to recall names (anomia)
- there can be difficulty understanding both written and spoken language
- there can be difficulty producing written language that makes sense to others.

The following example is taken from a conversation between Howard Gardner, a well-known cognitive psychologist, and a patient with Wernicke's aphasia.

"What kind of work have you done, Mr Johnson?" I asked.

"We, the kids, all of us, and I were working for a long time in the … you know … it's the kind of space, I mean place, rear to the spedwan …"

At this point, I interjected, "Excuse me, but I wanted to know what work you have been doing."

"If you had said that, we had said that, poomerm near the fortunate, forpunate, tamppoo, all around the fourth of martz. Oh, I get all confused," he replied, looking somewhat puzzled that the stream of language did not appear to satisfy me.

Source: Gardner, 1978

Effect of functional plasticity on recovery from Wernicke's aphasia

Recovering from aphasia is dependent on neural plasticity, specifically functional plasticity, where the surviving brain regions are reorganised in a way that they take on new or expanded roles in language processing. The role of neural plasticity in language recovery after Wernicke's aphasia peaks within 2 to 6 months if the aphasia is caused by a stroke. However, it is important to recognise that improvement in aphasia has been recorded long after a stroke.

Study tip

Use your syllabus to help find subject matter links between units and topics. Unit 3, Topic 1, Brain function has some overlap with what you are learning now with respect to the roles of Broca's and Wernicke's areas in language processing. Don't throw out your notes!

Check your learning 5.3

Check your learning 5.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** structural plasticity. (1 mark)
2 **Describe** functional plasticity. (1 mark)
3 **Explain** how functional plasticity occurs. (1 mark)
4 **Describe** Broca's aphasia and Wernicke's aphasia, including an example of the causes and symptoms. (4 marks)

Analytical processes

5 **Compare** structural and functional plasticity. (2 marks)

Knowledge utilisation

6 **Discuss** whether recovery or improvement following the occurrence of aphasia is likely to be caused by structural or functional plasticity, or a combination of both. (3 marks)

MODULE 5

Lesson 5.4
Review: Development and neural plasticity

Summary

5.1
- Brain development begins before birth with proliferation, migration and circuit formation. Circuit formation continues during infancy, and synaptic pruning and myelination begin. Myelination continues into early adulthood.
- During adolescence, there is significant brain development in the cerebellum and forebrain region. The last part of the frontal lobe to develop is the prefrontal cortex, responsible for tasks such as critical thinking, risk management and impulse control.

5.2
- Neural plasticity is the way the brain adapts and changes over time in response to the environment.
- The brain is very plastic before birth and in infancy, childhood and adolescence. This is also when critical and sensitive periods for learning through experiences occur.
- Being in an enriched or deprived environment during this period can affect whether learning occurs, and whether it will occur in the future when the brain is less plastic.

5.3
- Structural plasticity is ability of the brain to change and adapt throughout life.
- Functional plasticity is the ability of the brain to alter the location of functions to compensate for brain injury.
- Sprouting and rerouting of neurons allows functional plasticity to occur.
- Broca's aphasia arises from damage to the left frontal lobe, and Wernicke's aphasia arises from damage to the left temporal lobe. Both forms of aphasia can be improved by the effects of functional plasticity.

Review questions 5.4A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 Critical periods in development are
- **A** distressing times throughout a person's life.
- **B** times of special sensitivity to certain environmental factors that can shape a person's capacity for future development.
- **C** stages in fetal development when toxic substances can cause lethal harm.
- **D** not related to environmental conditions.

2 In comparison with critical periods, sensitive periods in development tend to
- **A** begin and end abruptly, and beyond this time, the psychological process will fail to appear or develop.
- **B** begin and end more gradually, but some development of the psychological process may be possible.
- **C** only be found in non-human species.
- **D** coincide with times when the brain is not undergoing rapid growth or pruning unused neurons.

3 As children grow, their brains become
- **A** less plastic and neural pathways less set.
- **B** less plastic and neural pathways more set.
- **C** more plastic and neural pathways more set.
- **D** more plastic and neural pathways less set.

4 What form of learning can occur at any time during an individual's life?
- **A** Experience-dependent
- **B** Experience-expectant
- **C** Critical period
- **D** Sensitive period

5 What form of learning can be most effective only at a particular time in life?
- **A** Experience-dependent
- **B** Experience-expectant
- **C** Critical period
- **D** Sensitive period

6 Which of the options best defines the distinction between experience-expectant learning and experience-dependent learning?
- **A** Experience-expectant learning involves experiences that are necessary for learning to occur, typically during sensitive periods; experience-dependent learning is learning that occurs as a result of an experience.
- **B** Experience-expectant learning involves experiences that are necessary for learning to occur, typically during critical periods; experience-dependent learning is learning that occurs as a result of an experience.
- **C** Experience-expectant learning is learning that happens as the result of an experience; experience-dependent learning is learning that occurs after a necessary experience.
- **D** Experience-expectant learning happens during critical periods; experience-dependent learning happens during sensitive periods.

7 Imprinting is
- **A** a period in life when certain experiences must happen for normal development to proceed.
- **B** where an immediate attachment is formed (to the first moving object seen after birth).
- **C** a period in time that is particularly suited to learning things due to the nature of the growing brain.
- **D** the absence or lack of important things that are needed for development.

8 Sisters Lara and Frankie are learning to speak Italian. Lara has rapidly progressed and is becoming fluent. Frankie, though, is struggling and is getting frustrated that she is not learning as quickly as her younger sister. Why could Lara be progressing faster?
- **A** Lara has a higher IQ than Frankie.
- **B** Frankie is older, and may have passed the sensitive period that makes it easier for Lara to learn Italian.
- **C** Lara experiences a more enriched environment on a daily basis than Frankie.
- **D** Lara and Frankie's parents spend more time with Lara to help her learn.

9 When does neural plasticity of the brain occur?
- **A** Only in childhood
- **B** Only in response to medication
- **C** As a result of head injury
- **D** Throughout life

10 Jade and her parents moved to Australia from Vietnam when Jade was an infant. Now that she is an adult, Jade speaks English fluently whereas her parents still struggle to speak English. Why might this be?
- **A** Jade's parents were too old for their brains to form any new neurological pathways when they moved to Australia.
- **B** Adult brains display less plasticity for language acquisition than a young child's brain.
- **C** Adult brains display more plasticity for language acquisition than a young child's brain.
- **D** The development of brain plasticity means that it is impossible to learn a new language after childhood.

11 An enriched environment can best be explained as
- **A** an environment that provides adequate amounts of food and water, and a safe living space.
- **B** an environment that has limited brain stimulation and lots of social stimulation.
- **C** an environment with significant opportunities for brain stimulation, limited opportunities for social interaction and few opportunities for safety.
- **D** an environment that encourages social interaction and provides significant opportunity for brain stimulation.

12 Which of the following statements about functional plasticity is true?
- **A** Functional plasticity refers to the brain's ability to adapt and reorganise its functions in response to injury or experience.
- **B** Functional plasticity is limited to specific brain regions and cannot occur across different areas.
- **C** Functional plasticity is only relevant during critical periods of development.
- **D** Functional plasticity is primarily associated with genetic factors and cannot be influenced by environmental factors.

13 Sally is home-schooled and, on a typical day, interacts mostly with her mother. Sally finds her days quite repetitive; she is rarely exposed to new information. Sally's brother Romulus attends the local primary school and gets to play with friends each day and is constantly learning about new topics. Which option best describes Sally's and Romulus's environments?

A Sally is in an enriched environment and Romulus is in a deprived environment.

B Sally and Romulus are both in an enriched environment.

C Romulus is in an enriched environment.

D Sally and Romulus are in deprived environments.

14 Which of the following statements about sensitive and critical periods in development is true?

A Sensitive periods refer to specific time frames when an organism is particularly responsive to environmental stimuli, while critical periods are more flexible and can extend beyond the optimal window.

B Critical periods are fixed time frames during which certain experiences must occur for normal development, while sensitive periods are less rigid and allow for more flexibility.

C Sensitive periods are exclusively related to language development, whereas critical periods apply to various aspects of development.

D Sensitive and critical periods are synonymous and the terms can be used interchangeably.

15 What type of neural plasticity is involved in the recovery of Broca's aphasia patients' ability to process language?

A Structural plasticity

B Informational plasticity

C Functional plasticity

D Aphasia plasticity

Review questions 5.4B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

16 **Describe** the neural plasticity of the brain during infancy. (1 mark)

17 **Describe** synaptic pruning. (1 mark)

18 **Describe** the changes in brain structure and function during adolescence. (3 marks)

19 **Explain** why someone in their late 20s might make better decisions than someone in their late teens. (1 mark)

20 **Identify** an example of a critical period in development in humans. (1 mark)

21 **Describe** a deprived environment and give an example of an effect this can have on development. (2 marks)

Analytical processes

22 Wilson was raised in a deprived environment. At the age of 10 he was found and transferred into a foster family that provided an enriched environment. **Consider** how plasticity may help Wilson recover when he is in a more nourishing environment. (3 marks)

23 **Discriminate** between critical and sensitive periods in learning. Provide two differences. (2 marks)

24 **Distinguish** between experience-expectant learning and experience-dependent learning, with reference to sensitive periods in learning a language. (2 marks)

25 **Consider** the effect of Genie's age when she was found on her language processing and cognitive development. (2 marks)

Knowledge utilisation

26 Extreme case studies, such as that of Genie Wiley, provide information about sensitive and critical periods. **Evaluate** the limitations of generalising findings from these extreme cases. (3 marks)

27 **Comment** on the effects of a deprived environment on brain development. (3 marks)

Data drill

Effects of deprivation and enrichment on brain development

In 1972, Rosenzweig, Bennet and Diamond used rats to investigate the effects of deprivation and enrichment on brain development. The researchers employed an independent groups design and allocated rats into three groups: control, deprivation (where the rats were on their own) and enriched (where the rats had other rats and toys so that they could socialise). Each group was placed in a cage. At the end of the experiment the rats were humanely euthanised and their brain mass was weighed. A total of 30 rats were used (10 per group). Figure 1 shows the average weight of the brain in each group.

Statistical tests were conducted and the data was found to be normally distributed.

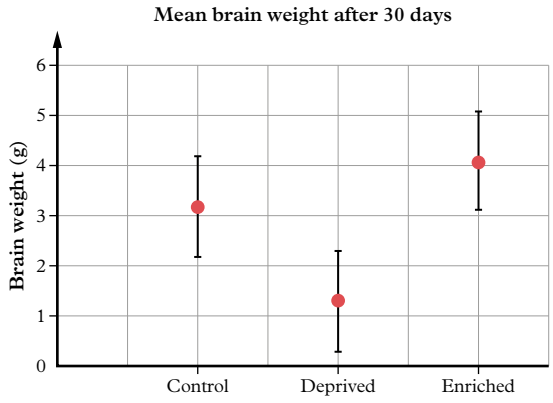


FIGURE 1 Mean brain weight (g) for the control, deprived and enriched groups of rats after 30 days (including error bars as confidence intervals)

Apply understanding

1 **Identify** the brain weight of the rats in the enriched condition. (1 mark)

2 **Identify** the group of rats that had the lowest brain weight. (1 mark)

Analyse data

3 **Sequence** the brain weight of the rat groups from lowest to highest. (1 mark)

4 **Identify** one characteristic of the data collected that makes it appropriate to use the mean as a measure of its central tendency. (1 mark)

Interpret evidence

5 **Deduce** from the confidence intervals which groups are most likely to have statistically significant differences in their results. (2 marks)

6 **Draw a conclusion** about the effect of environment on brain development in rats. (1 mark)

Module 5 checklist: Development and neural plasticity

Quizlet: Revise key terms online to test your understanding

MODULE 6

Emotional and cognitive development

Introduction

In recent years there have been significant advances in our understanding of the development of the human brain. We experience periods of rapid development from infancy to adolescence and these inform who we become. Even during the earliest period of development, our experience of our environment along with predetermined genetic factors play an important role in our development across the lifespan.

As we grow, we change in many ways. These changes are rapid and dramatic at first, then more subtle and slower – but development continues over the full lifespan. Some psychologists believe that change is a continuous, gradual process; while others believe that lifespan development occurs as a series of stages, rather like an international flight with rapid movement interspersed with extended stopovers on the way.

In this module, we consider the role of attachment in psychological development and also learn how early abuse or deprivation can have detrimental effects on cognitive development. Different cognitive, sociocultural and information processing theories of cognitive development will also be discussed.

Prior knowledge

Prior knowledge quiz

Check your understanding of concepts related to emotional and cognitive development before you start.

Subject matter

Science understanding

- → Describe the role of attachment in psychological development.
- → Describe the detrimental effects of early abuse or deprivation on cognitive development.
- → Discuss cognitive, sociocultural and information processing theories (i.e. processing speed, cognitive strategies and metacognition) of cognitive development.

Science as a human endeavour

→ Recognise that researchers build on and challenge the work of earlier researchers when developing psychological theory, e.g. key figures in the field of
  - attachment theory include Konrad Lorenz (1937), Harry Harlow (Harlow & Zimmermann 1958), John Bowlby (1969) and Mary Ainsworth (Ainsworth, Blehar, Waters & Wall 1978).

→ Appreciate that psychological scientists adhere to ethical principles when conducting research into the experiences of children who have suffered from abuse or deprivation.

Science inquiry skills

→ distinguish between types of investigations

→ identify and use appropriate sampling procedures for selection and allocation of participants

→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  - descriptive statistics

→ analyse data to identify trends, patterns and relationships; recognising error, uncertainty and limitations of evidence

→ use data and reasoning to discuss and evaluate the reliability and validity of evidence

→ select, synthesise and use evidence to
  - draw conclusions, using *p*-values to infer significance, allowing for the possibility of type I and II errors

Lesson 6.1
Attachment

Key ideas

- → Emotional development allows attachment between an infant and their caregiver/s to occur.
- → Infant attachment is crucial for the forming of strong relationships later in life.
- → Different theories of attachment come from Lorenz, Harlow, Bowlby and Ainsworth, with Bowlby's theory being the most widely accepted.
- → Bowlby's theory states that attachment occurs in the first year of a child's life, that the reactions and behaviours of the caregiver are crucial, and that attachment is a biological function.

Learning intentions and success criteria

Emotional development

Emotions are an important part of our lives. They assist people to develop and maintain relationships. Emotions can be positive: joy, love and enthusiasm. They can also be negative: anger, sadness and anxiety. The study of **emotional development** includes ascertaining the point in time at which people learn emotions, and how they deal with their emotions.

emotional development the development of a human's ability to experience, express and understand emotions and to cope with them appropriately throughout their life

The traditional view holds that all basic human emotions – such as anger, fear and joy – are learnt by 2 years of age (Bridges, 1931). Some researchers, however, believe that infants can express basic emotions from 10 weeks of age. Psychologist Carroll Izard studied babies' faces and identified many signs of emotions. The most common expression he found was interest, followed by joy, anger and sadness. Over a 2-year period, infants in Izard's study became more active in having emotional relations with their parents (Cicchetti et al., 1995).

Other researchers have suggested that a baby's temperament can affect emotional development. Temperament refers to an infant's emotional and behavioural reactions to the environment. A study conducted by Kagan (1989) stated that children who displayed a highly uninhibited temperament tended to be more social and talkative at 7 years of age, and those who were highly inhibited became quiet and shy at 7 years of age.

The study of emotional development is part of the discipline known as developmental psychology. The development of a human's cognitive, emotional, intellectual and social capabilities and functioning throughout life are all part of each person's **psychological development**.

psychological development the development of a human's cognitive, emotional, intellectual and social capabilities and functioning throughout their life

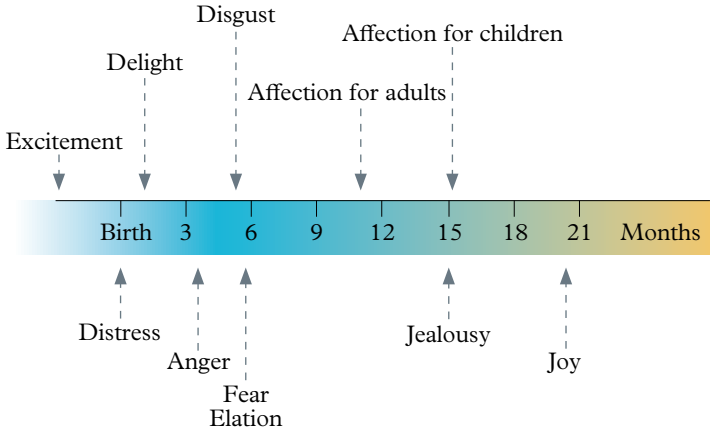


FIGURE 1 The traditional view of infancy holds that emotions are developed at different stages over the first 2 years.

FIGURE 2 Infants display many of the same emotional expressions as adults. Carroll Izard believed such expressions showed that distinct emotions appear within the first months of life. Other theorists argue that specific emotions come into focus more gradually, as an infant's nervous system matures.

Infant attachment

During the early part of life, the emotions that infants develop assist them in establishing relationships with their caregiver and other people. Emotional development allows **attachment** to occur: that is, a strong, close and emotional bond that develops between an infant and their caregiver and lasts for many years. The first few years of life is a sensitive period for forming a bond with caregivers, as it may be more difficult, although possible, to form strong bonds with caregivers later in life. The mutual love between infant and caregiver is not only crucial in the early years, but also helps people form relationships later in life with friends or lovers (Santrock, 2008). Attachment can be observed when you see children crying as their mothers leave them, or adults making sad farewells.

attachment the emotional bond created between infants and their caregivers; the tendency in adulthood to seek emotionally supportive social relationships

The attachment formed between child and caregiver is the first close emotional relationship a child has. Infants become attached to people who fulfil their needs for physical care and attention. However, it is not until infants reach 3 to 5 months of age that they demonstrate attachment-like behaviours, such as smiling at familiar faces rather than strange ones. At 6 to 8 months of age, infants typically begin to cry and hang on to their parents if they try to leave, and become more fearful when they see strangers. If infants become distressed at this age, they usually cannot be comforted by strangers; instead they seek comfort from the caregiver to whom they are attached (Peterson, 2004).

Study tip

Go to Lesson 5.2 to revise sensitive periods.

If attachment never occurs – that is, if a child never forms a close relationship with anyone – this is called **privation**. Privation can cause permanent emotional damage (Gross & McIlveen, 1998).

privation when attachment never occurs; an infant/child never forms a close relationship with anyone

Many theories and studies have been conducted surrounding infant attachment. We will now look at the work of Konrad Lorenz, Harry Harlow, John Bowlby and Mary Ainsworth, all early researchers in this field.

Konrad Lorenz

Konrad Lorenz was an Austrian zoologist, ethologist and ornithologist. He made detailed observations of animal behaviour and was interested in how attachment occurs in young ducklings and goslings. In 1935, Lorenz took a large clutch of goose eggs and kept them until they were about to hatch. Lorenz then placed half of the eggs under a goose mother, and kept the other half beside himself.

FIGURE 3 Konrad Lorenz with his goslings

When the eggs that Lorenz had kept hatched, Lorenz imitated a mother goose's quacking sound. The newly hatched geese then regarded Lorenz as their mother, and continued to follow him as though he were. The eggs that had been placed under the mother goose regarded her as their mother, and followed her accordingly.

This led Lorenz to conclude that newly hatched geese will follow the first moving object that they see within the 12- to 17-hour critical period after hatching. This tendency of a young animal to fixate its attention on, and thereafter follow, the first object to which it is exposed is known as imprinting. Imprinting suggests that attachment is an innate instinct and programmed genetically. It reflects a kind of automatic learning that typically occurs early in life, during a sensitive period of development, and is often referred to as phase-sensitive learning. For humans, the first object an infant fixates on is invariably a parent.

According to Lorenz (1937, as cited in Burton et al., 2015), imprinting provides an evolutionary advantage – it ensures that a young gosling will stay close to its parent, thereby increasing the chance of being fed and protected and taught survival skills. Lorenz's concepts therefore helped advance our scientific understanding of how behaviours evolve over time, and provided important insights into the adaptive values of specific kinds of behaviours that are important for the survival of the species (Hess, 2018).

Harry Harlow

Many recent theories are focused on the development and quality of attachment in infants, and are based on the influential views and work of Sigmund Freud and Harry Harlow. Freud proposed that infants become attached to people who provide them with oral satisfaction or nourishment. For most infants, this means that their attachment would be formed with their mothers, as they are the ones most likely to feed the infant. However, Harry Harlow (1958) demonstrated that this may not be the case (Santrock, 2008).

FIGURE 4 Freud proposed that infants formed attachments with those who provided them with nourishment or oral satisfaction.

Harlow's work focused on attachment in rhesus monkeys. Initially, he separated infant monkeys from their mothers at birth in order to raise them in a germ-free environment because many of the monkeys were dying from disease. He discovered that the monkeys grew up healthy, but were unable to get along with other monkeys. During the process, Harlow found that when he placed the monkeys in individual cages that contained a blanket, the monkeys became attached to the blanket and got upset if it was taken away. These behaviours indicated to Harlow that attachment may be formed by means other than nourishment.

Harlow's observations: Contact comfort and attachment

From these initial observations, Harlow conducted studies to determine if food or close comfort was more important in the formation of attachments. Harlow removed the monkeys from their mothers at birth, and for 6 months placed them with "surrogate (substitute) mothers". In one condition, half of the monkeys were raised by surrogate mothers that were made from wire and had a baby bottle attached to them. The other condition also included surrogate mothers, but these were made from soft cloth and did not include a feed bottle.

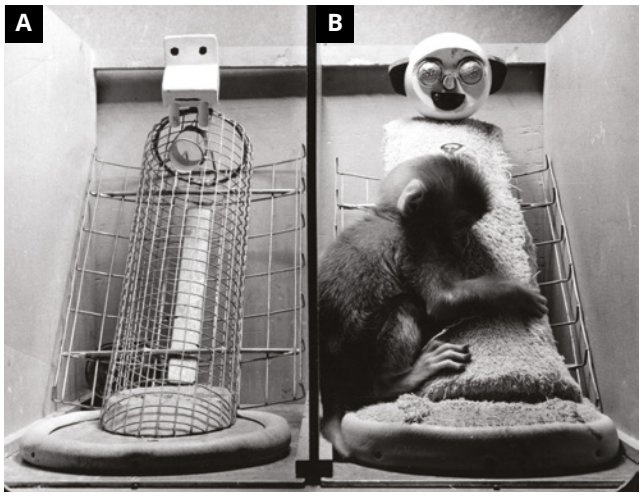


FIGURE 5 Harlow's two conditions: (A) a wire "mother" with a feeding bottle attached and (B) a soft "mother" with no feeding bottle attached

FIGURE 6 Infant monkeys frightened by a novel stimulus (in this case, a toy teddy bear banging a drum) retreat to the cloth-covered "mother" rather than to the wire "mother".

Harlow found that the infant monkeys that spent the most time with their surrogate mothers were those with the cloth surrogate mothers – even though the wire surrogate mothers provided food and nourishment. He also discovered that when he frightened the monkeys, those raised with the cloth surrogate mother would run and hold on to it for security, whereas those raised with the wire surrogate mother did not seek comfort from it at all (Santrock, 2008). Harlow stated that the cloth surrogate mother was also a "secure base" for the monkeys, as they would often move away from the cloth surrogate mother and explore the environment, and then return to the cloth surrogate mother before continuing to explore.

In further investigations, Harlow found that when the cloth surrogate mother was able to rock, feed and provide warmth to the infant monkey, then attachments were stronger. Consequently, Harlow demonstrated that feeding and nourishment do not create attachment: contact comfort is more important (Gross & McIlveen, 1998).

Harlow's observations: Interaction and attachment

While Harlow's research findings indicated that attachment formation requires contact comfort, further studies conducted by Harlow and Suomi (Suomi et al., 1970) noted that other factors – such as interaction with other monkeys during the first few months of life – also contributed to attachment. The infant monkeys raised by the cloth surrogate mothers did not develop normally; when fully grown, they became aggressive, rarely socialised with other monkeys and found mating very difficult (Gross & McIlveen, 1998).

Research conducted on monkeys has therefore provided us with ample information on the development of attachment and emotional development. It also provided a good foundation for further research and investigation in these areas.

FIGURE 7 When placed in strange situations without their surrogate mothers, infant monkeys displayed intense fear responses.

FIGURE 8 Bowlby considered that an infant's attachment to a caregiver is a biological function necessary for the infant's survival.

John Bowlby

British researcher John Bowlby (1969) was primarily interested in the development of attachment in children. Bowlby's theory of the development of attachment is the most widely accepted view. He believed that attachment occurs in the first year of a child's life, and that the reactions and behaviours of the caregiver are crucial. Bowlby stated that the development of attachment is biological and genetically inherited, and typical of human behaviour. In order to keep caregivers close, which is necessary for their survival, infants cry, coo, smile, crawl, walk and follow their mothers.

Bowlby's theory of attachment

Bowlby was both an ethologist and psychoanalyst, and he developed a theory of attachment leveraged from earlier work by both Harlow and Lorenz on human attachment and imprinting. Bowlby believed that human attachment is pre-wired and that attachment behaviour evolves over time (Burton et al., 2015). For example, in the early stages of emotional development, infants stay close to their parents and cry when they feel threatened or when their parent (i.e. attachment figure) is no longer present (Burton et al., 2015). Bowlby proposed that attachment develops in a series of phases. These phases demonstrate that initially a baby enjoys contact with any human being, but later prefers a partnership with a primary caregiver (Santrock, 2008).

From around 6 months of age, infants begin to demonstrate some emotional bond or attachment with one other person. An infant demonstrates attachment in several ways:

- They want to be close to a caregiver, especially when distressed.
- They show pleasure through smiling or cooing when in the company of their caregiver.
- They protest (for example, by crying) when the caregiver leaves.
- They express joy or relief if the caregiver returns or when reunited with them.
- They use the caregiver as a base from which to explore the environment, so that they can check back with them if they require reassurance (White et al., 2005).

TABLE 1 Bowlby's phases of attachment

Phase	Age	Description
Pre-attachment	0–2 months	Infants interact with humans and cannot discriminate between one person and another. They are likely to smile or cry for parents, siblings and strangers alike. Hence they can be left with an unfamiliar adult without becoming distressed.
Attachment in the making	3–7 months	Attachment to the caregiver begins. The baby learns to distinguish familiar from unfamiliar faces and so recognises its parents, although it may not protest when separated from them.
Clear-cut attachment	8–24 months	Infants seek specific attachments and may display separation anxiety when their caregiver leaves.
Goal-directed partnership	24 months onwards	Children recognise others' needs, feelings and plans, and also understand that their caregivers will come, go and return. Communication skills begin to develop and separation anxiety decreases.

Further research was conducted on the development of infant attachment by Schaffer and Emerson (1964). They discovered that "stranger fear" – or an infant's wariness of unfamiliar people and faces – develops at the same time as an infant's first attachment. This is demonstrated in Figure 9.

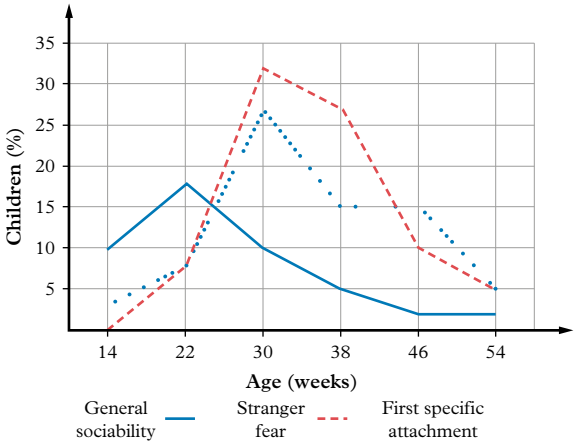


FIGURE 9 Developmental changes in stranger fear and specific attachment to an individual caregiver

Mary Ainsworth

When studying attachment theories, we must consider the *quality* of attachment between infants and their caregivers by observing behaviours. Mary Ainsworth and her colleagues (1978) were the first researchers to study differences in the quality of attachment. Rather than using naturalistic observation techniques, Ainsworth created a laboratory testing technique known as the **Strange Situation**. Figure 11 shows the layout of the laboratory for the Strange Situation tests.

The Strange Situation allowed Ainsworth to measure infant attachment by having infants experience a sequence of events, including separations and reunions with their mothers, and introductions to an adult stranger. The flow chart in Figure 10 outlines the Strange Situation procedure.

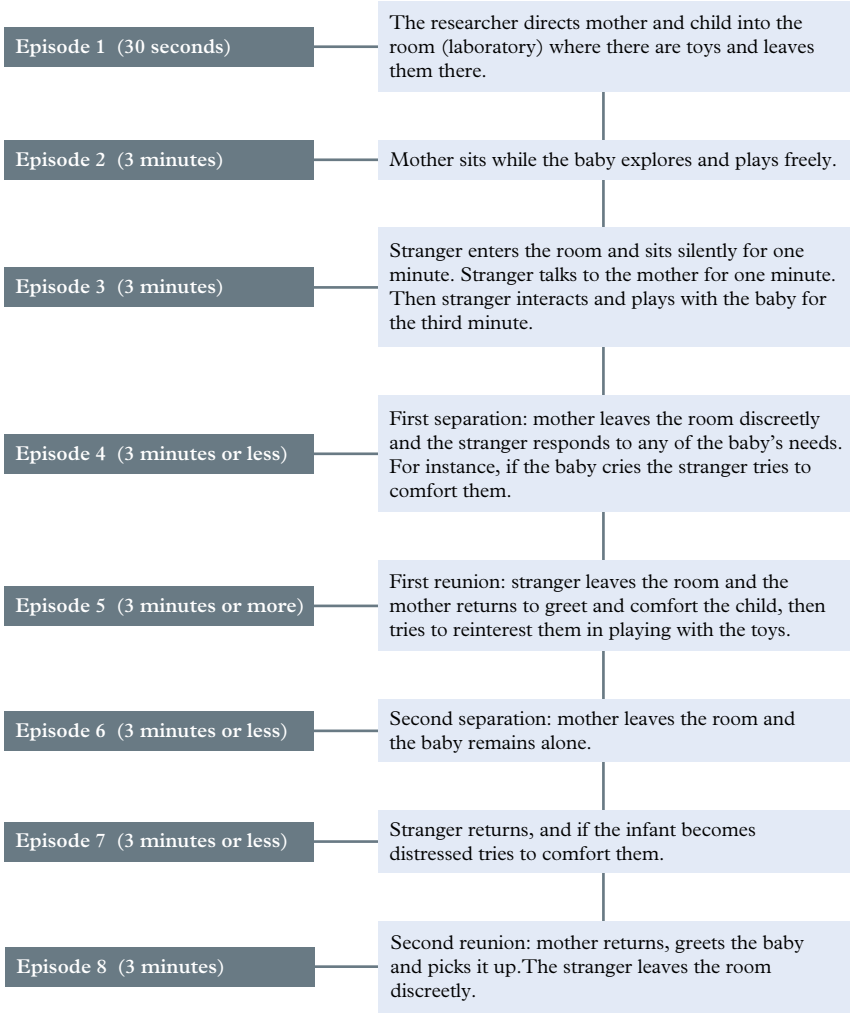


FIGURE 10 The Strange Situation procedure

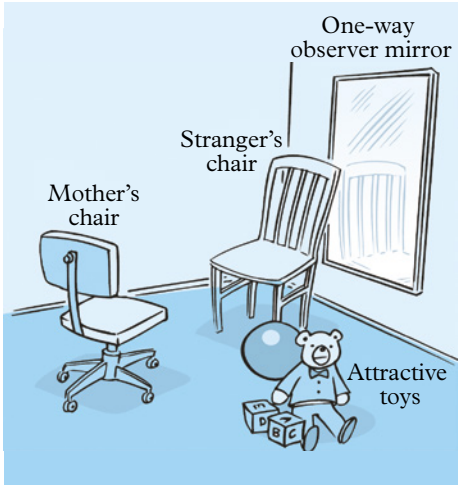


FIGURE 11 The Strange Situation laboratory, used to test the quality of attachment

Strange Situation
a method used by Ainsworth to study the differences in quality of attachment between an infant and a caregiver

Ainsworth's categories of attachment

Ainsworth categorised the babies' responses to the Strange Situation into three types of attachment: insecure avoidant, secure and insecure resistant. Table 2 describes the types of attachment.

TABLE 2 Ainsworth's attachment styles

Category*	Style	Description/typical behaviour	Percentage of 1-year-old infants in category
Type A	Insecure avoidant attachment	These infants rarely get upset when a stranger enters the room. They do not cling to their caregiver at any stage. They show no distress when their caregiver leaves the room and can ignore or avoid them when they return. These infants do become distressed when left alone; however, they can be comforted by either their caregiver or the stranger. Both adults are treated the same way by the infants.	20–25
Type B	Secure attachment	These infants play happily when their caregiver is present, trusting that their caregiver will be there if they need them. These infants are very attached to their caregiver and become distressed when their caregiver leaves. A stranger can comfort the infant, but is treated differently from the caregiver. When the caregiver returns, these infants seek immediate contact and are delighted when they are reunited. In this instance, infants are distressed by the absence of the caregiver, not by being alone.	65
Type C	Insecure resistant attachment	These infants are more clingy, cry more and do not explore or play as much as Type A or B. They become extremely distressed when their caregiver leaves and resist any comfort from the stranger. These infants seek contact with the caregiver when reunited, but will not display joy during this time. Instead they continue to be distressed, cry and will not play. These infants appear to be anxious and negative.	10

**Note: A small percentage of infants could not be classified using the Strange Situation procedure (Peterson, 2004).*

Disorganised attachment

As a result of further research conducted by Main and Solomon (1986) a fourth type of attachment, known as disorganised attachment, was identified. These infants display contradictory behaviours, such as crying when the caregiver leaves the room, but avoiding comfort from the caregiver when they return. If infants do seek comfort from the caregiver, they might also appear fearful of them. Disorganised attachment is thought to arise from an abusive, neglectful relationship between an infant and caregiver, where the infant's sense of trust in the caregiver is disrupted, although abuse and neglect are not always present.

Effect of cultural differences on attachment

The Strange Situation procedure has been particularly useful in measuring the quality of attachment between infants and their caregivers from Australia, New Zealand, the United States and Canada. However, there are cross-cultural variations: when similar research was conducted on infants from other cultures, the results were different. For instance, when the Strange Situation procedure was used on infants from Japan, the percentages in the three categories differed from the results observed with UK infants. Looking at the categories in Table 2, a high percentage of Japanese infants were classified as Type C. This means they became distressed when their caregiver left them and could not be calmed down or comforted

once the caregiver returned. The reason for this result is that Japanese children are rarely separated from their mothers, so the departure of their mother in the Strange Situation created more stress for the Japanese infants. UK infants, on the other hand, were more likely to be used to separation from their mothers (Miyake et al., 1985).

Figure 12 also illustrates other cultural differences in attachment that have been observed. These could be due to different cultural practices used in raising infants. However, despite the differences, the most common category of attachment among infants in every culture is Type B: "securely attached" (Thompson, 2006).

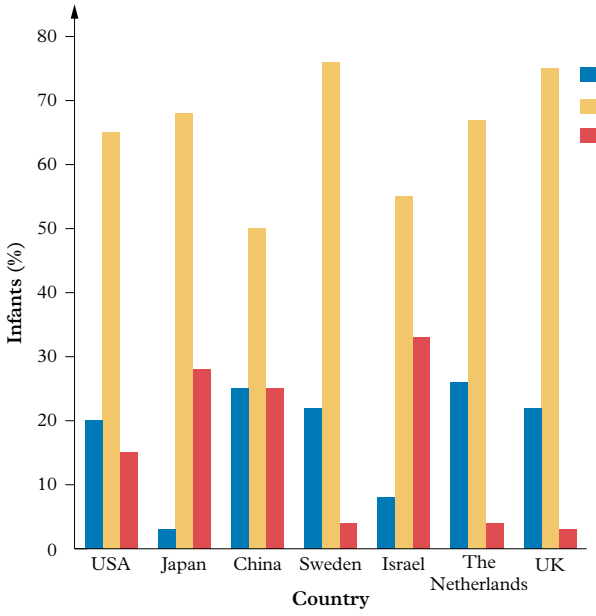


FIGURE 12 Attachment classifications of infants from different cultures tested in the Strange Situation (Peterson, 2004). Graph is based on data in Miyake et al. (1985).

Challenge

Changing attitudes to fathers

Society's attitudes to fathers being the primary caregiver to infants is changing. Collect online advertisements and/or children's storybooks that show an infant 2 years of age or younger with a caregiver, and count the number of times that the caregiver is the mother, father or another person (such as a grandparent).

1 From your collection of advertisements and/or storybooks
   - **a** **identify** whether mothers outnumber fathers
   - **b** **consider** the relationship between the number of times mothers and fathers appear and the sources of the images.
2 **Compare** the class findings, and **discuss** possible reasons for the findings.

Real-world psychology

Attachment styles and smartphone use

You are unlikely to meet a young person today in Australia who does not own a smartphone. In technologically more advanced societies, a median of 76 per cent report ownership, with 95 per cent in South Korea and 59 per cent in Greece. Smartphones and social network sites (SNS) are also playing an increasingly important role in everyday life, from helping people to manage tasks such as online banking, through to developing and maintaining interpersonal relationships.

A recent study by Gritte et al. (2023) investigated if there were any relationships between adult attachment style and interpersonal patterns and emotional bonds to a mobile device. They were interested in seeing if they could predict smartphone and SNS consumption from these factors.

The researchers recruited 376 participants, mainly from university courses, using a snowball sampling technique, where participants recruit other participants. The participants completed a range of questionnaires, assessing various aspects of their psychological profile, including interpersonal dependency, attachment styles, self-esteem and emotional processing abilities. Attachment to smartphones was defined as "the emotional bond a person forms with their device, characterised by

feelings of dependence, anxiety when separated, and viewing the smartphone as a source of comfort".

Their results indicated a parallel between attachment style and the emotional bond with the smartphone, with anxious attachment style (those who often feel insecure in their relationships) showing a tendency to form stronger emotional bonds with their smartphones.

The study also significantly adds to the literature showing that smartphone and social network use are multidetermined behaviours; that is, they are influenced by many factors. For example, individual demographic (e.g. single status) and psychological variables (e.g. level of self-esteem) as well as attachment styles influence smartphone use. These findings have implications for intervention strategies for smartphone dependency.

The early research in the field of attachment continues to grow and contribute to our understanding of psychological development.

Apply your understanding

1 **Describe** the nature of attachment to smartphones. (1 mark)
2 **Identify** the attachment style that is more likely to result in a person having a stronger emotional bond to their smartphone. (1 mark)
3 **Identify** a potential limitation of the study described. (1 mark)
4 **Explain** why it is important that the type of research conducted by Gritte and colleagues is carried out. (1 mark)

FIGURE 13 Mobile phone connectedness or dependence?

Check your learning 6.1

Check your learning 6.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the relationship between emotional development and attachment. (1 mark)
2 **Describe** the role of attachment in psychological development. (2 marks)
3 **Identify** two attachment behaviours that an infant can demonstrate towards a caregiver. (2 marks)

Analytical processes

4 Three-year-old Sameem used to cry every time his mother left him at his grandmother's house. He no longer does this. **Determine** the phase Sameem is in with reference to Bowlby's theory of attachment. (1 mark)
5 Eighteen-month-old Kira doesn't seem to notice if her mother leaves the room and doesn't react when she returns. **Apply** Ainsworth's theory of attachment to **explain** why this behaviour occurs. (2 marks)
6 **Consider** these reactions of three 2-year-old children when their parents went out for the evening. **Classify** each child into one of Ainsworth's types of attachment.
   a Child chased parents with a toy car as they left, and threw a ball at them. (1 mark)
   b Child cried until parents returned, then appeared happy. (1 mark)
   c Child played happily with their toys. (1 mark)

Knowledge utilisation

7 **Evaluate** two theories of attachment. (4 marks)

Lesson 6.2
Environmental influences on development

Key ideas

- → Early deprivation has a detrimental effect on cognitive development.
- → This is supported by Rutter et al.'s 2004 study which showed a negative relationship between length of deprivation and attachment and cognitive development.

Learning intentions and success criteria

Introducing environmental influences on development

There is an ongoing interaction between nature and nurture throughout life. Unfortunately, many children are not born into loving and caring environments (nurture). Early abuse or deprivation has been shown to negatively influence an infant's ability to develop attachments and cognitively process information. It is important to remember that abuse is not restricted to physical violence; emotional neglect can also have a profound negative effect on an infant's **cognitive development**.

cognitive development the development of mental processes and abilities throughout the lifespan

Introducing the Romanian adoption study

Michael Rutter was the UK's first professor of child psychiatry. Rutter considered **deprivation** to be the loss of or damage to an existing attachment. He differentiated this from privation, which he saw as when a child fails to develop an attachment at all.

In the 1980s, Romania was in a period of civil unrest, and the Western world learnt of many children being housed institutionally in warehouses. Romania considered these children to be beyond help. This knowledge inspired many families from the UK to adopt Romanian children and the adoptions provided Michael Rutter with an opportunity to conduct longitudinal research into the effects of early deprivation and abuse on infants. Rutter argued that it was not only a lack of attachment to a primary caregiver that influenced development, but a lack of intellectual stimulation and social experiences that attachment would normally provide.

deprivation the loss of or damage to an existing attachment

FIGURE 1 Romanian orphans from Rutter's adoption program

Method

Rutter, O'Connor and the English and Romanian Adoptees (ERA) research team (2004) investigated the effects of early deprivation. The research team compared 144 children reared from infancy in depriving institutions in Romania, who were later adopted into UK families, with 52 children born in the UK and placed in adoptive

Study tip

This lesson connects with subject matter from Lesson 5.2 where the effect of deprived environments on brain development was explored. When studying, you should always look for links and connections between what you are learning and what you have already learnt. This supports your ability to retrieve information from your memory.

families before 6 months of age. There were 45 Romanian children who were adopted under 6 months of age, 54 who were adopted between 6 and 24 months, and 45 children who were adopted between 24 and 42 months.

The children adopted from Romania typically experienced ongoing high levels of deprivation, which was recorded at the time of their entrance into the UK. The adopted Romanian and UK children were then measured at 4 or 6 years of age, depending on their age at the time of adoption. This measurement involved the children and their caregivers undergoing intensive interviews to determine their cognitive, emotional and intellectual levels.

Results

Rutter's research found that the "effects of institutional rearing on attachment disinhibition" appear to apply even if profound deprivation is not involved. Rutter found a relationship between the length of the institutional deprivation and attachment disorders in children. For example, infants who entered the UK under the age of 6 months showed no significant deficits, although many children displayed an insecure attachment pattern (Rutter et al., 2004).

This disinhibited attachment that children showed was characterised by:

- a lack of preference for contact with caregivers versus relative strangers
- lack of checking back with parents in anxiety-inducing situations.

Rutter thus proposed that a reactive attachment disorder develops if a child's needs for comfort, affection and nurturing are not met. In these circumstances, loving and caring attachments with others are never established and can potentially influence a child's ability to establish future relationships.

Rutter thus found that institutional deprivation in the early years strongly influenced later attachment. Specifically, the duration of institutional deprivation had a strong negative relationship with subsequent attachment and cognitive ability in childhood. These cognitive and emotional deficits continued to persist in Romanian children even after adoption. Cognitive problems and mental health disorders, such as increased symptom rates of attention deficit hyperactivity disorder (ADHD), autism spectrum disorder (ASD) and lower IQ were observed in the children, and some persisted through to adulthood. However, the Rutter study also revealed that the effects of early deprivation could be reversed. The Romanian children living with adoptive families showed considerable recovery towards normal levels of social functioning over time (Rutter et al., 2004).

FIGURE 2 Many children in Rutter's study showed an insecure attachment pattern, partly characterised by a lack of checking in with parents in stressful situations.

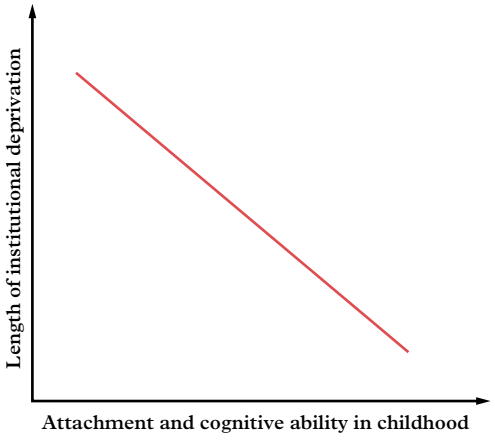


FIGURE 3 Rutter's study showed that the greater the length of institutional deprivation, the lower the levels of attachment and cognitive ability in childhood.

Further research

More recent research using the ERA adoptees studied the impact of early institutional deprivation on the adult brain structure by taking MRI scans of the brain. It was found that institutional deprivation was also associated with a smaller brain in young adulthood, with an indirect correlation between the duration of deprivation and brain size. The longer the adoptees had spent in the institution, the smaller their brains were likely to be in adulthood. A smaller brain volume was also correlated to more symptoms of ADHD and lower intelligence. These findings provide further evidence of extreme abuse and deprivation early in life being linked to changes in brain structure in adulthood and cognitive development.

Skill drill

Reliability and validity

Science inquiry skills: Planning investigations (Lesson 1.4); Evaluating evidence (Lesson 1.8)

Being able to assess the reliability and validity of the experimental process and research evidence is very important for writing up your student experiment and research investigation respectively. Reliability refers to the extent to which the results obtained from the research study are consistent (internal consistency), dependable (inter-rater reliability) and stable (test-retest). Validity is the ability of an instrument to measure what the research intended to measure or accuracy of the data to test the study's aim.

Practise your skills

Consider Rutter and colleagues' 2004 study when answering the questions.

1 **Identify** the type of sampling procedure used for the study. (1 mark)
2 **Identify** the type of investigation performed in the study. (1 mark)
3 **Evaluate** the reliability and validity of the evidence obtained in the study. (2 marks)

Real-world psychology

Investigating participant rights

So far in this course, you have learnt about several studies involving children and animals.

In Lesson 6.1, you learnt about Harry Harlow's 1958 research with rhesus monkeys that demonstrated the importance of attachment during infancy on psychological development. Harlow found that comfort and contact were more likely to lead to attachment between an infant and caregiver than provision of sustenance, and that infants who did not form attachments developed atypically and had difficulties socialising with others.

Also in Lesson 6.1, you learnt about Mary Ainsworth's 1978 findings that the style of parenting provided by a caregiver impacts a child's emotional behaviour and how they interact with their caregiver and strangers. Her studies involved working with caregivers/parents and their young children.

The study completed by Rutter and colleagues (2004) investigated the effects of early deprivation on psychological development. This study involved 144 children adopted in the UK from Romania, where they had lived in an orphanage (deprived environment) and 52 children born in the UK and placed in adoptive families before they were 6 months old.

In Lesson 5.2, you learnt about Genie Wiley, who had spent most of her life in a dark, isolated room, before being rescued and then studied by psychologists from the age of 13.5 years.

Ethical guidelines for research exist in Australia for working with animals and humans. All research involving any vertebrate must be approved by an ethics committee (typically of the institution that the researchers are working in).

Lesson 1.5 lists the ethical considerations that must be considered in carrying out any research with humans.

Apply your understanding

1 **Identify** the ethical considerations that were not applied in Genie's case. (1 mark)

2 **Discuss** the ethical guidelines that were violated in Ainsworth's Strange Situation experiment. (3 marks)

3 Animal research plays an important role in investigations involving psychological phenomena. The care and use of animals in research is governed by the National Health and Medical Research Council's (NHMRC) Australian code for the care and use of animals for scientific purposes (8th ed., 2013). **Evaluate** whether it is appropriate to apply findings based on animal studies to humans. (2 marks)

FIGURE 4 Harlow studied attachment in Rhesus monkeys.

Check your learning 6.2

Check your learning 6.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the effects of early deprivation on cognitive development. (1 mark)

2 **Construct** a diagram to show the relationships between deprivation, attachment and brain structure and function. (3 marks)

Analytical processes

3 **Consider** how the orphaned children's adoptive families may have affected their attachment. (2 marks)

Knowledge utilisation

4 **Hypothesise** the cognitive effects of emotional abuse on a child removed from the situation at 12 months of age, and the effects of emotional and physical abuse on a child removed from the situation at 6 months of age. **Justify** your responses. (4 marks)

Lesson 6.3
Theories of cognitive development

Key ideas

- → Piaget's theory of cognitive development centres on the combination of biological process and personal experience.
- → Vygotsky's theory of sociocultural cognitive development centres on social experiences within a cultural context.
- → The information processing theory of cognitive development centres on the individual as a processor of information.

Learning intentions and success criteria

Introducing theories of cognitive development

The way a child develops attachment is important, but their cognitive development is equally so. In this lesson, you will learn how cognitive abilities are informed by Piaget's theory of cognitive development. You will also learn about Vygotsky's sociocultural theory of cognitive development and about the information-processing theory of cognitive development, including processing speed, cognitive strategies and metacognition.

Introducing Jean Piaget's theory

Consider your childhood for a moment. What were your thought processes like? Were you rational at 6 years of age? Did you understand the concept of honesty at 3 years of age? Could you answer hypothetical questions at the age of 5? The study of cognitive development examines the way in which thinking changes as we grow.

One theory that gained much attention was formulated by Jean Piaget (1896–1980), a Swiss psychologist. Piaget believed that cognitive development depends upon the interaction of the brain's biological maturation with personal experiences. After many years of observations, Piaget proposed that all children go through four different cognitive stages sequentially, without missing any (unless there is some sort of brain injury, meaning a child could regress to earlier stages). He believed that these stages were the same for every child, regardless of their culture.

To understand Piaget's four stages of cognitive development, we must first consider schemata, and assimilation and accommodation.

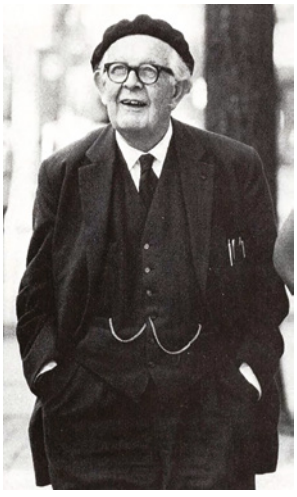


FIGURE 1 Jean Piaget

Schemata

Piaget proposed that during cognitive development, the brain builds **schemata** (singular: schema). These are mental frameworks that organise past experiences and provide an understanding of future experiences. In infants, schemata are simple: they are the basic blocks of knowledge, such as the inborn reflexes of sucking and grasping. As children grow, schemata become more complex to incorporate experiences or information that has been gathered.

schema
(pl. schemata) an organised mental framework about a person, place or thing

Assimilation and accommodation

assimilation
according to Piaget, the process where new experiences are combined with existing schemata

accommodation
Piaget's term for when new situations, objects or information are encountered and the person's schema is either modified or a new schema is created

Two processes that are involved in altering existing schemata or developing new schemata are called assimilation and accommodation. **Assimilation** is the process whereby new experiences are combined with existing schemata. For instance, when an infant experiences a new toy for the first time, they may put it in their mouth and suck on it. This behaviour demonstrates that the infant is trying to fit information about this new toy into their existing schema (mental framework) of sucking. Similarly, if a child saw a toy truck for the first time they would examine it and fit it into their schema of cars, since the truck has similar qualities to a car. However, if an infant or child discovers that new information does not fit into their schemata, then accommodation occurs.

Accommodation is when new experiences cause schemata to change or modify. For instance, if an infant discovers that the object they are trying to suck is too big or tastes awful, or the child discovers that the truck is bigger than a car, then these thoughts cause schemata to change and become more complex. These processes help infants and children understand their world.

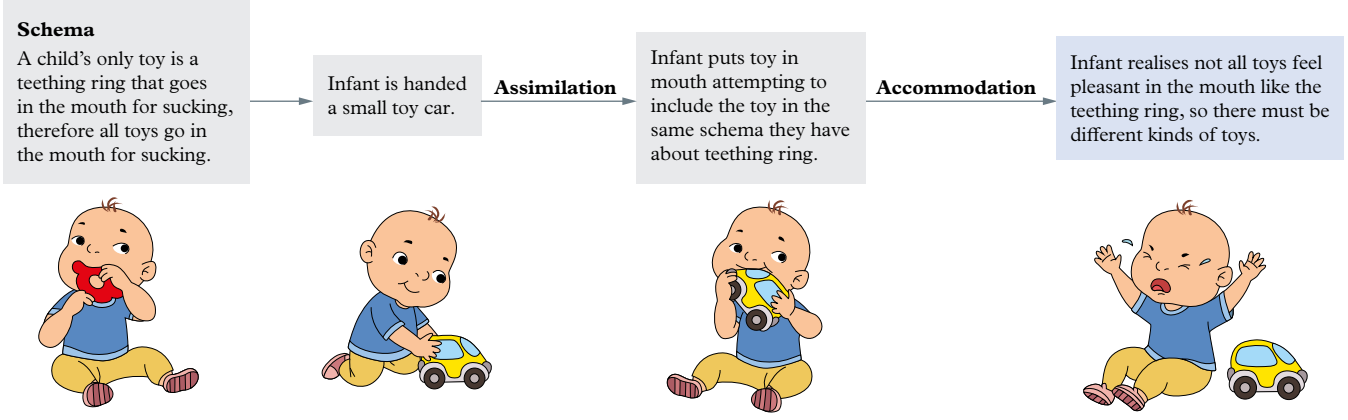


FIGURE 2 Example of how assimilation and accommodation can occur in relation to the same schema

Piaget's four stages of cognitive development

According to Piaget, cognitive development involves understanding new experiences in relation to the knowledge children already have (assimilation) and modifying thinking for new experiences (accommodation) that don't fit into current schemata. Piaget proposed four stages that summarise the different schemata a child has at particular times in their life and how the schemata change with experiences as they grow: sensorimotor, preoperational, concrete operational and formal operational. Table 1 summarises the schemata of each stage.

TABLE 1 Piaget's four stages of cognitive development

Stage	Age (years)	Schemata
Sensorimotor	0–2	Infants learn about their world through their senses (hearing, seeing) and by actions (motor) such as grasping or pulling.
Preoperational	2–7	Children continue to develop, and they use symbols, images and language to represent their world.
Concrete operational	7–12	Children perform basic mental operations that involve physical objects.
Formal operational	12+	Children think logically and methodically about physical and abstract problems.

Sensorimotor stage

During this stage, infants learn about the world through their senses, such as seeing and hearing, and their actions, such as grasping and pulling. The key development is **object permanence**, when they come to understand that an object still exists when it is no longer seen.

Preoperational stage

Children continue to develop during this stage. Key developments are **symbolic thinking**, where children use symbols, images and language to represent objects and events, which allows them to participate in pretend or make-believe play, and **animism**, where children believe that inanimate objects are alive; for example, talking about toy cars as people. This stage is also characterised by a number of limitations.

- **Egocentrism**: Children are unable to view the world from someone else's perspective. This was seen in Piaget's three-mountain experiment. Four-year-old children stood in front of a model of three mountains and were shown 10 pictures of the mountains from other sides of the model. Most children could pick out their own view. When asked to select a view from another person's perspective, most selected their own or another incorrect option.
- **Centration**: Children can only focus on one aspect of a task at a time; for example, if a child is asked to divide blocks according to size and colour, it is likely they will divide the blocks either for size or colour, but not both.
- **Seriation**: Children will have difficulty arranging objects according to one dimension; for example, arranging sticks from shortest to longest.
- Lack of **conservation**: Children cannot understand that objects stay the same despite changes in appearance.
- **Irreversibility**: Children are unable to realise that an action can be done and then undone.

FIGURE 3 Infants develop a sense of object permanence during the sensorimotor stage.

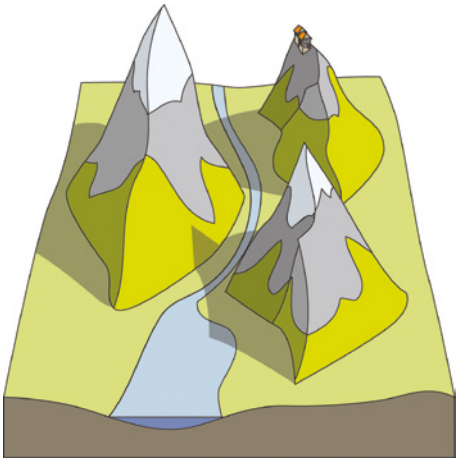


FIGURE 4 The three-mountain experiment set-up

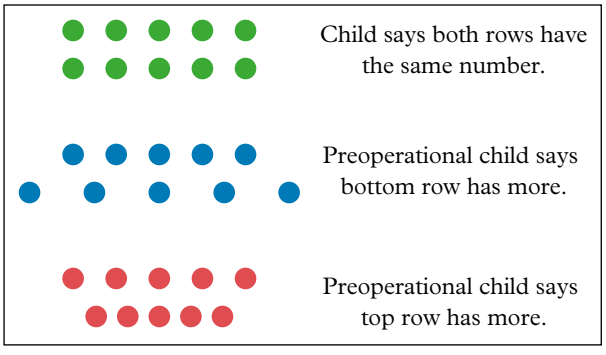


FIGURE 5 A conservation of numbers task: preoperational children are unable to understand that objects stay the same despite changes in their appearance.

object permanence
realising that an object still exists when it is no longer visible

symbolic thinking
development of symbols to represent objects or events

animism
Piaget's term for the preoperational stage where children will believe that inanimate objects are alive

egocentrism
Piaget's term for when a person does not make distinctions between their own thoughts, feelings and perceptions and those of others

centration
Piaget's term for the preoperational stage where children can only focus on one aspect of a task at a time

seriation
Piaget's term for the preoperational stage where children will have difficulty arranging objects according to one dimension

conservation
Piaget's term for understanding that one object can take different forms

irreversibility
children's inability to realise that an action can be done and then undone

Concrete operational stage

reversibility
Piaget's term for understanding that inversion of (reversing) an action will return it to its original state

During this stage, children begin to understand **reversibility** and conservation, and display less centration and egocentrism. Children may struggle to solve problems that require abstract thinking.

FIGURE 6 According to Piaget, the formal operational stage of cognitive development begins at 12 years of age.

Formal operational stage

Finally, in the formal operational stage, children begin to think more flexibly. They can solve hypothetical problems and can form and test hypotheses.

Evaluation of Piaget's theory

Piaget's theory of cognitive development has had a profound impact on psychology, and has influenced and guided much research on the way children think and learn. Research has supported Piaget's observations on the sequences of cognitive development and the notion that cognitive abilities develop across cultures. However, there have been some criticisms:

- Children can gain cognitive skills at an earlier age than Piaget believed.
- Piaget suggested that cognitive development involves children moving from simple to complex thinking, but other research suggests cognitive abilities can develop inconsistently and that children do not necessarily follow the same developmental path.
- Piaget's perspective on cognitive development considered scientific logical thinking, but not how different cultures can influence cognitive development. Some cultures believe that social intelligence and thinking is important and a part of cognitive development.
- Piaget often conducted cognitive tests and observations on his own children, so the methodology of his experiments has been questioned.

Introducing Vygotsky's sociocultural theory of cognition

Russian psychologist Lev Vygotsky (1896–1934) developed a sociocultural theory of cognitive development that has since become the foundation for further research into how children learn. His work became increasingly influential after it was translated into English in 1962. Vygotsky emphasised the importance of social interaction in a child's cognitive development. Children learn first by interacting with others who are more skilled, and then integrate that knowledge into their own mental structure. Vygotsky's theory is that the social and cultural context in which learning takes place actively affects a child's cognitive development. He argued, "learning is a necessary and universal aspect of the process of developing culturally organised, specifically human psychological function" (Vygotsky, 1978).

Vygotsky's sociocultural theory of cognitive development was based around three key themes: the zone of proximal development, the more knowledgeable other and scaffolding.

FIGURE 7 Vygotsky's theory emphasises the importance of social interaction for cognitive development.

Zone of proximal development

Probably the most recognised of Vygotsky's concepts is the **zone of proximal development** (ZPD). This refers to the "sweet spot", where children are able to learn how to accomplish a task, with guidance from someone else, which they would not be able to do by themselves. An example might be when a young child wants to wrap a present. Left alone, they would struggle to neatly wrap the present and tie a ribbon on it. However, with guidance from someone more skilled at wrapping presents, the child would learn how to accomplish the task by themselves. In this situation, the skills required are too difficult for a child to acquire independently, but can be learnt with help and guidance from someone else. This continuum of cognitive development, stretching from solo performance to collaborative cooperation, is the zone of proximal development.

zone of proximal development continuum of cognitive development stretching from solo performance to collaborative cooperation

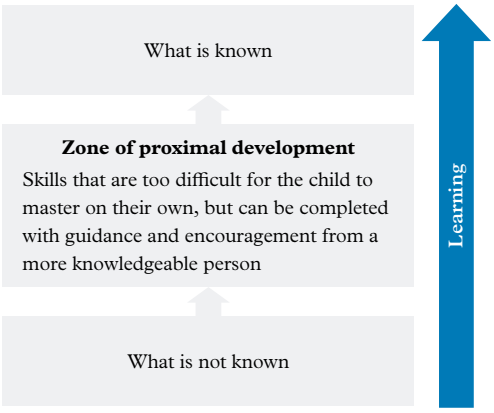


FIGURE 8 The zone of proximal development

FIGURE 9 Learning to wrap a present with guidance from someone more knowledgeable

More knowledgeable other

Closely related to the ZPD is the concept of the **more knowledgeable other**. This idea recognises the importance in a child's cognitive development of interaction with a person who has more understanding or knowledge about a particular topic. That is, we learn from others who know more than we do about a particular subject, task or process. In many cases, particularly when we are quite young, we learn primarily from our parents. For example, regarding the child learning to wrap presents, this could involve their father sitting down to teach them the task. But it could be anyone else with greater knowledge, such as an older sibling or a friend who has already been taught how to master that skill, or a teacher at school. These days, guidance may even come from a non-human source, such as a voice-activated chat bot or other artificial intelligence.

more knowledgeable other another individual with greater knowledge about a particular topic

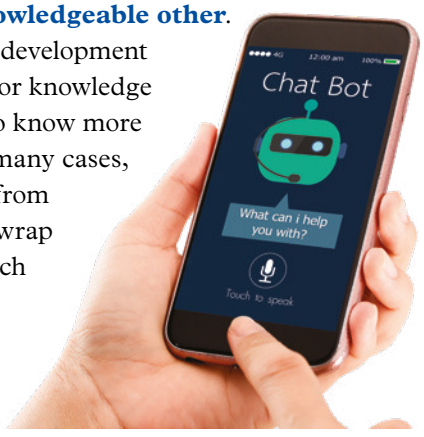


FIGURE 10 Today, the "more knowledgeable other" can be a form of artificial intelligence.

Scaffolding

The concept of **scaffolding** is also closely related to the previous two concepts. It refers to the level of temporary support that children need before they learn how to master a task independently. When someone is teaching a child how to accomplish a task, they may originally start by providing a lot of guidance and instruction, and then gradually reduce the

scaffolding providing support to a child to help them learn and master a task independently

FIGURE 11 You can see less scaffolding for wrapping a present provided, as the child learns to do it themselves alongside their more knowledgeable other.

level of support as the child masters the skills required. In the previous example, the child learning how to wrap a present may initially need their teacher to be very hands-on when instructing where and how to fold the paper, but eventually the child will be able to do it by themselves. The "scaffolding" support is reduced bit by bit until it is no longer needed.

Limitations of Vygotsky's theory

A limitation of the sociocultural theory is that it focuses mainly on the interaction of people and doesn't identify and explain how factors such as genetics or biology influence cognitive development. This theory cannot explain why cross-cultural studies show that stages of development mostly occur in the same order in all cultures, suggesting that the biological process of maturation affects cognitive development.

Contrasting Piaget's theory and Vygotsky's theory

Vygotsky's work is influential because it stresses the fundamental role of social interaction in the development of cognition (Vygotsky, 1978) as well as the fact that cultural context is an important contributor to development (McLeod, 2014). The way children develop in one culture may be quite different from another because of differences in the patterns of social interaction within those cultures.

As a result, Vygotsky's theory of cognitive development differs from Piaget's in a number of ways. Piaget theorised that there were universal stages of cognitive development that every child goes through, and this progression was largely independent of cultural context. Vygotsky places much more importance on the impacts of culture (McLeod, 2014). Piaget also indicates that cognitive development is largely a result of children exploring independently and constructing knowledge, whereas Vygotsky emphasises that children co-construct knowledge with guidance from others based on social interactions (Burton et al., 2015).

FIGURE 12 Piaget's theory centres on universal development, independent of social and cultural context, while Vygotsky's theory centres on the importance of social interaction and culture for development.

Introducing the information processing theory of cognitive development

The information processing theory aims to identify the specific processes that account for cognitive development, including how quickly we can process information and how our memories are encoded and retrieved as required. This theory sees the individual as a processor of information, similar to a computer that takes in information and follows a program to produce an output. For example, when you look at a book, the eye receives the visual information and codes this into an electrical message, which is relayed to the brain where it is "stored" and "coded". This information is then used by other parts of the brain relating to cognitive processes such as memory, perception and attention. The behaviour (i.e. output) could be reading aloud the words on the page or reading silently. The information processing theory considers thinking as the environment providing input of data, which is then transformed by our senses and, hence, brain.

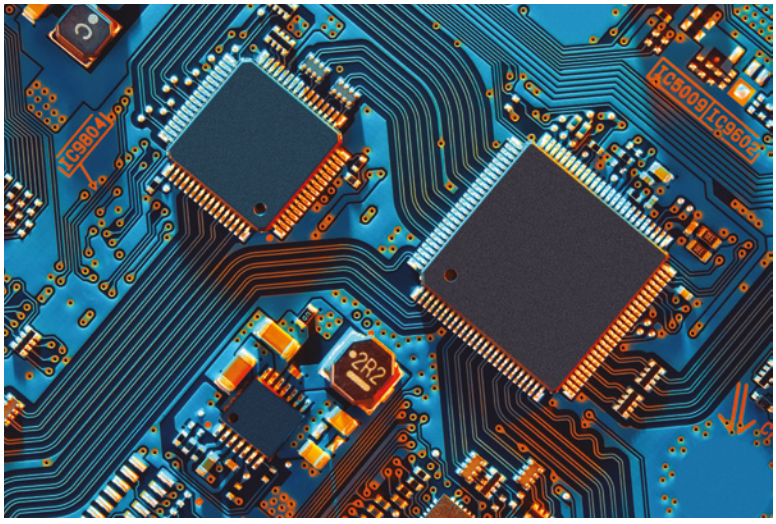


FIGURE 13 The information processing theory of cognitive development sees the individual as a processor of information, not unlike this computer processor.

Processing speed

According to the information **processing theory**, processing speed, or mental quickness, is the key variable that contributes to cognitive development (Burton et al., 2015). This means the older you grow, the more quickly and effectively you can complete a range of cognitive tasks and problems. Our processing time declines exponentially during childhood and adolescence, levelling off around age 15 (Kail, 1991). We are able to complete various complex cognitive tasks quickly due to our enhanced capability in processing information in working memory (Burton et al., 2015). This is where the analogy to the computer-mind does not apply and can be seen as a limitation of the theory. A computer typically has a limited central processor capacity and usually relies on serial processing. Humans have the capacity for extensive parallel processing of information and are also influenced in their cognitions by emotional and motivational factors.

processing speed the time it takes for an individual to mentally perform a cognitive (or mental) task

Cognitive strategies

The information processing theory of cognitive development also recognises that, across our lifespan, we learn new **cognitive strategies** to solve both simple and complex problems. In the early years of life, we typically use rote repetition to remember things. Think of the way you repeat a new acquaintance's name until it's locked in your memory; the idea is that you will be able to quickly recall the information the more you repeat it. However, we become increasingly sophisticated in our application of cognitive strategies throughout childhood; for example, using chunking and categorising strategies to help us remember. We learn what works over time and continually refine our approach by applying successful problem-solving strategies in new environments and gradually evolving new strategies, depending on situational changes (Burton et al., 2015).

cognitive strategy mental strategy that an individual uses to solve both simple and complex cognitive problems

Metacognition

metacognition an understanding and use of the way one thinks when solving problems, reasoning, planning and making decisions

Finally, **metacognition**, or "thinking about thinking", is another key factor that influences our cognitive development. Metacognition involves our personal awareness and understanding of our own thought processes. Metacognition enables us to better understand how and when to use particular strategies for learning or problem-solving. It also involves knowledge of our personal approach to solving cognitive tasks, such as strategies that can be used to help improve memory (Burton et al., 2015).

FIGURE 14 This student is highlighting their notes as a cognitive strategy to help them remember the content.

FIGURE 15 Metacognition is thinking about and understanding our own thought processes.

Check your learning 6.3

Check your learning 6.3: Complete these questions online or in your workbook.

1 **Define** the terms below and **describe** how they apply to Piaget's theory of cognitive development.
   - **a** Object permanence (2 marks)
   - **b** Animism (2 marks)
   - **c** Seriation (2 marks)
   - **d** Centration (2 marks)
   - **e** Egocentrism (2 marks)

2 **Explain** the three themes of Vygotsky's theory of sociocultural cognitive development. (3 marks)

3 **Identify** two examples of the zone of proximal development. (2 marks)

4 **Identify** the key parts of the information processing theory of cognitive development. (3 marks)

Analytical processes

5 **Compare** Piaget's cognitive theory and Vygotsky's sociocultural theory of cognitive development. (2 marks)

6 A teacher is instructing children how to draw a tree. Previously, the children had tried and been unsuccessful. **Apply** Vygotsky's theory to **determine** which theme the children are using. (2 marks)

Knowledge utilisation

7 **Evaluate** Piaget's cognitive theory of cognitive development. (3 marks)

MODULE 6

Lesson 6.4
Review: Emotional and cognitive development

Summary

6.1
- Emotional development allows attachment between an infant and their caregiver/s to occur.
- Infant attachment is crucial for the forming of strong relationships later in life.
- Different theories of attachment come from Lorenz, Harlow, Bowlby and Ainsworth, with Bowlby's theory being the most widely accepted.
- Bowlby's theory states that attachment occurs in the first year of a child's life, that the reactions and behaviours of the caregiver are crucial, and that attachment is a biological function.

6.2
- Early deprivation has a detrimental effect on cognitive development.
- This is supported by Rutter et al.'s 2004 study which showed a negative relationship between length of deprivation and attachment and cognitive development.

6.3
- Piaget's theory of cognitive development centres on the combination of biological process and personal experience.
- Vygotsky's theory of sociocultural cognitive development centres on social experiences within a cultural context.
- The information processing theory of cognitive development centres on the individual as a processor of information.

Review questions 6.4A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 What is emotional development?

A Development of emotions that includes how infants perceive the world through their senses

B Development of psychosocial emotions that are necessary for survival

C Development of emotions, including the point in time when people learn emotions and how they deal with their emotions

D All of the above

2 What is privation?

A Being able to keep all clients' information private and confidential

B A strong, close and emotional bond that develops between infants and their caregivers

C John Bowlby's theory of attachment

D When attachment never occurs and a child never forms a close relationship with anyone

3 **Identify** the correct order of Piaget's stages of cognitive development.

A Sensorimotor, concrete operational, formal operational, preoperational

B Sensorimotor, preoperational, concrete operational, formal operational

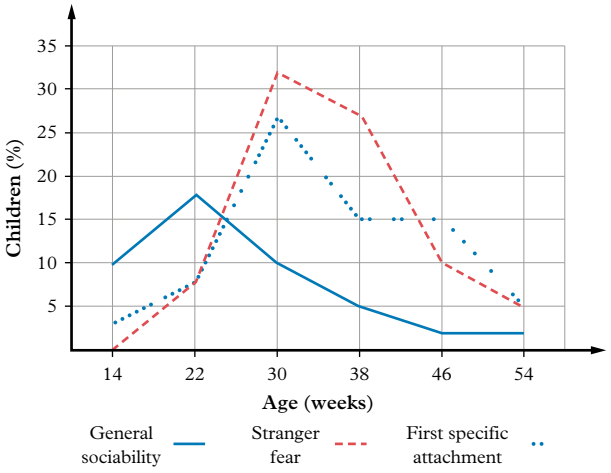
C Concrete operational, formal operational, sensorimotor, preoperational

D Sensorimotor, formal operational, concrete operational, preoperational

4 Tommy knows that if his mother hides his teddy bear, it will come back, but he struggles to think about his older brother's view of the world when they play together. Tommy also really likes to talk to his toys as though they are alive. **Identify** which of Piaget's stages Tommy is in.

A Sensorimotor
B Preoperational
C Concrete operational
D Formal operational

5 What does this graph suggest about developmental changes in attachment to a caregiver?



A More children will experience stranger fear at 8 months than at 3 months.
B Sociability of children will increase with age.
C Children will experience their first specific attachment at 54 weeks.
D Stranger fear decreases as sociability increases.

6 The experiences of Romanian adoptees demonstrated that

A reactive attachment disorder develops when a child's comfort, affection and nurturing needs aren't met.
B children will experience normal attachment regardless of their early experiences.
C deprivation in early years does not influence attachment later in life.
D imprinting is important in developing healthy attachment.

7 Personal awareness and understanding of our own thought processes is known as

A processing speed.
B cognitive strategies.
C scaffolding.
D metacognition.

8 Attachment refers to

A an infant's ability to follow small objects with their eyes.
B the grip an infant will develop on their caregiver.
C the close emotional bond an infant develops with their caregiver.
D the need of a child to always be with their caregiver.

Review questions 6.4B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

9 **Describe** the key processes that are important for understanding Piaget's theory of cognitive development. (4 marks)

10 **Describe** privation using an example. (2 marks)

11 **Identify** a strength and limitation of the sociocultural theory of cognitive development. (2 marks)

12 Although Piaget's work was undeniably important, in recent years, his findings have been criticised and questioned. **Identify** two criticisms of Piaget's work. (2 marks)

13 **Explain** the themes of the zone of proximal development, the more knowledgeable other and scaffolding in Vygotsky's sociocultural theory of cognitive development. (3 marks)

Analytical processes

14 **Categorise** the following behaviours into both the stage and the theory of cognitive development they belong to.

a Kaela can't arrange her building blocks from smallest to biggest. (2 marks)
b David can think about hypothetical situations in the future. (2 marks)

c Mas's dad used to have to help him when he was learning to ride his bike. Recently, Mas rarely gets help from his dad. (2 marks)

15 **Differentiate** between assimilation and accommodation. (1 mark)

16 **Contrast** Vygotsky's and Piaget's theories of cognitive development. (1 mark)

17 **Classify** symbolic play into one of the stages of Piaget's theory of cognitive development. (1 mark)

Knowledge utilisation

18 **Discuss** the sociocultural theory of cognitive development. (3 marks)

19 **Discuss** the information processing model of cognition. Refer to processing speed and cognitive strategies in your answer. (3 marks)

20 Although case studies are often criticised as a research method, some of the most significant theorists in psychology (including Piaget) have used them as a major source of data. **Evaluate** using case studies as opposed to other research methods. (3 marks)

21 The Strange Situation has been replicated many times. In similar cultures, such as Australia, the US, Canada and New Zealand, the results tend to be the same; however, when the Strange Situation is presented in different cultures, such as Japan, the results are noticeably different compared to infants from the UK. Much of this has to do with cultural differences in separation. **Propose** other reasons for cultural variation, and **identify** factors that may influence attachment in Western culture (e.g. day care, crèche, having a nanny). (4 marks)

22 When thinking about cognitive development, Piaget, Vygotsky and the information processing theory each present different ideas. **Discuss** the importance of having different perspectives on cognitive development. (3 marks)

23 **Create** your own example of assimilation and accommodation. After testing conservation on a 5-year-old and a 10-year-old, what differences in responses would you expect to obtain? (3 marks)

Data drill

Attachment and relationship satisfaction

Based on the research of Mary Ainsworth, Dr Frankie wanted to see if childhood attachment and relationship satisfaction corresponded with adult attachment and relationship satisfaction. A longitudinal study was employed, and participants were tested for their relationship satisfaction at 10 years of age, and then at 25 years of age. The same relationship satisfaction scale was used both times, and the test that was used was a standardised test used by psychologists. The results can be seen in Table 1 and Figure 1.

The satisfaction scores are given a value out of 100. A p-value of 0.14 was found using the Pearson correlation coefficient.

10-year-olds

78	54	90	65	44	89	77
58	52	41	56	74	58	

25-year-olds

80	43	98	68	34	85	68
74	86	65	59	65	63	

TABLE 1 Relationship satisfaction scores for the same 10-year-olds and 25-year-olds

	10-year-olds	25-year-olds
Mean score		68.7
Standard deviation	10.7	9.8

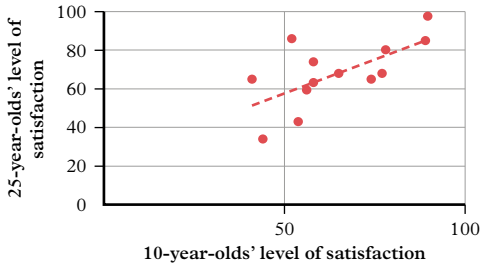


FIGURE 1 Relationship satisfaction scores out of 100 for the same 10-year-olds and 25-year-olds

Apply understanding

1 **Calculate** the mean relationship satisfaction score for 10-year-olds. (1 mark)

Analyse data

2 **Identify** the age group that has the largest variability in its relationship scores. (1 mark)

3 **Identify** the strength and direction of the relationship evident in Figure 1. (1 mark)

Interpret evidence

4 **Draw a conclusion** based on the inferential statistics. (2 marks)

Module 6 checklist: Emotional and cognitive development

Quizlet: Revise key terms online to test your understanding

UNIT 1

Topic 2 review

Multiple choice

(1 mark each)

1 Plasticity of the brain refers to
- **A** the brain's ability to remain stable over time.
- **B** the brain's ability to adapt and change when required.
- **C** the brain's inability to adapt and change when required.
- **D** the brain's ability to set like "plastic" when learning occurs.

2 Changes in the brain that occur as a result of environmental influences such as learning are due to a process called
- **A** myelination.
- **B** sensitive periods.
- **C** functional plasticity.
- **D** developmental plasticity.

3 According to Ainsworth (1978), the three types of infant attachment behaviours are
- **A** avoidant, happy and neutral.
- **B** avoidant, insecure and resistant.
- **C** insecure resistant, insecure detached and avoidant.
- **D** insecure avoidant, secure attached and insecure resistant.

4 A critical period is
- **A** a period in time that is particularly suited to learning things due to the nature of the growing brain.
- **B** a period in life when certain experiences must happen for normal development to proceed.
- **C** an immediate attachment that is formed (to the first moving object seen after birth).
- **D** an environmental agent or toxin that harms the embryo or fetus.

5 Harlow's work with motherless monkeys demonstrated that the infant monkeys
- **A** avoided a substitute mother that dispensed milk.
- **B** preferred a substitute mother that dispensed milk.
- **C** preferred a substitute mother with an artificial heart.
- **D** preferred a comfortable cloth-covered substitute mother.

6 The correct sequence of the stages of cognitive development described in Piaget's theory is
- **A** sensorimotor, concrete operational, preoperational, formal operational.
- **B** sensorimotor, formal operational, concrete operational, preoperational.
- **C** sensorimotor, preoperational, concrete operational, formal operational.
- **D** preoperational, sensorimotor, formal operational, concrete operational.

7 When does neural plasticity of the brain occur?
- **A** Throughout life
- **B** Only in childhood
- **C** As a result of head injury
- **D** Only in response to medication

8 A deprived environment can best be explained as

A an environment that discourages social interaction and provides significant opportunity for brain stimulation.

B an environment that provides inadequate amounts of food and water, and a safe living space.

C an environment with significant opportunities for brain stimulation and limited social interaction.

D an environment that has limited brain stimulation and few opportunities for social interaction.

9 Personal awareness and understanding of our own thought processes is known as

A scaffolding.

B metacognition.

C processing speed.

D cognitive strategies.

10 Learning can be defined as

A an indication of the average age a certain skill or behaviour will be attained.

B a process that is genetically programmed and governs growth.

C a relatively permanent change in behaviour due to experience.

D an automatic process that occurs at an optimal time due to the nature of the growing brain.

11 Which of the following best details characteristics of Piaget's concrete operational stage?

A The child starts to represent the work symbolically.

B The child is capable of performing operations on concrete objects and events.

C The child develops the ideas of object permanence and cause–effect relationship.

D The child gains an understanding of principles such as conservation and logical thought emerges.

12 According to Vygotsky's sociocultural theory of cognitive development, the range between what a child can do alone and what a child can do with help is called

A zone of proximal development.

B cognitive strategies.

C assimilation.

D scaffolding.

13 Which of the following factors plays a role in shaping the form and expression of attachment?

A Cultural models of the individual

B Caregiver beliefs about child rearing

C Caregiver–infant sleeping arrangements

D The physical setting in which the child lives

Short response

14 **Describe** neural plasticity with reference to sensitive and critical periods. (2 marks)

15 **Describe** the processes of myelination and synaptic pruning in relation to brain development during infancy. (2 marks)

16 **Explain** why it is important for human newborns to be exposed to light. (1 mark)

17 **Describe** three potential effects of deprivation on cognitive development in children. (3 marks)

18 Ella and Jane are playing hide and seek. Eight-year-old Ella hides under her bed and is completely hidden. Jane, who is only five, hides behind a short curtain, so her legs can still be seen. **Explain** Ella's and Jane's behaviours with reference to appropriate stages of Piaget's theory of cognitive development. (4 marks)

19 Mei was raised in a deprived environment until the age of 10, when she was found and transferred to a foster family who provided an enriched environment. Using your understanding of neural plasticity, **predict** how adaptive and developmental plasticity may help Mei recover when she is in an enriched environment. (3 marks)

20 The following question refers to Ainsworth et al.'s (1978) study on patterns of attachment. Two-year-old children were asked to respond to the question, "How would you cope if your parents went away?"

Child 1

Interviewer: What will you do?

Child: Chase them.

Interviewer: Chase who?

Child: Dad and Mum with my new toy car … toss a bow and arrow and shoot them.

Child 2

Interviewer: What will you do?

Child: Run away and just play with my toys.

Deduce which type of attachment each child has formed and justify your choice using the information given. (4 marks)

21 **Explain** the three key components of the information processing theory of cognitive development. (3 marks)

22 **Discuss** how the sociocultural theory of cognitive development explains the detrimental effects of early abuse and deprivation on cognitive development. (4 marks)

23 Longitudinal research into the effects of early deprivation and abuse on infants has been carried out by the English and Romanian Adoptees research team (Rutter et al., 2004). This team has studied the impact of this early institutional deprivation on the Romanian orphans'/adoptees' adult brain structure by taking MRI scans of the brain.

a **Predict** what these scans would show about brain structure and cognitive development when compared to similar-aged English adoptees who had not suffered this institutional deprivation. (1 mark)

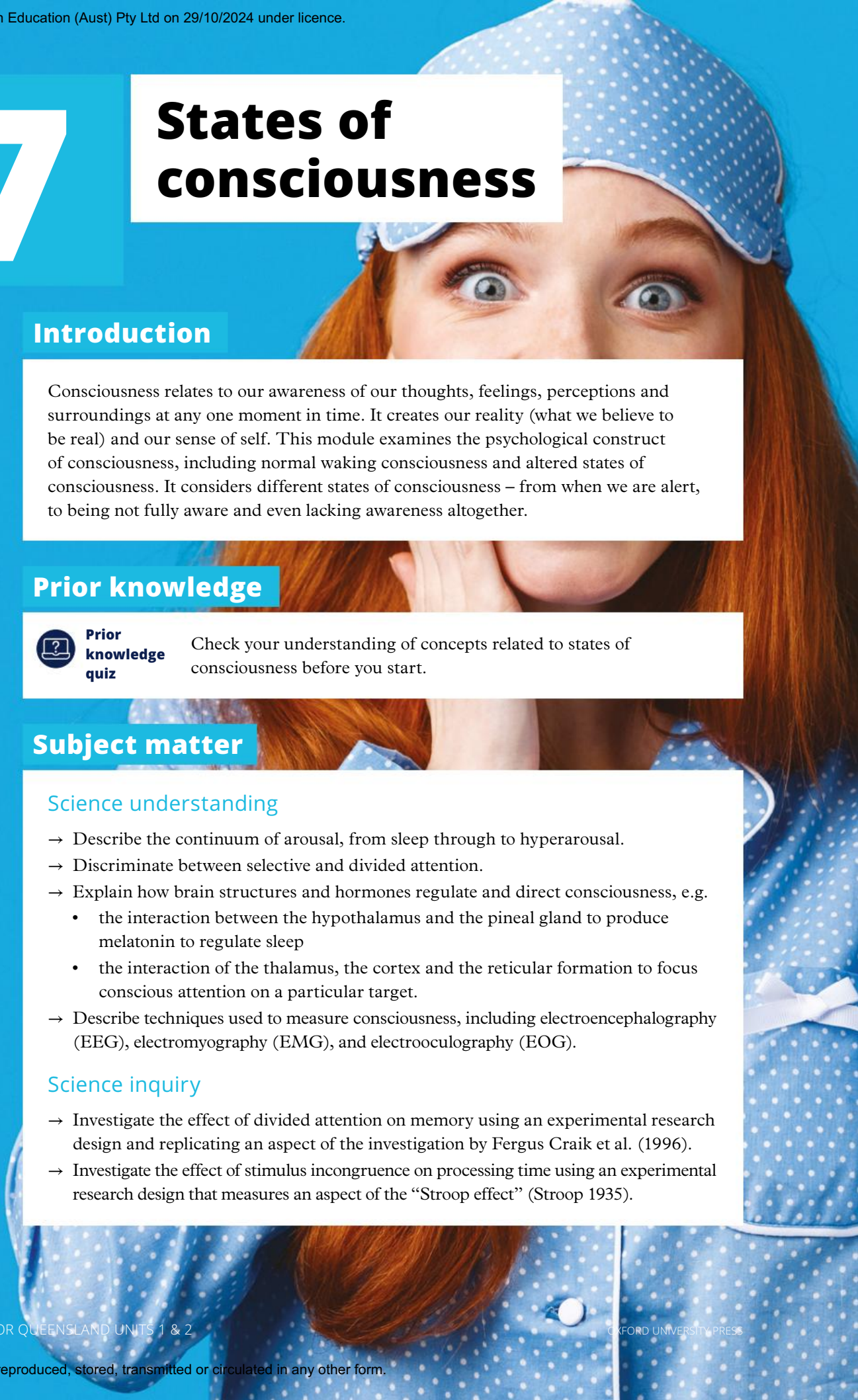
b **Discuss** the role of attachment and deprived environment on the psychological development of the Romanian adoptees. (3 marks)

TOTAL MARKS

/43 marks

MODULE 7

States of consciousness



Introduction

Consciousness relates to our awareness of our thoughts, feelings, perceptions and surroundings at any one moment in time. It creates our reality (what we believe to be real) and our sense of self. This module examines the psychological construct of consciousness, including normal waking consciousness and altered states of consciousness. It considers different states of consciousness – from when we are alert, to being not fully aware and even lacking awareness altogether.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to states of consciousness before you start.

Subject matter

Science understanding

→ Describe the continuum of arousal, from sleep through to hyperarousal.
→ Discriminate between selective and divided attention.
→ Explain how brain structures and hormones regulate and direct consciousness, e.g.
  - the interaction between the hypothalamus and the pineal gland to produce melatonin to regulate sleep
  - the interaction of the thalamus, the cortex and the reticular formation to focus conscious attention on a particular target.
→ Describe techniques used to measure consciousness, including electroencephalography (EEG), electromyography (EMG), and electrooculography (EOG).

Science inquiry

→ Investigate the effect of divided attention on memory using an experimental research design and replicating an aspect of the investigation by Fergus Craik et al. (1996).
→ Investigate the effect of stimulus incongruence on processing time using an experimental research design that measures an aspect of the "Stroop effect" (Stroop 1935).

Science inquiry skills

→ identify and apply ethical principles

→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through

- descriptive statistics

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Key studies

Key study summaries

Read summaries of the key studies for this module.

→ Fergus Craik et al., 1996

→ Stroop, 1935

Practicals

oxforddigital **These lessons are available on Oxford Digital.**

Lesson 7.3 Effect of stimulus incongruence on processing time

Lesson 7.4 Replication of Fergus Craik et al. (1996)

Lesson 7.1
Continuum of arousal

Key ideas

- → Consciousness is the awareness of our own thoughts, feelings and perceptions, and our surroundings, and is influenced by our levels of arousal and awareness.
- → Arousal is how responsive we are to the external environment and operates on a continuum from deep sleep to hyperarousal. It is physiologically controlled by the reticular activating system.
- → Awareness is our ability to perceive and recognise internal and external stimuli and operates on a continuum. It is controlled by the mechanisms and interactions of the brain cortices and influenced by our level of arousal.
- → Broadly, consciousness can be categorised as "normal waking" consciousness or as an "altered state" of consciousness.
- → Normal waking consciousness arises from a combination of moderately high levels of arousal and awareness.
- → Altered states of consciousness are any states that deviate from normal waking consciousness.

Learning intentions and success criteria

Introducing consciousness

Are you in a state of consciousness? If you are reading this, the answer is most definitely yes! You probably already have a good idea about the meaning of the word "conscious" and, indeed, the word "unconscious". In everyday conversation, we tend to use the word "conscious" interchangeably with the word "aware".

For example, how aware are you at this moment? Your answer will be subjective – it depends on what you are experiencing and your thoughts and feelings. It is often difficult to describe to others and for others to completely comprehend.

What is consciousness?

consciousness our awareness of our own thoughts, feelings and perceptions (internal events) and our surroundings (external events) at any given moment

psychological construct hypothetical concept created to explain a phenomenon that is believed to exist or occur, but cannot be directly observed or measured

Consciousness can be defined as the awareness of our own thoughts, feelings and perceptions (internal events) and our surroundings (external stimuli) at any given moment. It creates our reality (what we believe to be real and happening at this moment) and is central to our sense of self. Our sense of self is developed through being aware of what we are doing and why we are doing it, and the awareness that others are probably observing, evaluating and reacting to our expressed thoughts and behaviours. Our own conscious experience is personal and private, and it is difficult to measure accurately or compare with other people's consciousness.

Psychological constructs are used to understand or explain things that we believe exist but cannot see, touch or measure in any way. Consciousness is a psychological construct because it is believed to exist, but we are unable to physically measure it, so descriptions are "constructed" to explain it.

American psychologist William James (1842–1910) studied the conscious experience. He coined the phrase "stream of consciousness" as he viewed consciousness as an ever-changing series of thoughts that can shift smoothly and effortlessly from one moment to the next, just like water flowing in a stream. According to James, our conscious experience is:

- continuous: it is never empty; thoughts are not isolated and can flow easily from one topic to another without interruption
- ever-changing: it rarely travels along one line of thought and constantly changes as we become aware of new information
- a highly personal experience: it relies on our own thoughts, feelings and perceptions
- selective: we can usually choose to focus on some things and ignore others; we can focus on internal events (thoughts, feelings and perceptions) and/or external surroundings
- active: consciousness has a purpose to allow us to function in our world.

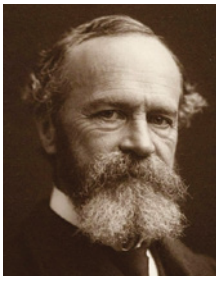


FIGURE 1 American psychologist William James (1842–1910)

Introducing arousal and awareness

Most recently, consciousness has been thought to be influenced by the interaction of two key factors: arousal and awareness.

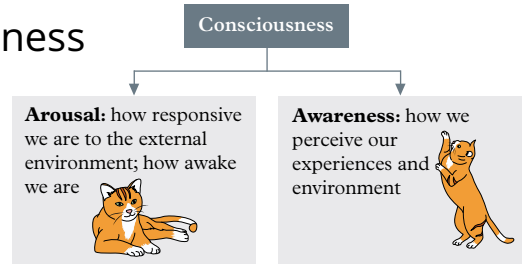


FIGURE 2 Arousal and awareness are components of consciousness.

arousal
how responsive a person is to the external environment; a psychological state of being physically awake and alert

Arousal

Arousal, or wakefulness, is defined as how responsive a person is to their external environment; how awake they are. This is physiologically controlled by the reticular activating system in the brain stem and basal forebrain.

Our levels of arousal fluctuate throughout the day. Sometimes we feel very alert and ready to respond to things, and other times we feel drowsy and less able to respond. Arousal may decrease in an environment that is not stimulating to our senses, and increase in a stimulating environment.

FIGURE 3 Our levels of arousal fluctuate throughout the day.

The continuum of arousal

Arousal can be thought of as operating on a continuum from a low level of arousal, where a person has a decreased ability to respond to stimuli, to a high level of arousal, where a person has a heightened ability to respond to stimuli. The continuum of arousal is shown in Figure 4. The more responsive our body and mind are to stimuli, the higher the level of arousal.

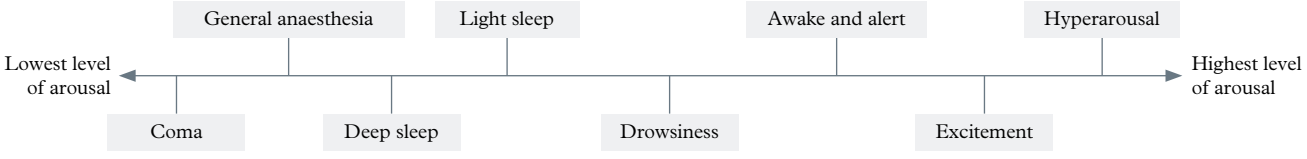


FIGURE 4 The continuum of arousal

FIGURE 5 During periods of low arousal such as sleep, the body's ability to respond to external stimuli is very low.

Low arousal

At the low end of the continuum is deep sleep. During deep sleep, the body's ability to respond to external stimuli is extremely low. Consider how you might respond to someone tapping your shoulder in the middle of the day when you are awake, compared with how you might respond to the same stimuli during a period of sleep. Your body is far less likely to be able to respond during sleep because it is in a state of rest and recovery, rather than a state of responsiveness. While the continuum shown in Figure 5 includes states of arousal lower than deep sleep (general anaesthesia and coma), you only need to remember the continuum from deep sleep through to hyperarousal for the purposes of QCE Psychology.

High arousal

hyperarousal
an altered state of consciousness and heightened (or hyper) arousal

At the high end of the continuum is **hyperarousal**, an abnormal state of increased responsiveness to stimuli. While hyperarousal exceeds the level of arousal found when awake and alert, it does not mean a person is better able to respond to stimuli, rather they are simply more responsive. Hyperarousal may include psychological changes such as increased anxiety and alertness, as well physiological changes such as increased heart rate and respiration.

Other symptoms of hyperarousal include:

- sleeping problems
- difficulty concentrating
- irritability
- a numbed, lethargic or uninterested emotional state
- an uncharacteristic sense of guilt or shame
- emotional outbursts, including anger
- anxiety, and in extreme cases, panic
- nervousness or fearfulness
- self-destructive behaviours.

FIGURE 6 Emotional outbursts are a symptom of hyperarousal.

People with post-traumatic stress disorder (PTSD) may experience these symptoms of hyperarousal. This typically happens when an individual recalls a traumatic episode experienced in the past (commonly referred to as a flashback). The body suddenly heightens its awareness, which often introduces a level of stress that is overwhelming for the individual.

Awareness

awareness
how conscious (aware) we are of internal and/or external event(s); level of awareness can vary in normal waking consciousness

Awareness is the ability to perceive and recognise internal and external stimuli. It is governed by mechanisms and interactions in the brain cortices, which govern our thoughts and feelings about our experiences and environment.

Like arousal, levels of awareness can vary from one extreme to another. A person that is in a hyperaware state is extremely or excessively aware of certain stimuli. A person with complete lack of awareness will not be able to register or recognise stimuli. Our level of awareness of internal events and external surroundings varies throughout the day.

Additionally, our level of awareness is influenced by our level of arousal. For example, a person in a wakeful state of arousal is more likely to be able perceive stimuli in their environment than a person in a state of low arousal such as drowsiness.

Challenge

Continuum of arousal

Study these pictures. Place the pictures in an order along a continuum, from total awareness (highly alert, number 1) to complete lack of awareness (unconscious or in a coma, number 7). Are some easier to place on the continuum than others? Describe your thinking.

FIGURE 7 Various states of arousal (awareness)

Introducing states of consciousness

The combination of our levels of arousal and awareness determine our **state of consciousness**; that is, the extent to which we are aware of internal events and external surroundings and our capacity to respond to them. States of consciousness are viewed as constantly changing on a continuum. Two broad categories exist on this continuum: **normal waking consciousness** and **altered states of consciousness**.

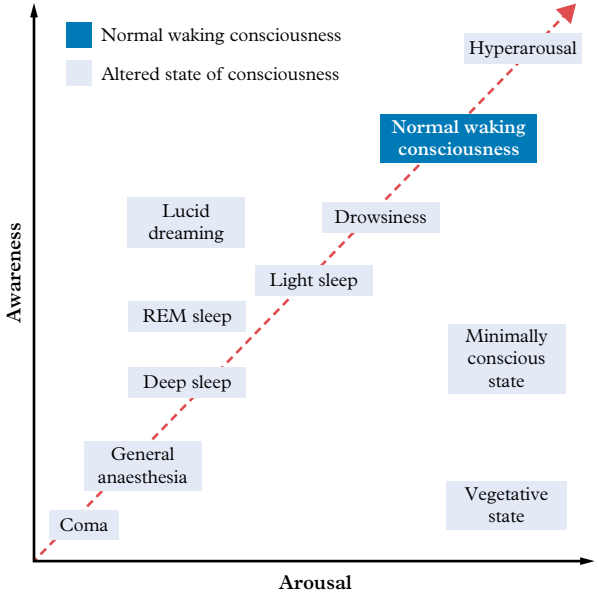


FIGURE 8 States of consciousness exist on a continuum that is determined by levels of arousal and awareness.

Normal waking consciousness

Think about how aware you are of your thoughts and feelings and what is happening around you at the moment. You have a real understanding of where you are, what time it is, what you are thinking, how you are feeling and who you are with. You are experiencing normal waking consciousness – a state that is relatively organised, meaningful and clear.

state of consciousness
an individual's level of awareness of internal events (thoughts, feelings and perceptions) and external surroundings

normal waking consciousness
the state of consciousness we experience when we are awake and aware of our thoughts, feelings and perceptions from internal events and the surrounding environment

altered state of consciousness
a state of consciousness that deviates from normal waking consciousness; can be deliberately induced or occur naturally

FIGURE 9 These children are experiencing normal waking consciousness.

Normal waking consciousness can be loosely defined as the state of consciousness you experience when you are awake and aware of your thoughts, feelings and perceptions from internal events and the surrounding environment. Your experience during normal waking consciousness creates your reality and provides a baseline from which to judge other states of consciousness. Throughout the day, and even throughout a lesson, your level of arousal will vary, which may affect your consciousness. You may focus intently on reading your textbook but later feel a bit drowsy and find yourself distracted and less able to concentrate. These changes are part of normal waking consciousness.

Normal waking consciousness tends to occupy the upper right part of the continuum shown in Figure 8, meaning it is a combination of moderately high levels of arousal and awareness.

FIGURE 10 Being sick with a fever is an example of an altered state of consciousness.

Altered states of consciousness

An altered state of consciousness can be defined as any state of consciousness that deviates from normal waking consciousness, in terms of marked differences in our level of arousal (awareness), perceptions, memories, thinking, emotions, behaviours, and sense of time, place and self-control.

As such, altered states of consciousness can include states produced by the learnt technique of meditation, recreational and illicit drugs (including alcohol), fever, psychosis (a serious condition where the sense of reality is lost), and even daydreaming and sleep. Altered states are often culturally significant and can happen through religious experiences. An altered state of consciousness can be induced deliberately or occur naturally.

Check your learning 7.1

Check your learning 7.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** consciousness. (1 mark)
2 **Explain** why consciousness is considered a psychological construct. (1 mark)
3 **Describe** the continuum of arousal, from sleep to hyperarousal. (1 mark)
4 **Identify** where normal waking consciousness lies on the continuum of arousal. (1 mark)
5 **Identify** the two broad categories of consciousness. (2 marks)
6 **Identify** three factors that might cause an altered state of consciousness. (3 marks)
7 **Identify** where you are more likely to find an altered state of consciousness on the continuum of arousal. (1 mark)

Analytical processes

8 **Distinguish** between normal waking consciousness and altered states of consciousness. (1 mark)
9 **Contrast** arousal and awareness. (1 mark)
10 **Construct** a continuum of arousal from sleep through to hyperarousal. (1 mark)

Lesson 7.2
Attention

Key ideas

- → Attention relates to the internal and external information that we are actively processing, either consciously or unconsciously.
- → Attention can be selective or divided.
- → Selective attention is the process of focusing on one particular thing to the exclusion of irrelevant stimuli. It is applied when we perform controlled processes.
- → When we perform an automatic process, divided attention allows us to perform more than one process at the same time.

Learning intentions and success criteria

Introducing attention

At any given time, an enormous amount of information is available from our senses, memories and other cognitive processes. It is impossible to attend to all this information at once, so we tend to focus on what is most interesting or relevant to us. **Attention** relates to the information that we are actively processing. Your attention can be focused on events that you are aware of in the environment (external) or inside your mind (internal), and attention can shift consciously or unconsciously.

attention information you are actively processing, either consciously or unconsciously

selective attention the ability to focus on only select stimuli or objects in the environment and to filter out other distractions

Attention overlaps with consciousness, as you must first become aware of something or perceive it before you can focus attention on it. For example, when an announcement is played over the school loudspeaker, you may become generally aware that someone is speaking, but to remember what was said in the announcement you would have to divert more focus to it to pay attention. A range of stimuli can attract our attention, including:

- novel stimuli (something new or unusual)
- changes in stimulation (such as the volume of a speaker suddenly increasing)
- something that is personally meaningful to us (such as our name being mentioned across a crowded room) or important for us to attend to at the time.

Attention can be broadly classified into selective attention and divided attention. We will look at these in more detail.

Selective attention

Selective attention refers to the limitations placed on how much we can focus at any given moment on one stimulus or event to the exclusion of others. It describes the process of focusing on a particular object in the environment while ignoring or filtering out other irrelevant stimuli in the environment. Using selective attention, we can focus on what really matters and take no notice of unimportant details.

FIGURE 1 Learning to read requires selective attention.

Divided attention

divided attention the ability to attend to and perform multiple activities at the same time

Divided attention refers to the capacity to attend to and perform two or more activities at the same time. Divided attention allows us to simultaneously process different information from various sources and to successfully complete multiple tasks at a time. Thus, divided attention allows us to multitask by simultaneously allocating attentional resources to multiple tasks or ideas.

FIGURE 2 Once you know how to read, you can do other things at the same time, like walking.

Testing divided attention

In 1975, L. H. Shaffer conducted a well-known experiment that tested divided attention using a process called dichotic listening and found that we cannot fully attend to two different messages delivered simultaneously through two earphones.

Proficient typists performed a test in which they had to type the information being presented via headphones (task 1) in one ear while simultaneously performing a second task (task 2). Task 2 included two different conditions:

- Condition 1: a shadowing task in which unrelated information was presented via headphones to the other ear; the typist had to say aloud the information presented in this ear
- Condition 2: a reading task in which the typist had to read aloud visual information that was presented.

In both cases, the typists' performance on the test was poorer compared to their performance when carrying out the two tasks separately. Shaffer suggested that performance was poorer because of the similarity of the tasks. In the first condition, the material was similar to task 1 in the way it was presented (a listening task) and thus interfered with the ability to receive the auditory information. The second condition interfered with the typists' ability to produce the typed information as both task 1 and the second condition required verbal and writing skills.

FIGURE 3 We are not very good at attending to two different messages delivered simultaneously through two earphones.

Real-world psychology

"Away for the day" policy: No mobiles in class

From the beginning of Term 1 2024, all Queensland state school students must keep their mobile phones switched off and "away for the day" during school hours, and must also turn off notifications on wearable devices. This policy is based on the advice of Cheryl Vardon AO, who completed an independent review of Queensland's approach to mobile phones in schools. She investigated student and teacher concerns about mobile phones causing distractions in the student learning environment. Students reported feeling pressure to respond straight away to notifications, messages and phone calls received during lessons.

> In those high schools with mobile phone restrictions and systems already in place, both school staff and students reported benefits, including:
> - more face-to-face interactions during class time and lunch breaks
> - increase in focus and concentration during learning time
> - increase in the wellbeing and physical activity of students
> - reduction in misuse of mobile phones during school hours.
>
> Department of Education, 2024

There have been numerous studies over the past decade investigating mobile phone use in schools and its effects on several variables such as academic performance. The results of a study by the London School of Economics (LSE, 2015) surveying 91 schools in four English cities found that test scores for students aged 16 increased by 6.4 per cent after mobile phones had been banned. They also found that the bans had different effects on different types of learners, with no significant impact on the test scores of high achievers, but a 14.23 per cent improvement in learning outcomes for low-achieving students. Another study (Ward et al., 2017) found that even when people maintained sustained attention on a task, the mere presence of their smartphones left fewer attentional resources available for engaging in the task at hand.

These are just two of many research studies that have been completed on this issue, but it is important to acknowledge that there is also research that supports the use of mobile phones in schools. One such study examined the relationship between smartphone behaviour and academic performance for fifth and sixth graders in Taiwan. They found that smartphone behaviour and academic performance were correlated. The high-use smartphone group of students academically outperformed the low-use smartphone group.

Queensland's decision to adopt the "away for the day" policy brought the state in line with the other states and territories in Australia. There certainly needs to be ongoing research into this area to ensure that the decision remains the right one for students and schools. Have you found this policy supports your ability to concentrate in class and be less distracted?

FIGURE 4 Mobile phones are banned in Queensland state schools.

Apply your understanding

1 **Identify** a reason used to support the "away for the day" policy. (1 mark)
2 **Describe** how mobile phones can have a negative impact on learning. (1 mark)
3 **Discuss** the banning of mobile phones in secondary schools with reference to the Department of Education policy and the LSE study. (3 marks)

Skill drill

Ethical principles

Science inquiry skill: Considering ethics and safety (Lesson 1.5)

In all psychological research, ethical principles must be adhered to. Keep these in mind as you read the following research scenario.

Calista decided to test whether talking on the phone would affect concentration. She set up an obstacle course and asked participants to drive through it, telling them that she was observing their driving skills. Participants were told to take all belongings with them, including their phones. One minute prior to the drive, Calista called each participant claiming to be a telemarketer and kept them on the phone. She then observed video footage and measured how many driving mistakes each participant made. Two of the participants had major accidents while using their phones, crashing into water drums and becoming scared by the experience. Calista thanked them for their participation and sent them on their way because the research was finished. When Calista published her paper, she used the participants' names; as a result, one of the participants lost their car insurance policy based on the results.

Practise your skills

1 **Identify** if the participants gave informed consent. (1 mark)
2 **Determine** if deception was used and if this was ethical. (2 marks)
3 **Identify** another ethical principle that has been violated. (1 mark)

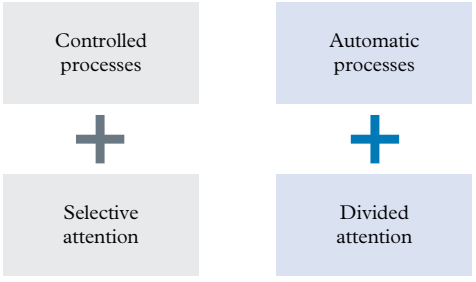


FIGURE 5 Controlled processes are linked with selective attention, and automatic processes are linked with divided attention.

controlled process
a process that requires mental effort to focus attention on the required task

Controlled and automatic processes

A cognitive process is a mental function related to the use of information. It can be controlled, or conscious, such as when we learn to do something new, like driving a car. It can also be automatic, or unconscious, where the process occurs without us being aware of it. Controlled processes are linked with selective attention, and automatic processes are linked with divided attention. We will look at these relationships in more detail.

Controlled processes and selective attention

Controlled processes require selective attention. A person must actively focus attention to successfully complete a task.

Think about someone who is learning how to write text messages; for example, a person with their first mobile phone. The person must concentrate on how to create the message and it requires their full attention. For this person, texting is a complex task as it is yet to be learnt or mastered and requires mental effort. It is an example of a controlled process. This person needs to be consciously aware of what they are doing and concentrate on how to perform the task. They are unable to complete another controlled process at the same time, as both would require their full attention, and therefore would interfere with each other. Selective attention is required.

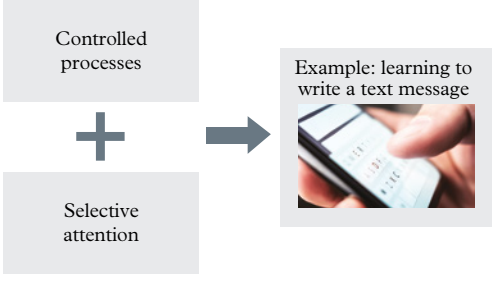


FIGURE 6 The controlled process of learning something new requires selective attention.

Automatic processes and divided attention

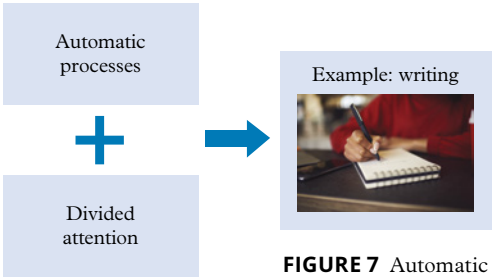


FIGURE 7 Automatic processes allow divided attention.

Automatic processes enable us to have divided attention. If a task requires little mental effort and attention, we can often engage in other tasks at the same time.

Think about when you write. You pay attention to the meaning or spelling of a word rather than the process of forming each letter. The act of writing each letter or word is automatic and occurs with little mental effort or conscious awareness. Automatic processes require very little awareness or mental effort to be performed well and they generally do not interfere with other automatic or controlled processes. In other words, automatic processes require little attention and little thought, and can allow you to do two things at once, or to use divided attention.

automatic process
a process that requires little attention and thought, and can allow you to do two things at once

The relationship between controlled and automatic processes

Over time, controlled processes can become automatic. Studies have found that certain parts of the brain involved in controlled processes become less active as a task becomes more familiar. Learning how to drive is a good example of this.

At first, you can feel awkward and experience difficulties monitoring your hands and feet, especially if you are learning to drive a manual vehicle. At this stage, operating the car requires your full attention because it is a controlled process. You might even find it hard to talk to your instructor or read road signs. As your skills develop, you will find it easier to steer, indicate, check the rear-view mirror and change gears. Eventually, you will find yourself doing these things automatically and will be able to concentrate on the traffic and other driving conditions. The basic skills of driving the car are now automatic processes.

Table 1 summarises the differences between controlled and automatic processes, and their relationship to different types of attention.

TABLE 1 The differences between automatic and controlled processes

Measure	Controlled process	Automatic process
Amount of conscious awareness	Requires full conscious awareness	Requires little, if any, conscious awareness
Attention	Requires selective attention (must actively focus attention on the task)	Requires little attention or mental effort (enables us to have divided attention)
Task difficulty	Usually complex (difficult) or novel (new or yet to be mastered) tasks	Simple (easy) or mastered tasks

Challenge

Mobile phones and driving

Driving a car safely requires your full attention, which is why there are laws in Queensland that restrict the use of mobile phones while driving. In the Sunshine State, driving while using a mobile phone in your hand is illegal – even if you are stopped in traffic. That means you are not allowed to:

- hold the phone to your ear
- write, send or read a text message
- turn your phone on or off
- operate any other function on your phone.

There are additional restrictions on some drivers. Learner and P1 provisional drivers under 25 must not use hands-free, wireless headsets or a mobile phone's loudspeaker function. Passengers in a car driven by learner and P1 provisional drivers are also banned from using a mobile phone's loudspeaker function.

Identify one other law that applies only to inexperienced drivers. **Justify** the use of this law based on your understanding of attention.

Check your learning 7.2

Check your learning 7.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** selective attention. (1 mark)
2 **Describe** divided attention. (1 mark)

Analytical processes

3 **Discriminate** between selective and divided attention. (1 mark)
4 **Determine** if divided or selective attention requires a higher level of awareness. (1 mark)

Knowledge utilisation

5 **Justify** why learner drivers in Queensland under the age of 25 must log at least 100 hours of supervised driving time. Refer to controlled and automatic processes in your response. (4 marks)
6 Prepare a supporting document that justifies the laws on the banning of mobile phones while driving. **Describe** the laws and the reasons for implementing them. **Justify** your argument by referencing the relevant characteristics of normal waking consciousness. (4 marks)

Practical

Lesson 7.3

Practical: Effect of stimulus incongruence on processing time

Learning intentions and success criteria

oxforddigital **This practical lesson is available on Oxford Digital. It is also provided as part of a printable resource that can be used in class.**

Practical

Lesson 7.4

Practical: Replication of Fergus Craik et al. (1996)

Learning intentions and success criteria

oxforddigital **This practical lesson is available on Oxford Digital. It is also provided as part of a printable resource that can be used in class.**

Lesson 7.5
Biological regulation of consciousness

Learning intentions and success criteria

Key ideas

- → Melatonin is a hormone that plays a crucial role in regulating sleep.
- → The suprachiasmatic nucleus (SCN) in the hypothalamus regulates sleep by signalling the pineal gland to release melatonin when environmental light is low (at night). When environmental light is high, the SCN signals the pineal gland to stop the release of melatonin.
- → The thalamus, cortex and reticular formation work together to focus conscious attention.
- → The thalamus focuses attention on important visual and auditory information, and relays this information to the cerebral cortex where it is interpreted. The reticular formation extends into both the thalamus and cortex where it can influence the information that comes to our attention.

Introducing biological regulation of consciousness

In Lesson 7.1 we learnt that consciousness comprises arousal and awareness, and that states of consciousness can broadly be categorised as normal waking and altered state. In Lesson 7.2 we learnt that attention is influenced by awareness, a component of consciousness. But how is consciousness regulated? In this lesson we will look at the biological regulation of consciousness, paying particular attention to the regulation of sleep as a naturally occurring altered state of consciousness and conscious attention.

Biological regulation of sleep

Our bodies are attuned to a **sleep–wake cycle** that revolves around night and day. This regular cycle, an example of a **circadian rhythm**, is determined by an internal body clock, called the **suprachiasmatic nucleus (SCN)**, located in the **hypothalamus** in the brain. Levels of arousal, hormone secretions, metabolism, heart rate and body temperature are largely influenced by this clock. For most people, the circadian cycle peaks (when you are awake and alert) during the day (usually the afternoon), with the lowest point being early in the morning (when you are drowsy and sleepy).

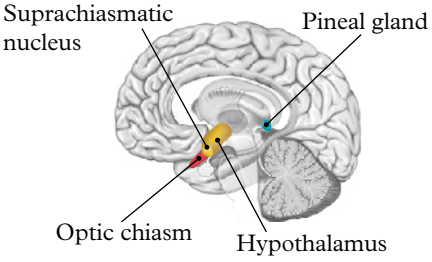


FIGURE 1 The SCN, part of the hypothalamus, interacts with the pineal gland to regulate our sleep–wake cycle.

Hormones

Hormones including cortisol and melatonin are regulated by the SCN in the hypothalamus. **Cortisol** levels are linked with our level of alertness, with higher levels associated with greater alertness. Cortisol is thought to play a role in initiating wakefulness, with levels peaking in the morning, right before we wake up.

The hormone **melatonin** causes sleepiness and is released when it is dark. It is secreted from a small structure in the midbrain called the **pineal gland** when signalled by the SCN. The SCN is located in the hypothalamus above the optic chiasm, where the left and right optic nerves cross paths.

sleep–wake cycle
the biological process of alternating between sleep and wakefulness

circadian rhythm
a biological rhythm that occurs approximately once every 24 hours; for example, the sleep–wake cycle and body temperature

suprachiasmatic nucleus (SCN)
located in the hypothalamus where the left and right optic nerves cross paths, it controls circadian rhythms in response to external stimuli

hypothalamus
structure of the forebrain that plays a major role in controlling emotion and motivated behaviours such as eating, drinking and sexual activity

cortisol
a hormone released by the adrenal glands that is thought to play a role in initiating wakefulness, with levels peaking in the morning right before you wake up

melatonin
a sleep hormone secreted by the pineal gland that causes sleepiness and is released when it is dark

pineal gland
an endocrine gland in the middle of the brain that receives information about the level of light from the environment, and controls the production and secretion of melatonin

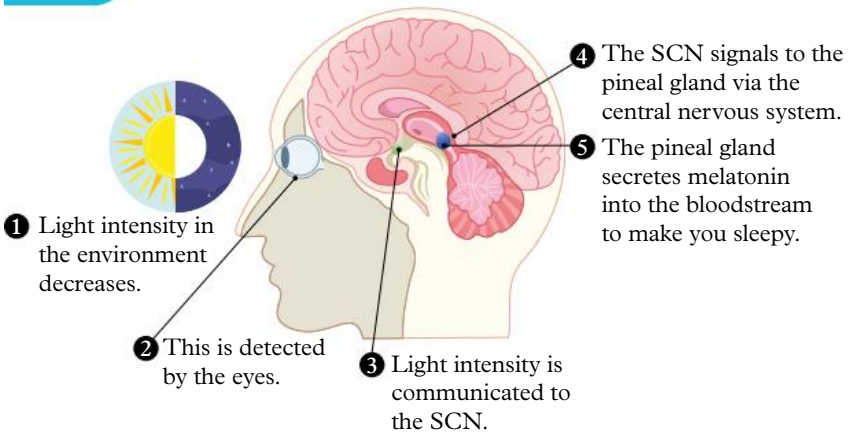


FIGURE 2 In low light, the SCN in the hypothalamus and the pineal gland work together to secrete more melatonin.

The location of the SCN allows it to detect light from the optic nerves quickly. The SCN then sends neural messages about light levels to the pineal gland. When the pineal gland receives a message that light is low, it secretes melatonin, which leads to sleepiness (Figure 2). When the pineal gland receives a message that light is present, it stops the release of melatonin, which leads to wakefulness.

Environmental cues

Our internal body clock does not appear to be synchronised with the clock on the wall. The clock runs a 24-hour cycle, whereas our bodies – in the absence of environmental cues about the time – run close to a 24.2-hour cycle (Czeisler et al., 1999) or even longer (up to 25 hours). This small deviation from the 24-hour clock is significant.

This means that our natural sleep–wake cycle is slightly longer than 24 hours. If we were able to follow this natural cycle, we would be going to bed at noon and awakening at midnight within a couple of months. This explains why it is often easier to fall asleep slightly

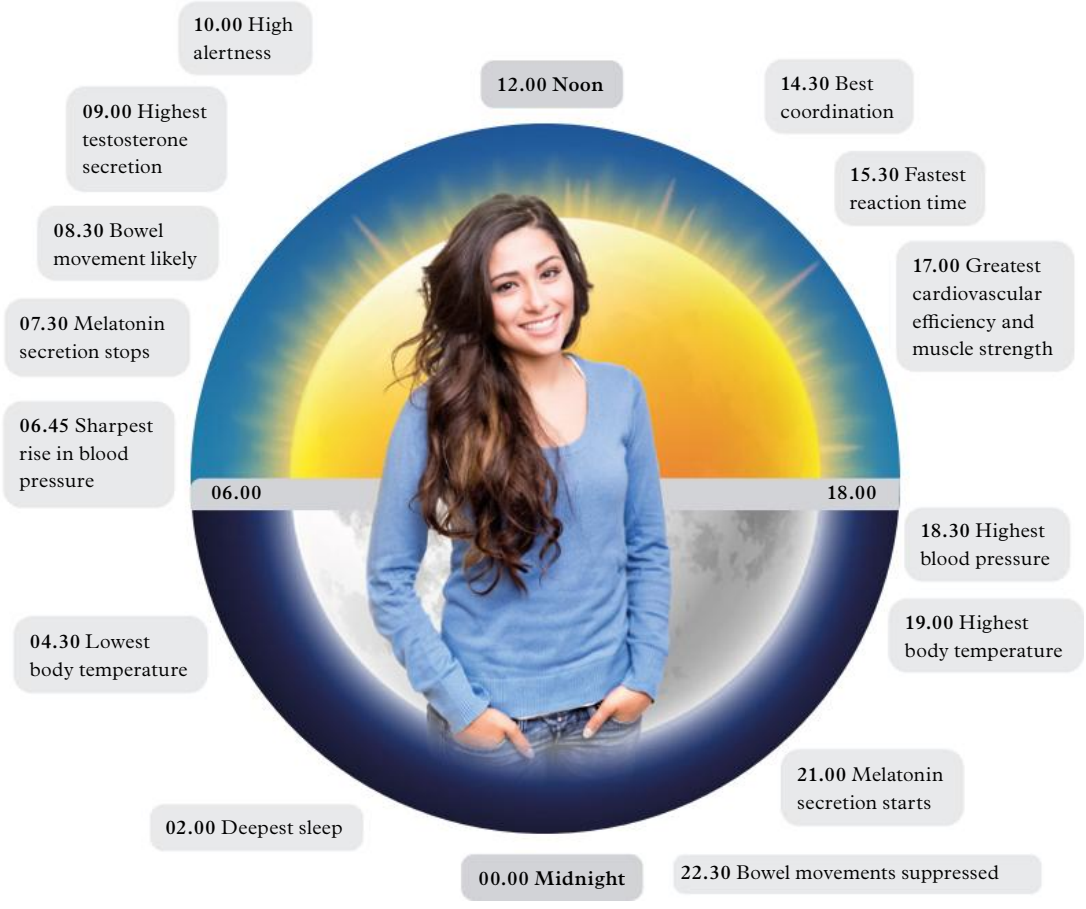


FIGURE 3 Circadian rhythms occur across a period of between 24 and 25 hours.

later than usual rather than earlier than usual at night. It suggests that our sleep–wake cycle is largely endogenous, meaning it is based on internal biological factors. However, external (environmental) cues, such as light and dark, partially influence the sleep–wake cycle. Such cues are known as **zeitgebers**.

zeitgeber
external or environmental cue that affects the sleep–wake cycle, such as the level of light in a room

The zeitgeber sunlight appears to readjust this small mismatch between day and night and our natural sleep–wake cycle. Light sensors in our eyes (and even the backs of our knees!) inform our brain when it is light, which then adjusts our internal body clock accordingly. This means detection of light is the primary external signal for the SCN.

Exposure to light at different times in the day has different effects. Early-morning light can cause a circadian phase shift, leading to waking. Light in the middle of the day does not affect us too much. Light in the evening, however, causes a circadian phase delay by keeping us awake (preventing us from sleeping). You will learn more about circadian phase shifts in Module 9.

Study tip

Data on a zeitgeber could be a variable measured in a correlational study investigating sleep (e.g. amount of time spent reading in bed before sleep).

Challenge

Melatonin's involvement

Melatonin is a hormone that causes sleepiness in humans. It is secreted, when it is dark, by the pineal gland, a small structure in the brain. Thus, we naturally feel sleepy at night. This fact cannot be ignored by shift workers; it is not uncommon for them to experience difficulties working in the early hours of the morning and to have difficulties sleeping well in daylight hours. Light stops melatonin secretion and, therefore, helps prevent sleepiness, or can assist in helping us to feel awake if needed.

Discuss the effects on sleep if melatonin were secreted in the light instead of in the dark. Refer to other mechanisms that would govern sleep–wake cycles.

Biological regulation of conscious attention

Study tip

Using an example in a question response can often make it easier to provide a detailed account of an idea or situation.

We looked at attention in Lesson 7.2. Do you recall that at any given moment, our brain is processing an enormous amount of information from our senses, memories and other cognitive processes? How closely did you pay attention to this information? Do you remember that attention can shift consciously or unconsciously? Selective attention is a cognitive process enabling preferential routing of behaviourally relevant information through the brain. The interaction of the thalamus, cortex and reticular formation play key roles in focusing our attention on a particular target. For example, when you hear your name called out to receive the football in a game, your attention is gained and focused on receiving the ball (particular target).

The role of the thalamus

The thalamus (a subcortical structure located in the forebrain) plays an important role in the selective attention of visual and auditory information (Lesson 3.1). It is involved in focusing a spotlight on the important information and inhibiting the unnecessary background information. The thalamus acts as the body's relay station, processing information from all senses (except smell) before relaying this information to the cerebral cortex for interpretation. The thalamus also plays a role in regulating arousal and alertness.

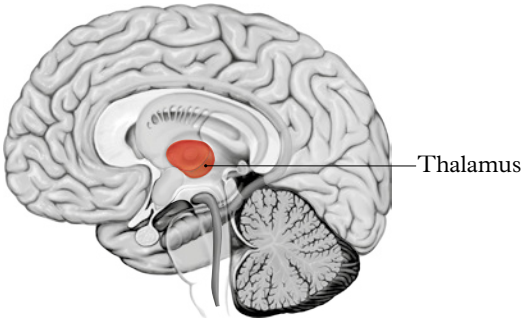


FIGURE 4 The thalamus is part of the forebrain.

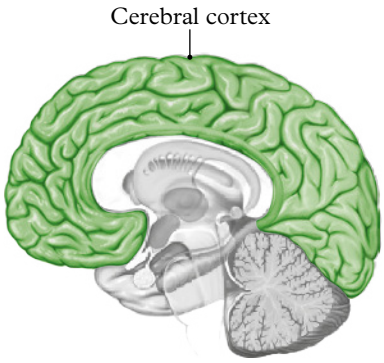


FIGURE 5 The cerebral cortex is the outer layer of the cerebrum.

The role of the cerebral cortex

The outermost layer of the cerebrum is the cerebral cortex, which contains a network of billions of neurons. The cortex allows us to undertake a range of tasks, from the simple to the complex. For example, the prefrontal cortex of the frontal lobe plays a key role in control of cognitive processes and the ability to switch attentional control based on a task's demands. The parietal cortex can be divided into the somatosensory cortex and post-parietal cortex; the post-parietal cortex is also involved in selective attention. These two primary cortices will be "active" together with other cortical areas, allowing us to perceive our surroundings and make sense of our experiences, as well as the thalamus and reticular formation to regulate our conscious attention.

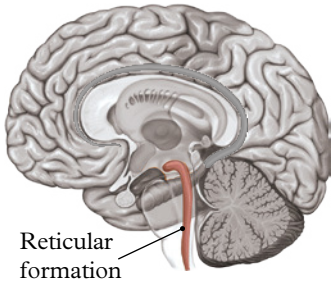


FIGURE 6 The reticular formation is part of the brain stem.

The role of the reticular formation

The reticular formation has projections into the thalamus and cerebral cortex, exerting some control over which sensory information reaches the cerebrum and comes to our attention. Have you ever learnt a new word, and then started seeing and hearing the word everywhere? This is thanks to the reticular formation (which has lots of roles, just like other brain areas) "tuning" our attention to the word. This structure of interconnected nuclei and neurons is in the brain stem, extending from the lower part of the medulla in the hindbrain to the upper part of the midbrain.

The reticular formation plays a central role in regulating attention, consciousness and wakefulness. It determines the importance, or saliency, of sensory information received by the thalamus. The prefrontal cortex then uses this saliency information to maintain or shift our attention. By modulating the interactions between the thalamus and cortex, the reticular formation influences which sensory signals reach conscious awareness. During alertness, the reticular formation enhances cortical activity, allowing us to focus on specific stimuli. During sleep, the reticular formation reduces cortical activity, leading to reduced awareness.

The reticular formation influences not only conscious attention, but also our circadian rhythms, cardiovascular and respiratory control, and coordination of somatic motor movements.

Check your learning 7.5

Check your learning 7.5: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the roles of cortisol and melatonin in sleep regulation. (2 marks)
2 **Recall** two brain structures involved in sleep regulation. (2 marks)
3 **Identify** three brain structures that interact in regulating conscious attention. (3 marks)
4 **Describe** the role of the thalamus in regulating conscious attention. (1 mark)
5 **Explain** how sleep is regulated. (3 marks)
6 **Explain** the role of different brain structures focusing conscious attention on a particular target. (3 marks)
7 **Explain** the interaction of the thalamus, the cortex and the reticular formation to focus conscious attention while driving a car in traffic. (4 marks)

Lesson 7.6
Measuring consciousness

Key ideas

- → Physiological measurements of consciousness include electroencephalography (EEG), electrooculography (EOG) and electromyography (EMG).
- → EEG measures brainwave activity during sleep, and the patterns of the waves can help determine the stage of sleep a person is in.
- → EOG measures the movement of muscles around the eyes during sleep and can help determine whether a person is in rapid eye movement (REM) (dreaming) or non-rapid eye movement (NREM) (non-dreaming) sleep.
- → EMG measures the movement and tension of other muscles in the body, which helps us determine when a person is in REM sleep.

Learning intentions and success criteria

Introducing the measurement of consciousness

Consciousness is a subjective and private experience and is ever-changing (dynamic), self-reflective and central to our sense of self. But how do psychologists study consciousness? The methods used can include (but are not limited to):

- measurement of physiological responses, such as electroencephalography (EEG), electrooculography (EOG) and electromyography (EMG)
- behavioural and cognitive measures, such as measurement of speed and accuracy on cognitive tasks and video monitoring
- self-report (subjective) measures, such as sleep diaries.

In this lesson, we will consider measurement of physiological responses.

FIGURE 1 As our state of consciousness or alertness level changes, so do our brainwave patterns.

Measurement of physiological responses

Measurable changes in physiological responses are probably the most reliable and least subjective means of indicating different states of consciousness during sleep and wakefulness. Typically, the data is consistent and stable, and it can be recorded and usually interpreted consistently between researchers and on different occasions.

Many **physiological measures** provide psychologists with information about how bodily functions change during normal waking consciousness and altered states of consciousness. Such bodily functions include brainwave patterns (caused by changes in the electrical activity of the brain), eye-muscle movement, body-muscle movement, heart rate, body temperature, electrical conductivity of the skin (called galvanic skin response and which measures sweat gland activity, which can be a measure of emotional arousal), respiration rate and blood pressure.

physiological measures the observation of a measurable bodily (physical or physiological) response (such as heart rate, brainwave activity and galvanic skin response)

Limitations of physiological measures

There are limitations associated with using physiological measures alone to measure consciousness. First, they are limited in their ability to identify the participant's private

and personal conscious experience. Remember: consciousness is our awareness of internal and external stimuli and our thoughts and feelings about them. Researchers may be able to observe physiological changes, but they won't really know about the experience unless they ask the participants! Second, changes in physiological events may be due to other reasons, such as the person having a fever.

Introducing techniques for measuring physiological responses

The three main techniques used for measuring physiological responses to measure consciousness are electroencephalography, electrooculography and electromyography.

Electroencephalography

electro-encephalography (EEG)
a technique used to detect, amplify and record electrical activity in the brain in the form of brainwaves

Electroencephalography (EEG) is a technique that detects, amplifies and records electrical activity in the brain in the form of brainwaves. It does this by monitoring the electrical activity of the brain that is detectable on the outside of the skull. Many tiny electrodes are placed on the skull with individual patches or using a headcap (Figure 2). The electrodes are placed so that they can measure activity in different lobes of the brain, and they measure the very small voltages created by the synchronised activity of large numbers of neurons in the cerebral cortex.

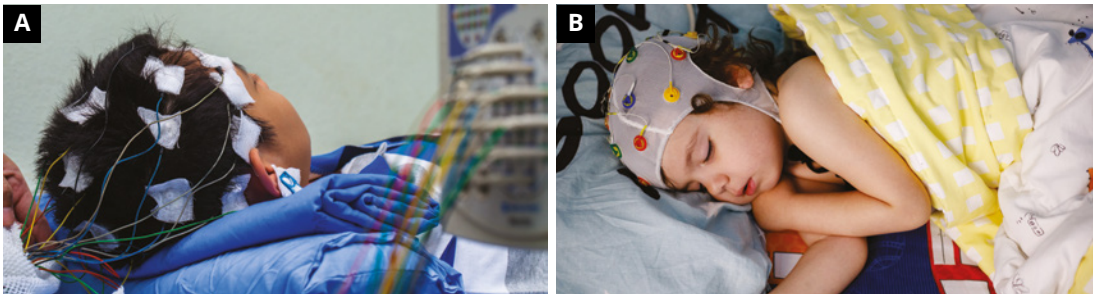


FIGURE 2 Electroencephalography is conducted by using (A) individual electrode patches or (B) a headcap.

EEG recordings indicate changes in brainwave activity associated with changes to states of consciousness, such as when a person is drowsy or alert, falls asleep, or in various stages of sleep, including the stage in which we are most likely to experience dreaming (REM stage).

Brainwave patterns

frequency
the number of brainwaves per second

amplitude
in terms of brainwaves, the height of the peaks and troughs of the curved graph that represents brainwave activity

Brainwave patterns may vary in **frequency** (the number of brainwaves per second). High-frequency brainwave patterns indicate faster brainwaves as demonstrated by more waves per unit of time (usually seconds). Frequency is measured in hertz (Hz: vibrations per second). Brainwaves may also vary in **amplitude** (the height of the peaks and troughs of the curved graph that represents brainwave activity). Amplitude is measured in microvolts (μV). Figure 3 shows these characteristics of brainwaves.

When we are awake and alert, we exhibit fast (high-frequency) and small (low-amplitude)

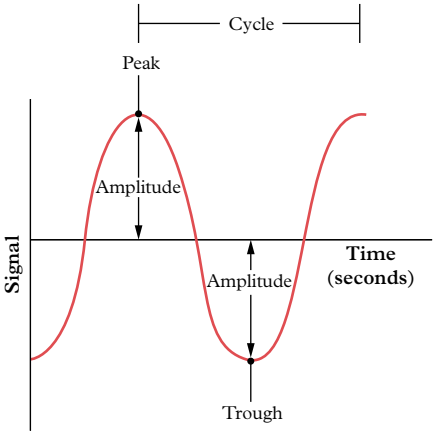


FIGURE 3 Characteristics of brainwaves obtained from electroencephalography

brainwaves, known as **beta waves**. When we are awake but relaxed, we tend to exhibit **alpha waves**.

Brainwave patterns during sleep vary according to the phase and stage of sleep we are in: one of the three stages of non-dreaming sleep, called **non-rapid eye movement (NREM) sleep**, and dreaming sleep, called **rapid eye movement (REM) sleep**. (You will learn more about the stages of sleep in Module 8.)

In deep NREM sleep, we exhibit slow (low-frequency) and big (high-amplitude) brainwaves, known as **delta waves**. During stage 2 of NREM sleep we experience medium-frequency **theta waves**. Figure 4 shows different brainwaves associated with different levels of consciousness, and Table 1 summarises brainwave patterns associated with different levels of consciousness.

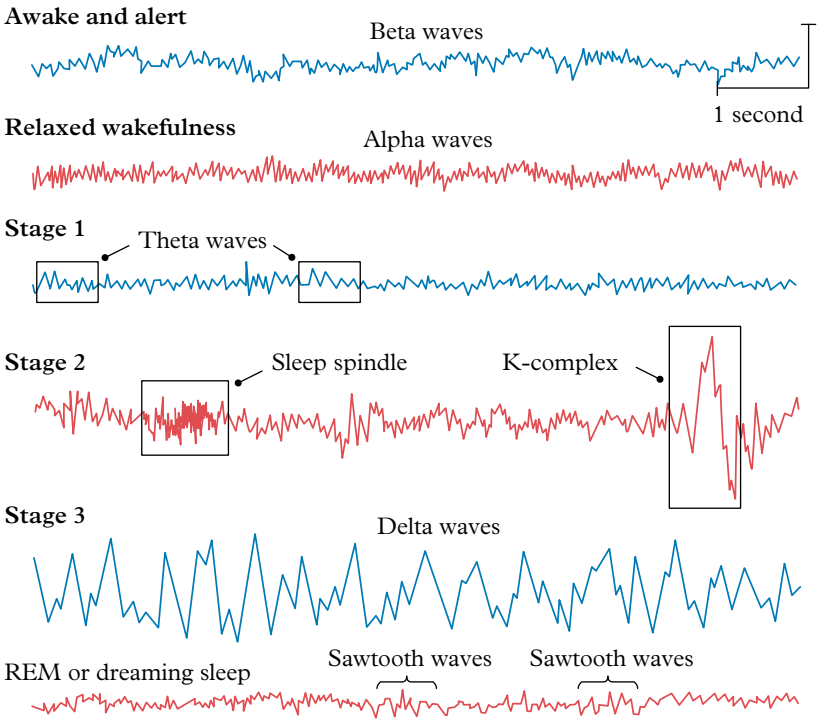


FIGURE 4 Different brainwave patterns are associated with different stages of consciousness.

TABLE 1 Levels of consciousness and associated brainwave patterns

Level of consciousness	Dominant brainwave pattern	Degree of brainwave activity
Hyper-alert	Gamma and beta waves	Very high
Awake and alert	Beta waves	High
Awake and drowsy	Alpha waves	Medium–high
The flow state (being in "the zone" – ideal for optimal performance and creative insight; work seems effortless)	Alpha-theta (borderline) waves Some gamma waves	Medium–high
REM sleep (typically dreaming)	Beta-like waves	High
Stages 1 and 2 NREM sleep	Theta waves	Medium (less than in waking and REM sleep)
Stage 3 NREM sleep (deep sleep)	Delta waves	Low
General anaesthesia	Gamma waves	Reduced
Vegetative state (coma)	Alpha waves	Very reduced

beta wave
typical brainwave pattern – high frequency (fast) and low amplitude (small) – during normal waking consciousness, associated with being alert, active, anxious and paying (selective) attention

alpha wave
typical brainwave pattern (reasonably high frequency, but not as high as beta waves; low amplitude, but slightly higher than beta waves) that occurs when awake but very relaxed

non-rapid eye movement (NREM) sleep
one of two phases of sleep, characterised by little or no rapid eye movement, and often divided into three stages of NREM sleep that are determined mainly by predominant brainwave patterns

rapid eye movement (REM) sleep
one of two phases of sleep, characterised by rapid eye movement

delta waves
typical brainwave pattern – a steady pattern of low frequency (slow) and high amplitude (large) – associated with NREM deep sleep

theta waves
typical brainwave pattern (medium frequency and mixed amplitude) during the early stages of sleep

Electrooculography (EOG)

electrooculography (EOG) a technique that detects, amplifies and records electrical activity in the muscles that allow the eye to move

Electrooculography (EOG) is a technique that detects, amplifies and records electrical activity in the muscles that allow the eye to move. It measures changes in voltage as the eyes move and rotate in their sockets. Electrodes are attached to areas on the face around the eyes and the recording procedure is similar to that used for the EEG. EOG is particularly useful to determine whether a person is in REM or NREM sleep. When muscles around the eyes move a lot, we can infer that a person is in REM (rapid eye movement) sleep.

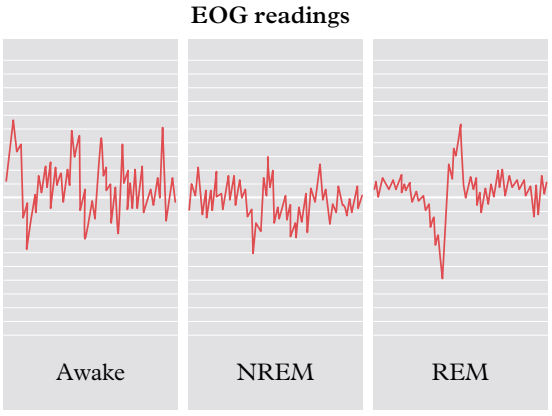


FIGURE 5 EOG recordings for someone who is awake and asleep (REM and NREM sleep)

Study tip

You are not required to know the types of brainwaves associated with each stage of the sleep–wake cycle; however, knowing about them supports your understanding of the EEG technique, which you need to describe.

Electromyography

electromyography (EMG) a technique that detects, amplifies and records the electrical activity of muscles

Another technique commonly used to measure the stages of sleep is **electromyography (EMG)**. The electromyograph is a device that detects, amplifies and records the electrical activity of muscles. Electrodes are attached to the skin directly above the muscles (usually the ones located under the chin, or in the legs and torso) and the recording procedure is similar to that of an EEG and EOG. The EMG can be useful to determine whether a person is awake or asleep and, if asleep, whether they are in REM or NREM sleep. A person in REM sleep is virtually paralysed, so when little muscle movement is recorded, we can infer that the person is in REM sleep.

When someone is awake, activity on the EMG recordings varies between moderate and high, depending on the activity at the time. During NREM sleep, the activity is moderate to low (with some mild spasms or "hypnic jerks" associated with light sleep), and during REM sleep it is virtually non-existent.

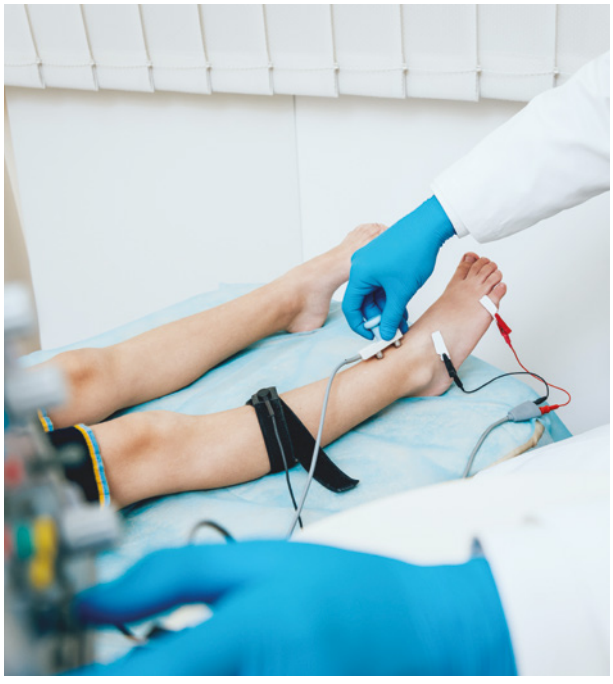


FIGURE 6 EMG probes being attached to the leg

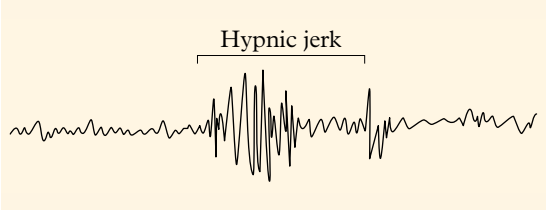


FIGURE 7 An EMG recording can capture mild spasms or hypnic jerks that occur during NREM sleep.

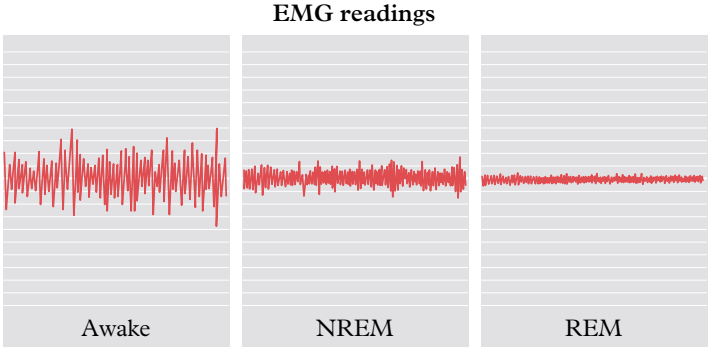


FIGURE 8 EMG recordings for someone who is awake and asleep (REM and NREM sleep)

Polysomnograms

Data can be collected simultaneously from the EEG, EOG, EMG and other devices, and displayed on a continuously moving chart, known as a **polysomnogram**. This allows a researcher to compare corresponding data at once and make more informed decisions about a person's state of consciousness and any underlying problems.

polysomnogram a continuously moving chart that displays data collected simultaneously from EEG, EOG, EMG and other devices

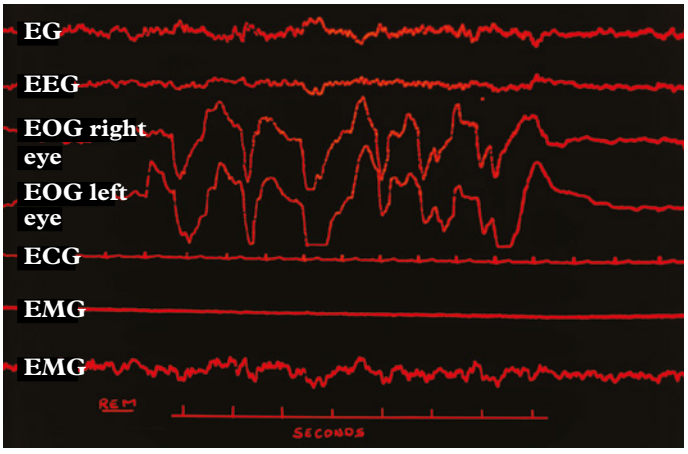


FIGURE 9 This polysomnogram clearly shows when the subject entered REM sleep; we see high-amplitude EOG data.

Summary

Table 2 summarises the results of EEG, EOG and EMG recordings for normal waking consciousness and sleep.

TABLE 2 Physiological measurements used to research states of consciousness

Physiological measurement	What is measured	Normal waking consciousness: alert	Normal waking consciousness: drowsy (relaxed)	Non-rapid eye movement (NREM) sleep	Rapid eye movement (REM) sleep
Electroencephalography (EEG)	Detects, amplifies and records electrical activity in the brain in the form of brainwaves	Beta waves	Alpha waves	Alpha, theta and delta waves, sleep spindles and K-complexes, depending on the stage of NREM sleep	Similar to being awake, including random and fast sawtooth waves
Electrooculography (EOG)	Detects, amplifies and records electrical activity in the muscles that allow the eye to move	Depends on the activity, rapid if involves eye movement	Little	None or very little	Bursts of rapid movement
Electromyography (EMG)	Detects, amplifies and records the electrical activity of muscles	Moderate and high depending on the activity at the time	Moderate	Moderate to low	Virtually non-existent

Check your learning 7.6

Check your learning 7.6: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** two limitations of physiological measurements of consciousness. (2 marks)

2 **Describe** the process of electroencephalography (EEG). (1 mark)

3 **Explain** the difference between electromyography (EMG) and electrooculography (EOG). (1 mark)

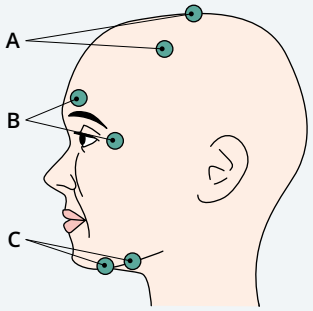
4 Look carefully at the illustration of a participant wired up to EEG, EOG and EMG devices. **Identify** which electrodes (A, B or C) are collecting data for each device. (3 marks)

Analytical processes

5 **Discriminate** between brainwave activity during normal waking consciousness and stage 3 NREM sleep (deep sleep). (1 mark)

Knowledge utilisation

6 **Discuss** the benefits of using more than one physiological technique to measure consciousness. (3 marks)



MODULE 7

Lesson 7.7
Review: States of consciousness

Summary

7.1
- Consciousness is the awareness of our own thoughts, feelings and perceptions, and our surroundings, and is influenced by our levels of arousal and awareness.
- Arousal is how responsive we are to the external environment and operates on a continuum from deep sleep to hyperarousal. It is physiologically controlled by the reticular activating system.
- Awareness is our ability to perceive and recognise internal and external stimuli and operates on a continuum. It is controlled by the mechanisms and interactions of the brain cortices and influenced by our level of arousal.
- Broadly, consciousness can be categorised as "normal waking" consciousness or as an "altered state" of consciousness.
- Normal waking consciousness arises from a combination of moderately high levels of arousal and awareness.
- Altered states of consciousness are any states that deviate from normal waking consciousness.

7.2
- Attention relates to the internal and external information that we are actively processing, either consciously or unconsciously.
- Attention can be selective or divided.
- Selective attention is the process of focusing on one particular thing to the exclusion of irrelevant stimuli. It is applied when we perform controlled processes.
- When we perform an automatic process or processes, divided attention allows us to perform more than one process at the same time.

7.3
- Practical: Effect of stimulus incongruence on processing time

7.4
- Practical: Replication of Fergus Craik et al. (1996)

7.5
- Melatonin is a hormone that plays a crucial role in regulating sleep.
- The suprachiasmatic nucleus (SCN) in the hypothalamus regulates sleep by signalling the pineal gland to release melatonin when environmental light is low (at night). When environmental light is high, the SCN signals the pineal gland to stop the release of melatonin.
- The thalamus, cortex and reticular formation work together to focus conscious attention.
- The thalamus focuses attention on important visual and auditory information, and relays this information to the cerebral cortex where it is interpreted. The reticular formation extends into both the thalamus and cortex where it can influence the information that comes to our attention.

7.6
- Physiological measurements of consciousness include electroencephalography (EEG), electrooculography (EOG) and electromyography (EMG).
- EEG measures brainwave activity during sleep and the patterns of the waves can help determine the stage of sleep that a person is in.
- EOG measures the movement of muscles around the eyes during sleep and can help determine whether a person is in rapid eye movement (REM) (dreaming) or non-rapid eye movement (NREM) (non-dreaming) sleep.
- EMG measures the movement and tension of other muscles in the body, which helps us determine when a person is in REM sleep.

Key studies

Fergus Craik et al., 1996

Stroop, 1935

Review questions 7.7A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 Johannes is sitting in class, trying to listen to what the teacher is saying, but he is also aware that he is feeling warm in the sunshine, he is looking forward to a game of tennis after school, the new girl in the row in front of him has sparkling highlights in her hair, and the chair he's been sitting in for the double lesson has a hard seat! What is Johannes most likely experiencing?

A Normal waking consciousness

B An altered state of consciousness showing reduced awareness

C An altered state of consciousness showing heightened awareness

D Distortions of cognition and perception

2 Which of the following scenarios displays the highest level of awareness?

A Emma is bored in class and puts her head down on the desk to fall asleep.

B Justin is watching his favourite show on TV while eating chips.

C Cadence is about to jump out of a plane to go tandem skydiving.

D Will is reading a book while he is on the train.

3 Which of the following is a true statement?

A Controlled processes require no attention.

B Automatic processes require little attention.

C Controlled processes require little attention.

D Both controlled and automatic processes require full attention.

4 When Erwin was first learning to play the guitar, he found it impossible to change chords and sing at the same time. Now that he has been in a rock band for two years, he finds it easy to play, sing and even perform complex sequences of steps on stage. What is the explanation for this?

A An automatic process has become a controlled process, requiring little attention.

B A controlled process has become an automatic process, requiring full attention.

C An automatic process has become a controlled process, requiring full attention.

D A controlled process has become an automatic process, requiring little attention.

5 Miranda has been driving a manual car for several years; Hugo has just passed his test for his P-plates. When Victor is a passenger in their cars, he finds that he can have a sensible conversation with Miranda, but Hugo does not seem to pay any attention to him. Which of the following is the most likely explanation for this?

A For Miranda, driving is a controlled process enabling divided attention.

B For Miranda, driving is a controlled process requiring selective attention.

C For Hugo, driving is a controlled process enabling divided attention.

D For Hugo, driving is a controlled process requiring selective attention.

6 Hormones influence human circadian rhythms. Which of the following hormones cause sleepiness when released in the dark?

A Adrenalin

B Cortisol

C Insulin

D Melatonin

7 What is the technique that detects, amplifies and records electrical activity in the brain to measure consciousness?

A Electroencephalography

B Electrooculography

C Electromyography

D Galvanic skin response

8 Wendy can sing along to music on the radio while driving her car and efficiently navigate to her friend's house at the same time. Which feature of consciousness is best described by this scenario?

A Concentration

B Divided attention

C Selective attention

D Controlled processing

9 Which of the following brainwave patterns is indicative of being alert and awake?
- **A** Beta waves
- **B** Alpha waves
- **C** Theta waves
- **D** Delta waves

10 The most appropriate measurement for REM sleep is
- **A** EMG.
- **B** EOG.
- **C** EEG.
- **D** all of the above.

Review questions 7.7B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

11 **Describe** consciousness. (1 mark)

12 **Describe** the key difference between normal waking consciousness and altered states of consciousness. (1 mark)

13 **Describe** how an EEG can indicate whether a person is awake or has just fallen asleep. (1 mark)

14 **Describe** the continuum of arousal. (1 mark)

15 **Identify** where sleep is situated on the continuum of arousal. (1 mark)

16 **Explain** the interaction between the hypothalamus and pineal gland to produce melatonin. (1 mark)

17 **Explain** how the hormone melatonin regulates consciousness. (1 mark)

18 **Explain** how the thalamus, cortex and reticular formation focus conscious attention on a particular target. (3 marks)

19 **Explain** what is meant by "attention", using an example from everyday life. (2 marks)

20 **Describe** what an EOG measures and how it is used by sleep researchers. (2 marks)

21 **Describe** a polysomnogram and **explain** why it is useful for sleep researchers. (2 marks)

Analytical processes

22 **Differentiate** between selective and divided attention. (1 mark)

23 Jing's mother often jokes that Jing selectively ignores her. **Determine** whether Jing is actually ignoring her mother, or whether selective or divided attention is involved. (2 marks)

Knowledge utilisation

24 **Discuss** whether it is possible to experience more than one state of consciousness at a time. (2 marks)

Data drill

Time perception in different states of consciousness

The following results are from research that investigated the perception of time in normal waking consciousness and altered states of consciousness. The study involved a repeated measures investigation with a sample of Year 11 students. An inferential statistic was calculated and a *p*-value of 0.004 was found.

TABLE 1 Results of perceived time spent in focused attention and daydreaming

Focused attention (minutes)	Daydreaming (minutes)
4.5	3.0
5.5	2.0
3.8	4.0
5.0	2.6
4.2	3.5
5.0	3.0
4.8	2.5
6.0	3.2
4.0	4.0
Mean = 4.76	Mean =
SD = 0.71	SD = 0.67

Apply understanding

1 **Calculate** the mean perceived time for daydreaming. (1 mark)

2 **Identify** the sample size. (1 mark)

Analyse data

3 **Identify** the condition that had the greatest uncertainty. (1 mark)

Interpret evidence

4 **Infer** what the results of the statistical test show. (2 marks)

Module 7 checklist: States of consciousness

Quizlet: Revise key terms online to test your understanding

MODULE 8

Sleep

Introduction

Sleep is simply irresistible. We all need it and, even when we try to stay awake, sleep eventually takes over. Sleep is an example of an altered state of consciousness. During sleep, we are almost – but not totally – unaware of our environment. Much happens to our mind and body when we drift off to sleep. This module considers why we sleep and looks at the various different states we are in when asleep, states known as the stages of sleep. We will also explore how our sleep changes over our lifetime and delve into what happens to us when we don't get enough sleep.

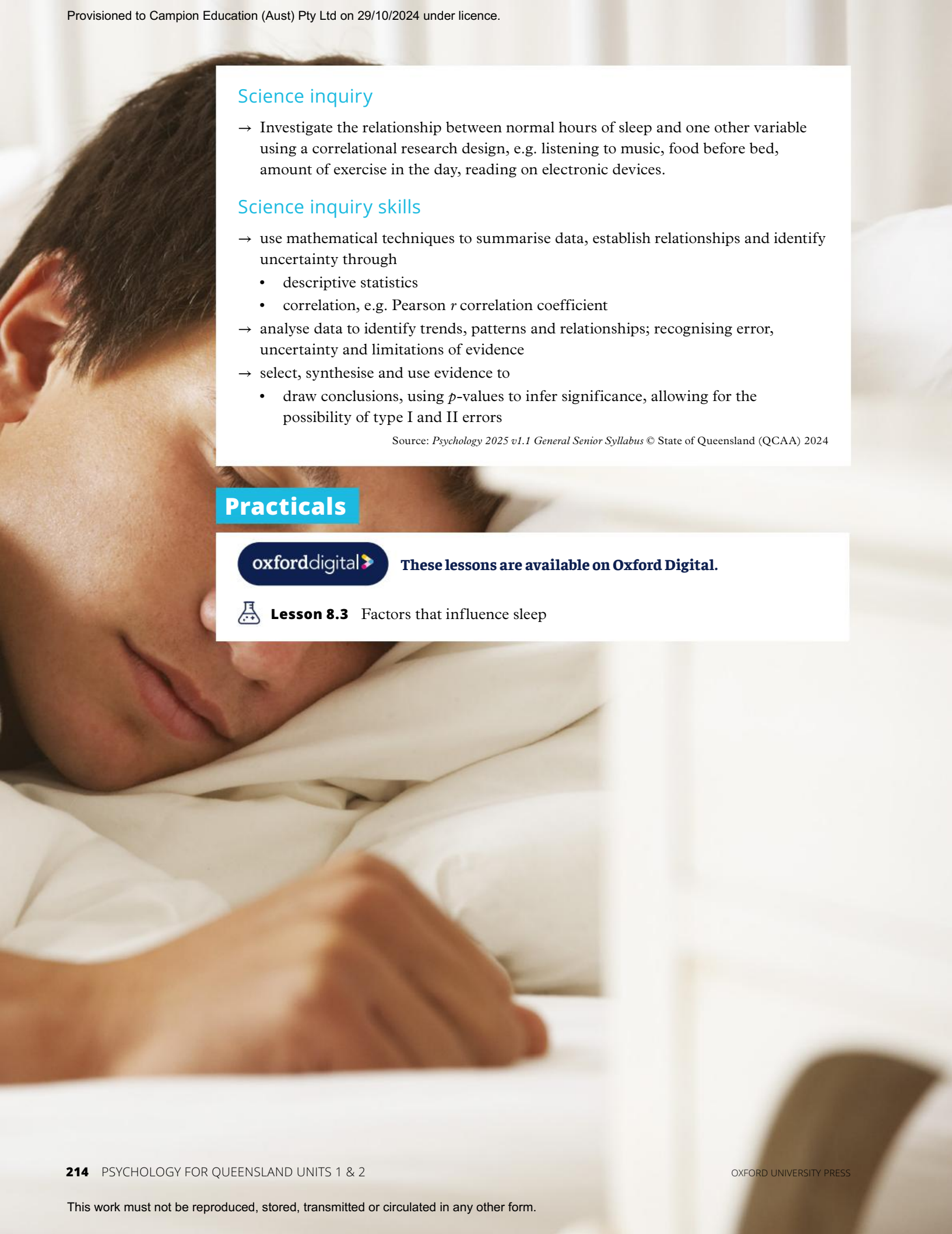
Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to sleep before you start.

Subject matter

Science understanding

- → Describe the sleep–wake cycle, with reference to the stages of sleep, including rapid eye movement (REM) and non-rapid eye movement (NREM) sleep.
- → Discuss the purpose of sleep by comparing the restoration and evolutionary theories.
- → Describe the changes in the sleep–wake cycle across the life span, including the sleep–wake shift in adolescence.
- → Identify the physical and psychological consequences of total and partial sleep deprivation, including effects on concentration and mood.
- → Interpret correlational data about the relationship between normal hours of sleep and one other variable (e.g. listening to music, food before bed, amount of exercise in the day, reading on electronic devices).



Science inquiry

→ Investigate the relationship between normal hours of sleep and one other variable using a correlational research design, e.g. listening to music, food before bed, amount of exercise in the day, reading on electronic devices.

Science inquiry skills

→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
- descriptive statistics
- correlation, e.g. Pearson *r* correlation coefficient

→ analyse data to identify trends, patterns and relationships; recognising error, uncertainty and limitations of evidence

→ select, synthesise and use evidence to
- draw conclusions, using *p*-values to infer significance, allowing for the possibility of type I and II errors

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Practicals

These lessons are available on Oxford Digital.

Lesson 8.3 Factors that influence sleep

Lesson 8.1
Characteristics and patterns of sleep

Key ideas

- → Sleep is a naturally occurring state of altered consciousness that follows a predictable sequence of stages. It is divided into non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. NREM sleep is further divided into three stages. Physiological activity is different during each stage for NREM sleep and REM sleep.
- → Stage 1 NREM (N1) sleep is very light sleep from which people are easily awakened.
- → Stage 2 NREM (N2) sleep is still light sleep, but deeper than N1 sleep. We spend most time in this stage.
- → Stage 3 NREM (N3) sleep is the deepest stage.
- → REM sleep is lighter than N3 sleep and characterised by rapid eye movements, increased brain activity and vivid dreaming.
- → The percentage of time spent in REM sleep increases and NREM sleep decreases as the night progresses.

Learning intentions and success criteria

Introducing sleep

Sleep is a naturally occurring altered state of consciousness marked by a diminished sense of awareness and responsiveness to the external environment. Sleep comprises several predictable stages and follows a highly organised sequence of events. Throughout sleep, our bodies shift through several stages, each with its own unique characteristics. The different stages of sleep are usually identified by measurable changes in physiological responses. As we learnt in Lesson 7.6, physiological changes include changes in brainwave patterns, muscle tension, eye movement, body temperature, heart rate, blood pressure, respiration and hormone release.

sleep
a naturally occurring altered state of consciousness marked by a diminished sense of awareness and responsiveness to the external environment

sleep–wake cycle
the biological process of alternating between sleep and wakefulness

circadian rhythm
biological rhythm that occurs approximately once every 24 hours; for example, the sleep–wake cycle and body temperature

The sleep–wake cycle

As we learnt in Lesson 7.5, our bodies are attuned to a **sleep–wake** cycle that revolves around night and day. This regular cycle is an example of a **circadian rhythm**. The word circadian comes from the Latin circe (about) diem (a day), so a circadian cycle lasts, literally, about one day. For most people, the circadian cycle peaks (when you are awake and alert) during the day (usually the afternoon), with the lowest point being early in the morning (when you are drowsy and sleepy).

FIGURE 1 Sleep is a naturally occurring state of altered consciousness that follows a predictable sequence of stages.

Introducing the stages of sleep

rapid eye movement (REM) sleep
one of two phases of sleep, characterised by rapid eye movement

non-rapid eye movement (NREM) sleep
one of two phases of sleep, characterised by little or no rapid eye movement, and often divided into three stages of NREM sleep that are determined mainly by predominant brainwave patterns

Throughout the night, individuals experience two distinct types of sleep: **rapid eye movement (REM) sleep** and **non-rapid eye movement (NREM) sleep**. In an eight-hour sleep period, the average adult typically experiences roughly four to six sleep cycles, each lasting around 90 minutes, shifting between REM and NREM sleep. The primary distinguishing feature between NREM and REM sleep is that rapid eye movement occurs in REM sleep. The amount of time spent in REM sleep increases and NREM sleep decreases as the night progresses. This means that we typically spend more time in REM sleep in the cycle just before we wake in the morning compared to cycles earlier in the night.

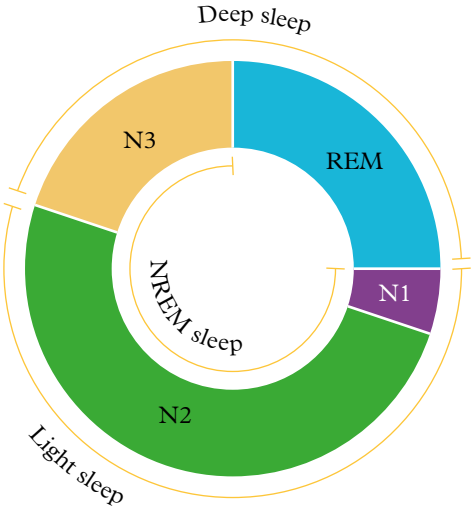


FIGURE 2 The stages of sleep. Most time is spent in stage 2 NREM sleep.

Non-rapid eye movement sleep

Once asleep, we enter NREM sleep, which is characterised by a progressive reduction in physiological activity. NREM sleep consists of three stages and accounts for about 80 per cent of our total sleep time. It is thought that our body repairs itself during NREM sleep.

Stage 1 NREM sleep

hypnogogic state
the transitional period between wakefulness and sleep, characterised by vivid and dreamlike sensory experiences as an individual drifts off to sleep

hypnic jerk
involuntary muscle contraction or sudden twitch that occurs as a person is falling asleep, often accompanied by a sensation of falling

During the transition from being awake to being asleep or falling asleep, we enter a relaxed state known as a **hypnogogic state**. During this state, we may experience hallucinatory images, such as flashes of light and vivid images. Hypnogogic or **hypnic jerks**, involuntary muscle twitches that cause us to jolt, are common in this stage of sleep. This is the sensation of falling and then waking with a start that you have most likely experienced when falling asleep.

Stage 1 NREM sleep is brief, lasting around 5 minutes for most people, but it can range from 30 seconds to 10 minutes. It is a very light sleep when physiological responses begin to slow down, including body temperature, brain activity and heart rate. We can be easily awakened in this stage and if this happens, we often think we haven't been asleep at all. Stage 1 NREM sleep is sometimes called the "pre-sleep stage".

Stage 2 NREM sleep

Many consider the start of stage 2 NREM sleep as the point at which true sleep begins. It typically lasts for between 10 and 25 minutes per sleep cycle. Time spent in stage 2 can increase with each sleep cycle so that overall, we spend most time (around 45 to 50 per cent of time asleep) in this stage each night. During stage 2, our physiological responses continue to slow down. However, despite being a deeper stage of sleep than stage 1 NREM, it is still fairly easy to be woken in stage 2 NREM. If we are woken, it is likely that we still won't believe we were asleep. As we slip further into stage 2 NREM sleep, our eyes stop rolling, our muscles become more relaxed, and our breathing and heart rate continue to decrease.

Stage 3 NREM sleep

Study tip

Stage 4 NREM sleep is now considered part of stage 3 NREM sleep. Although older studies refer to stage 4 NREM sleep, you do not need to.

Stage 3 NREM sleep is the deepest stage of sleep. It typically lasts for between 20 and 40 minutes per sleep cycle, but duration can vary. It tends to be longer earlier in the night, and shorter in subsequent sleep cycles. It is extremely difficult to wake someone who is in this sleep stage. This is when we are "fast asleep" or "sleeping like a log". Stage 3 NREM sleep is often referred to as "slow-wave sleep" due to the reduced brain activity during this stage. Time spent in stage 3 will decrease throughout the night, up to the point where a person may not experience it at all in their last couple of sleep cycles. We often slip back into stage 2 NREM sleep from stage 3 before finally moving into rapid eye movement sleep.

Real-world psychology

Smoke alarms

House fires are regularly reported in the media, including reports of tragic fire-related deaths in houses with working smoke alarms. Most of these deaths occurred in the night at times when individuals were likely in stage 3 NREM sleep. These reports question the effectiveness of smoke alarms in rousing us from our deepest sleep. Could there be a more effective signal to wake us?

A team of Melbourne sleep psychologists investigated this critical issue (Bruck et al., 2008). Bruck and her colleagues tested a number of different signals, varying in pitch and complexity, for their ability to wake people from the deepest sleep. They believed that a higher pitch and more complex tones were more likely to wake a person in deep sleep than a lower pitch with less complex (more pure) tones. Thirty-nine volunteers (18 male and 21 female) participated in the study. All were healthy young adults (18–27 years old), not on medication, not affected by a sleep disorder and had normal hearing. They were paid $80 per night with a bonus of $180 on completing the study. The research was approved by the ethics committee of the researchers' university.

Most of the participants were tested in their own home, with a few deciding to be tested in the sleep laboratory. For the study, recording devices were attached to the participants and a researcher sat in the hallway monitoring their brainwaves. Participants were tested one night per week for three weeks, and were allowed to recover from any sleep loss between tests. Conditions were kept similar on each testing night (same diet, exercise, bedtime, door closed, etc.) and all the participants were administered the same test. During the testing, four different signals were tested per night at different times and the order of these signals was counterbalanced between participants. When each participant entered deep sleep, one of the signals was switched on. It became louder until the participant pressed a button by their bedside to turn it off. The length of time it took for beta brainwave patterns (which appear when we are awake and alert) to appear was recorded.

Analysis of the results found that a low pitch and a complex tone were significantly more likely to wake people. Standard smoke alarms are currently high pitched with pure tones and are at least seven times less likely to wake an adult in deep sleep. Professor Bruck and her team are calling for changes to Australian smoke alarm signals. You can learn more about Professor Bruck's studies on YouTube.

FIGURE 3 Smoke alarms in Australia are not optimised to wake adults from deep sleep.

Apply your understanding

1 **Explain** why participant conditions were kept similar on each testing night. (1 mark)
2 **Identify** two limitations of the research methods used in this investigation. (2 marks)
3 **Determine** how Professor Bruck's research could be used to make changes to Australian smoke alarm signals. (1 mark)

Rapid eye movement sleep

In the middle of last century, two sleep researchers noticed that, at certain times, the eyeballs under a sleeper's eyelids would move rapidly to and fro (Aserinsky & Kleitman, 1953). At the same time, they noted a change in brainwave patterns, decided it was a distinct stage of sleep, and aptly named it "rapid eye movement sleep". This simple observation changed the whole course of sleep research.

As the name suggests, rapid eye movement (REM) sleep is a period of sleep when your eyes move rapidly, for short bursts of time. The first cycle of REM sleep lasts for about 10 minutes. REM sleep is a lighter sleep than stage 3 NREM sleep and therefore easier to wake from. Unlike NREM sleep, if we are woken during REM sleep, we are likely to report that we were dreaming. This is true for everyone, even those who say they don't usually dream.

FIGURE 4 Rapid eye movement occurs during REM sleep.

Physiological activity during REM sleep

There is marked physiological activity during REM sleep. There are repetitive bursts of rapid eye movement; heart rate, blood pressure and respiration increase and fluctuate. Body temperature tends to match the surrounding environment.

There is, however, no muscle tension – the muscles that move voluntarily, especially those below the neck, are very relaxed to the point of being almost paralysed (except for the occasional twitching). This paralysis is known as muscle atonia or cataplexy. REM sleep is often referred to as paradoxical sleep. This is because the body can appear calm on the exterior (virtually no muscle activity), but other bodily systems and the brain are highly active, having many features that are similar to being awake.

FIGURE 5 Dreams during REM sleep can present a strange picture of the "real" world!

Psychological activity during REM sleep: Dreaming

It appears that most dreaming occurs during REM sleep. Dreams during REM sleep tend to follow a storyline (though a bizarre one at times) and the dreamer often feels as if they are experiencing a different world. The final dream of the night tends to be the longest, strangest and most exciting – elements that make it more likely to be remembered. Therefore, the dreams you remember and repeat to other people are most likely to be your last REM dreams in the night. In reality, though, we remember very few of our dreams. Can you remember the four or five dreams you had last night? You probably spent about 2 hours dreaming. That adds up to about 6 years of dreaming in a lifetime.

People who are lighter sleepers and people who are anxious are more likely to dream in NREM sleep. Have you ever felt as if you have been awake all night thinking about a problem? The chances are that you did sleep and some of this thinking occurred during an NREM dream.

Summary

Table 1 summarises the physiological characteristics of each sleep stage.

TABLE 1 Physiological characteristics of the stages of sleep

Characteristic	Stage 1 NREM sleep	Stage 2 NREM sleep	Stage 3 NREM sleep	REM sleep
Sleep state	Drifting in and out of sleep	Light sleep (real sleep starts)	Deep sleep	Light sleep
Brain activity	Theta waves: high-frequency, low-amplitude, and low-frequency, high-amplitude waves	Theta waves: low-frequency, high-amplitude waves	Delta waves: lowest frequency, highest amplitude waves	Beta-like waves: highest frequency, lowest amplitude waves
Heart rate	Irregular	Slower and more regular	Slow and regular	Increases and fluctuates
Breathing rate	Irregular	Slower and more regular	Slow and regular	Increases and fluctuates
Muscle tension	Relatively tense	Lower muscle tension	Relaxed (low tension)	Virtually non-existent
Body temperature	Normal	Lower	Lowest	Unregulated

Study tip

Create a visual sleep-cycle chart to consolidate your understanding of the sleep–wake cycle and the characteristics of each sleep stage. Divide a piece of paper into segments representing a typical 8-hour sleep period and label each segment with the stage of sleep, typical duration and key features.

Check your learning 8.1

Check your learning 8.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the sleep–wake cycle. (1 mark)

2 **Describe** the three stages of NREM sleep. (3 marks)

3 **Explain** what happens to the muscles that move voluntarily during REM sleep. (1 mark)

Analytical processes

4 **Discriminate** between NREM and REM sleep. (1 mark)

5 **Sequence** the stages of sleep in the correct order. (1 mark)

Knowledge utilisation

6 **Discuss** the nature of dreams during REM sleep, including their typical structure and emotional content. (2 marks)

Lesson 8.2
Sleep patterns across the lifespan

Learning intentions and success criteria

Key ideas

- → Sleep patterns change across the lifespan according to requirements for normal development, and physiological processes.
- → Cycles of REM and NREM sleep are predictable according to a person's age. While the basic structure of sleep cycles (alternating between REM and NREM) remains consistent across ages, the proportion and characteristics of each stage can vary significantly.
- → Adolescents typically experience delayed sleep phase onset.

Introducing sleep patterns

Sleep patterns change with age. You probably do not need as much sleep now as you used to, and can go to bed later than when you were little.

Newborns spend about 16 hours per day sleeping, with about half of this time in REM sleep. Young children also spend a lot of time in deep NREM sleep, but as they grow up, the type of sleep they experience changes. Evidence suggests that REM sleep helps with brain development, particularly early in life. This would explain why infants need so much more.

Adults sleep for about 8 hours, with about a quarter of this in REM sleep. By the age of 60 years, very little time, if any, is spent in stage 3 NREM sleep, with sleep lasting for about 6 hours, still with 20–25 per cent in REM sleep. As we can see in Figure 1, the amount of REM sleep we experience decreases as we get older. This does not mean we need less sleep, rather it means our sleep becomes more fragile.

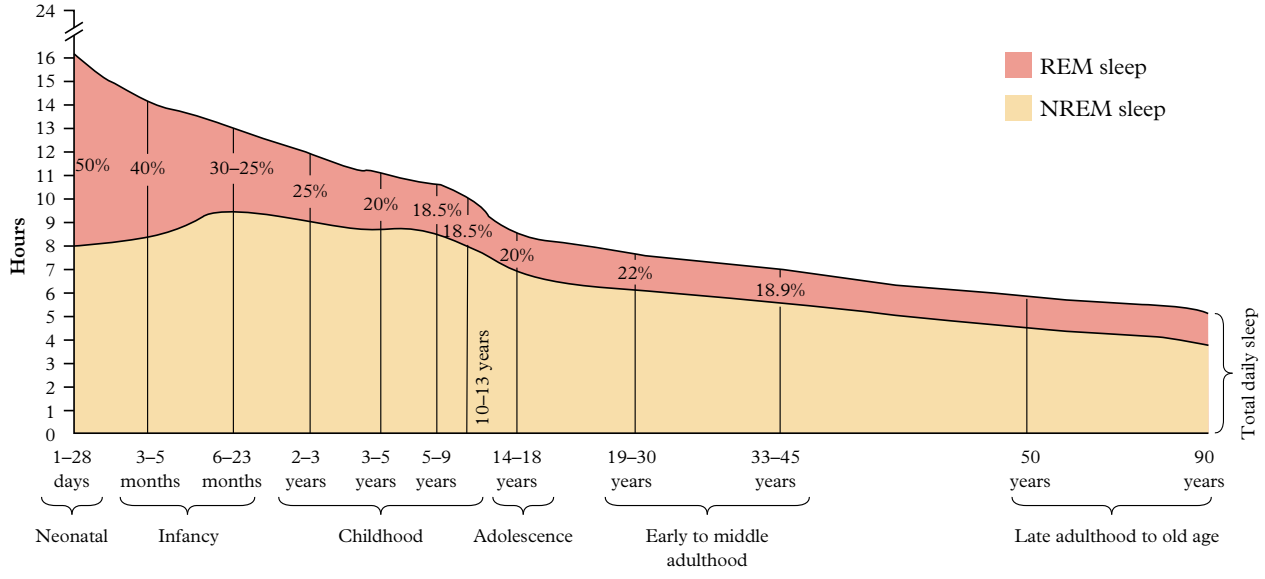


FIGURE 1 Sleep patterns change with age.

Proportion of REM and NREM sleep in a typical pattern of sleep

As we learnt in Lesson 8.1, sleep cycles consist of REM sleep and NREM sleep. NREM sleep is broken down into stages 1, 2 and 3. When we first fall asleep, we tend to experience NREM stage 1, then stage 2, stage 3, stage 2 and finally REM sleep. This is our first NREM–REM cycle and lasts for about 90 minutes.

After the first NREM–REM cycle, we often skip stage 1 NREM sleep and enter stage 2 NREM sleep again. We then descend through stage 3 NREM sleep before returning to stage 2 and to REM sleep. This cycle can be plotted on a graph known as a **hypnogram** (Figure 2).

hypnogram
graphic representation of the transition between stages of sleep over time

The return to stage 2 NREM sleep marks the start of the third cycle and, this time, we stay in this stage for about an hour, often not descending into stage 3 NREM sleep. We spend a longer period of time in REM sleep and, again, the end of REM sleep marks the end of the cycle.

The fourth, fifth and (sometimes) sixth cycles are similar; we are unlikely to enter stage 3 NREM sleep and increasingly more time is spent in REM sleep. We also tend to wake briefly (usually without conscious awareness) before or after a period of REM sleep (Zepelin, 1986). We might wake up in the fifth sleep cycle, either directly from stage 2 NREM sleep or REM sleep, but often roll over and go back to sleep and start another cycle. While the exact pattern of sleep varies from person to person and from night to night, the following features are the same:

- Stage 3 NREM sleep typically occurs in the first two to three cycles of the NREM–REM sleep cycle.
- We spend more time in REM sleep as the night progresses.

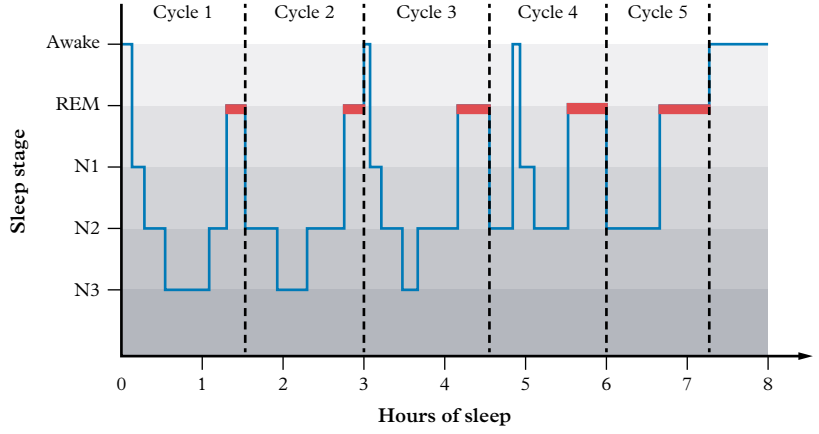


FIGURE 2 A typical hypnogram of a night's sleep

Adolescent sleep–wake cycles

It is not unusual for a teenager to want to go to bed later and sleep in longer in the mornings. While an adult might fall asleep at 10 pm, a teenager may find themselves lying awake, staring at the ceiling, until midnight. It takes longer for a teenager to "wind down" at the end of the day. Teenagers are not lazy people who want to sleep all morning by choice – there are valid biological reasons for the desire to stay awake late and sleep in the next day! This phenomenon resembles a **delayed sleep–wake phase disorder**, a circadian rhythm sleep disorder.

delayed sleep–wake phase disorder
a circadian phase disorder that delays sleep patterns

FIGURE 3 Some Year 12 students can suffer from inadequate sleep leading up to exams.

The adolescent sleep–wake shift occurs only during the teenage years. The sleep patterns tend to shift back to an adult pattern at around 19½ years for females and 21 years for males. Most adults need about 8 hours of sleep per night.

Teenagers need nine or 10 hours of sleep per night. Not surprisingly, most don't get this much. A hectic schedule of school, homework, part-time jobs, social activities and family commitments leaves many teenagers with too little time to sleep. In addition, myriad electronic devices, social networking sites, television and playing sport late at night keep our brains stimulated and prevent sleep.

Sleep–wake hormones in adolescents

In teenagers, the release of sleep–wake hormones such as melatonin at night (inducing sleepiness) and cortisol in the day (encouraging alertness) is often delayed by up to 2 hours. This means that the average bedtime of 9.30 pm or 10.30 pm is pushed back later and most teenagers report not being tired at this time. This leads to a behaviour that is seen as typical of teenagers: they prefer to go to bed late (on average around 11 pm) and, therefore, wake up later. A sleep time of 11 pm and a wake time of 7 am – perhaps typical of the school week – will leave a teenager at least one hour short of the optimal amount of sleep. Over the period of a week, this adds up to a **sleep debt** of at least 5 hours. If this happens, teenagers can become chronically sleep deprived. You will learn more about sleep deprivation in Lesson 8.5.

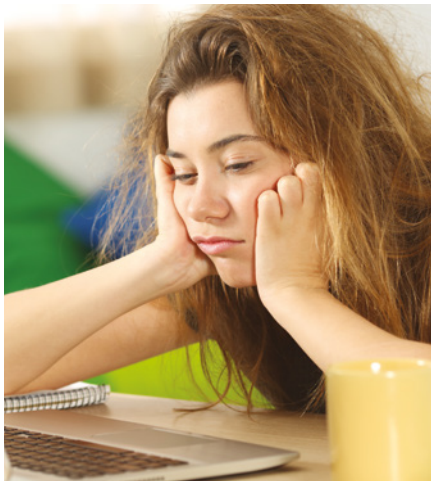


FIGURE 4 A weekly sleep debt of 5 hours can lead to chronic sleep deprivation in teens.

Impact of adolescent sleep deprivation

Being a night owl is less than ideal in our school environment. Research has found that night owls (those who go to bed late and are late to rise) tend to experience more emotional stress than early birds (Ong et al., 2007). In this study, night owls held more negative and rigid beliefs about the need for sleep and what their sleep should be like. They felt less in control of their sleep and did not go to bed or wake up at regular times. Consequently, they felt sleepier during the day and were more at risk of depression and insomnia.

sleep debt
the accumulated amount of sleep loss from insufficient sleep

Potential solution for adolescent sleep deprivation

Some schools, especially those in the United States that traditionally have a very early start time, are taking this sleep research seriously and are starting school later. Studies are demonstrating that students with a later start time are getting almost 1 hour more sleep, are less sleepy during the day and are showing improved grades. In addition, there are fewer school absences (Carskadon et al., 1998; Wahlstrom, 2002; Wolfson et al., 2007). These improvements were found to be almost immediate, highlighting the dramatic effect that good sleep can have on a teenager's life.

FIGURE 5 Research has shown that later start times in schools can influence student performance.

Advanced sleep–wake phase disorder

While a delayed sleep–wake phase pattern is usually seen in adolescents and young adults, **advanced sleep–wake phase disorder** is most common in the elderly. People with advanced sleep–wake phase disorder experience sleepiness in the late afternoon or early evening, resulting in an early bedtime (between 6 pm and 9 pm). They usually wake early (between 2 am and 5 am), and find it difficult to go back to sleep.

FIGURE 6 Advanced sleep–wake phase disorder results in an early bedtime.

advanced sleep–wake phase disorder
a circadian phase disorder that brings sleep patterns forward, often seen in the elderly

Check your learning 8.2

Check your learning 8.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Explain** how the duration of sleep changes over the lifespan. (1 mark)
2 The sleep–wake cycle is often delayed during adolescence.
   a **Explain** why a teenager is more likely to want to go to bed late at night. (1 mark)
   b **Identify** when the delay in the teenage sleep–wake cycle is likely to shift back to an adult sleep–wake cycle. (1 mark)
3 **Explain** how the proportion of time spent in NREM and REM sleep changes
   a during the night (1 mark)
   b over the lifespan. (1 mark)

Analytical processes

4 **Deduce** why people need less REM sleep as they get older. (1 mark)
5 Use Figure 1 to **determine** how much sleep is needed by 1-year-old babies, 5-year-old children and people in middle adulthood. (3 marks)

Knowledge utilisation

6 The question "Should school start later?" is politically charged and complex. Many aspects of school, including family, student and teacher needs, must be considered before making a decision. **Discuss** whether this is a realistic idea. Refer to your understanding of sleep–wake cycles in your answer. (4 marks)

Practical

Lesson 8.3
Practical: Factors that influence sleep

Learning intentions and success criteria

This practical lesson is available on Oxford Digital. It is also provided as part of a printable resource that can be used in class.

Lesson 8.4
Purpose and function of sleep

Key ideas

- → The evolutionary theory of sleep focuses on when and why different species sleep, with regards to survival.
- → The restoration theory of sleep focuses on why sleep is important for daily physical and psychological functioning.
- → The theories work together and both have attracted criticism as explanations for the purpose and function of sleep.

Learning intentions and success criteria

Introducing the purpose of sleep

Have you ever been told your behaviour indicates that you need more sleep? Or have you ever justified your poor behaviour by blaming a lack of sleep? If so, it shows that you have some understanding of the need for sleep and know what can happen if you don't get enough.

While the quality or quantity of sleep should not justify bad behaviour, it can highlight the importance of sleep. Feeling grumpy, tired, irritable, antisocial and unmotivated are just some of the consequences – you can probably think of more. On the other hand, you have probably noticed that too much sleep can make you feel sluggish and irritable.

Sleep is a necessity, not a luxury. While sleep is essential to being healthy, alert and happy, the overriding purpose of sleep is much debated. We know we need sleep, but we are still unclear about exactly why. The amount of sleep we need also varies markedly from one person to another.

There are several theories of sleep function, including the evolutionary (circadian) theory of sleep and the restoration (restore and recover) theory of sleep.

FIGURE 1 Sleep is necessary and there are several theories about its purpose and function.

Introducing the evolutionary theory of sleep

evolutionary theory of sleep the theory that sleep serves to increase an animal's or human's chance of survival in its environment

According to the **evolutionary theory of sleep**, sleep is a means of increasing an animal's chances of survival in its environment. Animals' sleep patterns, and periods of activity and inactivity, have evolved around the circadian day–night cycle to match periods of light and darkness.

Sleep requirements differ between species to allow them to meet the demands of their environment, and depend on the availability of food, species' safety when they sleep and methods of defence from attack. These things are, in turn, influenced by whether a species is predator or prey. Periods of wakefulness occur when it is safer to be awake, and sleep occurs when it is more hazardous to be awake.

Within populations of animal species, individuals with certain sleep patterns (traits) survive over time. They have offspring who are likely to inherit these sleep traits, so they also go on to survive and reproduce. The species has adapted its sleep patterns to environmental conditions over time and increased its chances of survival. We will look in more detail at some of the evolutionary factors affecting requirements for sleep, as shown in Figure 2.

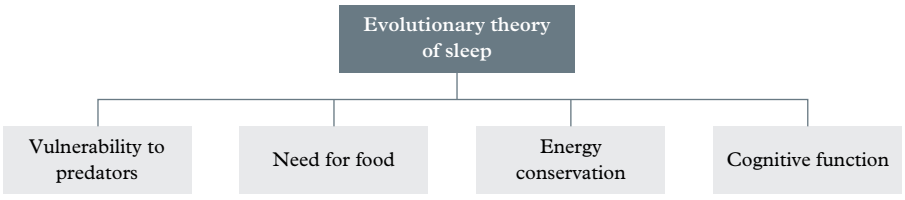


FIGURE 2 Summary of the evolutionary theory of sleep

FIGURE 3 Lions sleep for approximately 15 hours each day. They have few natural predators so don't need to be ready for a quick escape.

Vulnerability to predators

Sleep depends on an animal's vulnerability to predators. Small animals that are very vulnerable to predators, such as mice, sleep more so that they can hide safely from carnivores that want to eat them. Larger prey animals, such as deer, sleep less because they are more exposed in their environment and need to be ready to escape from predators. Animals with few natural predators, such as bears and lions, often sleep for long periods (12 to 15 hours) each day.

From an evolutionary stance, our prehistoric ancestors were more vulnerable to predators at night. They relied heavily on vision, a sense that is not very good in the dark. To avoid predators, they carried out duties (hunting and gathering food) during the safe daylight hours and slept quietly and safely at night, a time when their vision was poor.

FIGURE 4 Cows need to eat a lot of plant matter to meet their nutritional requirements. This takes time and leaves only approximately 4 hours per day for sleeping.

The need for food

Sleep depends on the need to find food. Animals that need to graze for hours, such as cows, sleep less. They sleep less because they need more food to survive.

Energy conservation

Sleep conserves energy. When an animal sleeps, its metabolism slows, thus reducing the need for food – a human's metabolic rate during sleep is about 10 per cent less than when awake (Wouters-Adriaens & Westerterp, 2006). Sleeping is a means of conserving energy in hibernating animals, such as squirrels or grizzly bears, which sleep during winter months when food is scarce and the weather conditions are harsh.

FIGURE 5 Food is scarce for grizzly bears during the colder months, so they hibernate for between 5 and 7 months of the year to conserve energy.

Cognitive function

Sleep plays a role in cognitive functions such as memory consolidation and learning. This aligns with the idea that improved cognitive performance can provide an evolutionary advantage in navigating the environment, making decisions and solving problems.

Criticisms of the evolutionary theory

The evolutionary theory has attracted some criticism:

- It assumes sleep is useful but not essential, and does not explain why so many species sleep, despite the amount of food (abundant or scarce) or danger they are in.
- It does not acknowledge the considerable variability in sleep patterns among different organisms that challenges the universality of the evolutionary theory.
- It assumes sleep is a way to hide safely from predators. For animals that are highly preyed upon, sleeping can be dangerous. The loss of awareness during sleep makes the animal vulnerable to predators and unlikely to be able to respond to danger.
- While the evolutionary theory proposes adaptive functions of sleep for survival, this relationship has been argued to be a correlation rather than a direct cause-and-effect relationship. Given that sleep has so many additional benefits (which we will explore in the next part of this lesson) it is difficult to determine whether any specific benefit is an adaptive response for survival. It could be that certain benefits are indirect effects of sleep, or a combination of adaptation for survival and indirect effects.

restoration theory of sleep a theory stating that sleep allows us to recharge our bodies, and recover from the physical and psychological work during the day; it also allows our body's growth processes to occur

Introducing the restoration theory of sleep

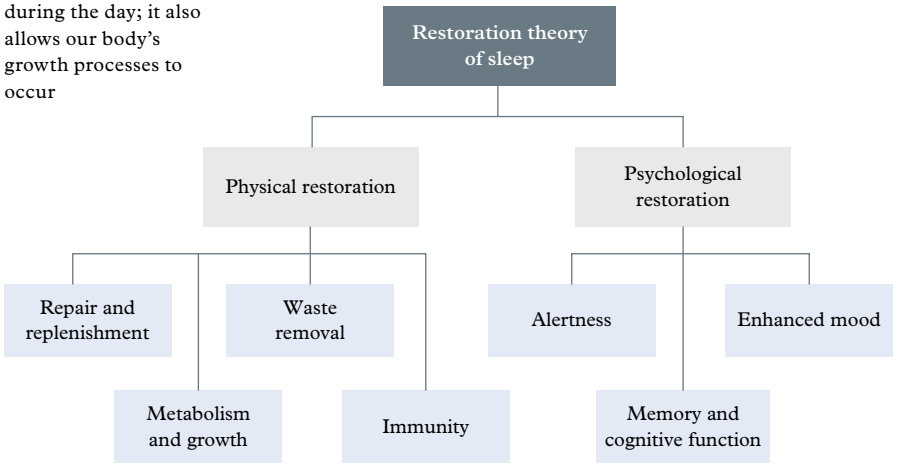


FIGURE 6 Summary of the restoration theory of sleep

According to the **restoration theory of sleep**, sleep allows us to recharge our bodies: to grow and recover from the physical and psychological work during the day. Think about how you feel when you wake up after a good night's sleep: refreshed, re-energised and ready to start the day. Sleeping is like undergoing a routine check-up and maintenance! We will look at both physical and psychological examples supporting the restoration theory shown in Figure 6.

Repair and replenishment

Sleep repairs and replenishes the body and prepares it for action the next day. Sleep looks after the health of the physical body. Activities that are more physically demanding should increase the need for sleep. A study of long-distance runners supports this view (Shapiro et al., 1981). They slept 90 minutes longer and doubled their deep sleep (stage 3 NREM) for the two nights after running a 92-kilometre race.

FIGURE 7 Research shows that activities that are more physically demanding should increase the need for sleep.

Waste removal

The neurotransmitter **adenosine** may provide further evidence for the physical restoration theory. Adenosine is produced when our cells use energy – it is suspected to be a cellular waste product that accumulates when we are awake. The more energy we spend, the more adenosine is produced. Adenosine is linked to making us feel sleepy and the longer we are awake, the sleepier we get. When we are asleep, adenosine levels decrease and we wake feeling refreshed and alert (Rainnie et al., 1994; Alanko et al., 2004).

adenosine
a neurotransmitter produced when our cells use energy and that accumulates when we are awake

It is a bit like taking out the rubbish – sleep gets rid of the waste products! Lack of sleep will affect our energy levels and make us feel drowsy and fatigued. Caffeine increases alertness and also blocks adenosine, further adding support to the theory of adenosine's role in making us feel sleepy.

FIGURE 8 Sleep gets rid of adenosine, a suspected cellular waste product that makes us drowsy, just as taking the rubbish out to the bin gets rid of household waste.

Metabolism and growth

It has been found that mammals with higher metabolic rates, such as dogs and cats, are likely to spend more time sleeping, especially in deep sleep (stage 3 NREM sleep), than mammals with lower metabolic rates, such as cows and kangaroos (Allison & Cicchetti, 1976). This finding may suggest that animals with a higher metabolic rate need more sleep to recover.

Sleep activates growth hormone. Growth hormone is responsible for physical growth. It has been linked with sleep, especially during the early years and adolescence, and the more you sleep (especially stage 3 NREM sleep), the more likely you are to meet your potential growth (Gais et al., 2006).

Growth hormone is also involved in controlling our metabolism. This means that sleep increases growth hormone levels and therefore helps control metabolism, including our energy levels (Pekkanen, 1982).

FIGURE 9 Animals with a higher metabolic rate tend to sleep for longer to recover from this activity. Cats, for example, sleep for approximately 13 hours per day.

Immunity

Sleep increases immunity to disease. For good reasons, we are often told to rest and sleep when we are ill. Sleep is a natural medicine as it appears to help our immune system become stronger. Immune cells that fight disease and infections are produced during sleep (Motivala & Irwin, 2007). If we go without sleep, our immune system will often reduce its natural response, causing us to be more susceptible to disease and infection (Irwin et al., 2003). We are more prone to heart disease if we sleep either too much or too little.

FIGURE 10 Going without sleep reduces the ability of our immune system to respond to infection.

Alertness

Sleep increases alertness. Sleep keeps our minds alert and assists our psychological state. When we are not getting enough sleep, we tend to be inattentive and more easily distracted (Jennings et al., 2003; Kendall et al., 2006).

FIGURE 11 Getting adequate sleep increases our level of alertness when we are awake.

Neurotransmitters, including **norepinephrine**, also known as noradrenalin, play a major role in keeping us alert during the day. It has been found that our bodies are more sensitive to norepinephrine when our sleep is adequate (Steriade & McCarley, 1990). Therefore, less norepinephrine is required to make us feel alert after a good night's sleep compared to a poor night's sleep. Other neurotransmitters such as adenosine (mentioned previously) are also involved in determining our alertness after sleep.

norepinephrine
a neurotransmitter involved in regulating arousal that helps keep us alert during the day

Enhanced mood

Sleep enhances mood. Are you grumpy, short-tempered or miserable? Perhaps you need more sleep! Many hormones and neurotransmitters influence your mood and emotions. A number of these are activated during sleep. Consequently, not getting enough sleep can lead to negative thoughts, feelings and behaviours, making us cranky, irritable and unhappy (Boivin et al., 1997; Durmer & Dinges, 2005).

Memory and cognitive function

Psychological restoration theory acknowledges the role of sleep in memory consolidation and cognitive function. During sleep, especially in REM and slow-wave sleep, the brain processes and consolidates memories, contributing to learning and overall cognitive performance.

Criticisms of the restoration theory

Not all research has supported the restoration theory, and there are criticisms of some of the underlying assumptions.

- The theories assume that more sleep is needed to recover when we have been physically active. Unless we partake in extreme physical activities (such as a 100-kilometre run), there is little evidence that we need more sleep after we exercise. A review of research in this area concluded that we tend to sleep longer – by about 10 minutes – on days we have exercised (Youngtedt, 1997), which is a small difference from the days we don't exercise.
- If this assumption is true, we might expect that those who do little exercise, including people with physical disabilities or who are confined to bed, would sleep less, but there is no evidence to support this statement: bedridden people show sleep patterns that are similar to those of active individuals. The need for sleep is not reduced with lack of exercise.
- Different individuals and species have varying sleep requirements, and some individuals may function well with less sleep than others. The restoration theory struggles to explain this variability and why certain individuals seem to need less sleep without apparent negative consequences.
- The theory assumes that the body rests during sleep. The brain is active during sleep. There is increased blood flow and energy expenditure during REM sleep and this slows down the synthesis of proteins, assisting the body with getting ready for the next day.

- The restoration theory may not fully account for the benefits observed in short naps or interrupted sleep. Some research suggests that brief periods of sleep or napping can have positive effects on alertness and cognitive function, challenging the idea that a single, consolidated period of sleep is essential for restoration.
- While there is strong correlation between certain physiological processes and sleep, establishing a direct cause-and-effect relationship between sleep and restoration is challenging. Many of the proposed restorative functions of sleep are based on associations observed in research rather than definitive evidence of causation.

Summary

The evolutionary and restoration theories address different issues about the purpose of sleep. The evolutionary theory focuses on when and why different species sleep, whereas the restoration theories help to explain why sleep is important. While the two sets of theories give different views of the purpose of sleep, they are complementary and both contribute to our understanding of why we sleep, as do other theories that are not discussed in this lesson. There is certainly a need for further research to better understand the purpose of sleep. Table 1 summarises the two theories we have explored in this lesson.

TABLE 1 Summary of the evolutionary and restoration theories of sleep

Theory of sleep	Purpose	Function
Evolutionary theory	• To increase chances of survival • Explains when and why different species sleep	Sleep allows creatures to hide and conserve energy, and wake to safely find food.
Restoration theory	• To recharge, grow and recover from the physical and psychological work during the day • Explains why sleep is important	Sleep repairs and replenishes the body and prepares it for action the next day.

Check your learning 8.4

Check your learning 8.4: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the main purpose and function of two theories of sleep. (2 marks)

2 **Identify** whether each of the following statements supports the evolutionary theory or restoration theory of sleep.

- **a** Sleep increases alertness. (1 mark)
- **b** Sleep enhances mood. (1 mark)
- **c** Sleep conserves energy. (1 mark)
- **d** Sleep depends on the need for food. (1 mark)
- **e** Sleep increases immunity to disease. (1 mark)
- **f** Sleep activates growth hormones. (1 mark)
- **g** Sleep depends on an animal's vulnerability to predators. (1 mark)
- **h** Sleep repairs and replenishes the body and prepares it for the next day. (1 mark)

Analytical processes

3 **Compare** the evolutionary theory and the restoration theory of sleep. (2 marks)

Knowledge utilisation

4 **Discuss** the evolutionary and restoration theories of sleep. Outline the arguments that support and limit the usefulness of each theory. (4 marks)

Lesson 8.5
Sleep deprivation

Key ideas

- → Age, lifestyle and genetics all affect how much sleep a person needs.
- → Partial sleep deprivation occurs when a person does not get the amount of sleep they need (poor quantity) or when they are deprived of a sleep stage (poor quality).
- → Partial sleep deprivation has affective, behavioural and cognitive effects, as well as physiological effects. Tasks requiring concentration (sustained attention) are impaired. Mood can be low.
- → Chronic sleep deprivation occurs when partial sleep deprivation is ongoing.
- → Total sleep deprivation occurs when a person has no sleep in a 24-hour or longer period.
- → In cases of total sleep deprivation, tasks requiring concentration (sustained attention) are seriously impaired. Mood can be irritable and confused.

Learning intentions and success criteria

Introducing sleep needs

William Dement, a pioneer in sleep research, decided to test himself and see if he could stay awake for a long period of time (Goleman, 1982). As much as he tried, he could not fight off sleep. He found that, just as we cannot hold our breath until we die, neither can we stay awake indefinitely. In the end, sleep sets in and saves us.

Dement's experience of sleeplessness probably does not surprise you. We all know the groggy feeling that lack of sleep can cause and how it affects our ability to concentrate, and we dislike being forced to stay awake when we are very tired. We know that we function much better when well rested! But how much sleep do we need to feel well rested?

The media sometimes portrays examples of well-known people who function well on very little sleep. Political figures such as Kevin Rudd, Barack Obama, Margaret Thatcher, Winston Churchill and Bill Clinton are often noted for only needing (or claiming to need) four hours of sleep per night. But these are rare examples and most of us need much more sleep.

> The amount of sleep we require is what we need not to be sleepy in the daytime.
>
> Jim Horne, sleep researcher

There are no hard and fast rules about the amount of sleep we need. Sleep needs vary between individuals and depend on factors such as age, lifestyle and genetics. We will look at each of these factors.

Age

As a guide, most teenagers need 9 to 10 hours of sleep per night. A young child needs more and an adult needs less to perform at their best. Mason (2005) found that 80 per cent of teenagers in the United States wish they slept more on school nights. This echoes the love–

hate relationship some of us have with sleep. We love the feeling of being well rested but dislike sleep interfering with things we enjoy or our time completing work.

FIGURE 1 Young children require more sleep than adults.

Lifestyle

Our lifestyle influences the amount of sleep we can access. For instance, working night shifts, sleeping in noisy environments (Basner & McGuire, 2018) and having a stressful way of life can all affect our access to adequate sleep. People tend to alter their sleep routines as responsibilities, relationships and stressors change with age. However, people reporting adequate sleep are more likely to have a regular bedtime and rise time than those reporting inadequate sleep (Carney et al., 2006).

Genetics

Our genes also may influence our sleep–wake cycle. Surveys of twins in Australia and Finland found that identical twins tend to have more similar sleep patterns (going to bed at the same time and sleeping the same length of time) than fraternal (non-identical twins; Heath et al., 1990). Some studies suggest that females tend to need more sleep than males and therefore are more likely to be sleep deprived (Wever, 1984).

FIGURE 2 How busy we are influences how much sleep we need to feel well rested.

FIGURE 3 Genetically identical twins have more similar sleep patterns than fraternal twins, who are not genetically identical.

Skill drill

Calculating the mean

Science inquiry skill: Processing and analysing data (Lesson 1.7)

Tyson wanted to see if using a computer before bed would affect sleep time. He gathered 20 participants through convenience sampling; half were aged 11, and half were aged 16. Table 1 shows the mean total sleep time for each participant for the week.

TABLE 1 Mean sleep time for participants aged 11 and 16

11 year olds			16 year olds		
Participant	Computer use before sleep	Mean sleep time (hours)	Participant	Computer use before sleep	Mean sleep time (hours)
1	Yes	8.1	1	No	9.8
2	No	11.5	2	Yes	6.4
3	No	12.5	3	No	8.4
4	No	10.5	4	No	10.2
5	Yes	9.4	5	Yes	7.2
6	Yes	10.1	6	Yes	7.0
7	No	11.0	7	Yes	8.0
8	No	12.0	8	No	9.7
9	Yes	9.4	9	Yes	7.4
10	Yes	8.9	10	No	9.5

Practise your skills

1 **Calculate** the mean sleep times for the following groups. Show your working and round to the nearest whole number.
   a 11-year-old participants who said "Yes" to using a computer before sleep (2 marks)
   b 16-year-old participants who said "Yes" to using a computer before sleep (2 marks)
2 **Identify** one characteristic that makes it appropriate to use mean to calculate the measure of central tendency for both groups. (1 mark)

Study tip

Get into the habit of showing your working when calculating. One mark can be allocated just for your working.

Introducing sleep deprivation

When our sleep needs are not met, we can experience what is known as sleep deprivation. When we are sleep deprived, we tend to get bored more easily. Activities we usually enjoy can seem dull. We are likely to feel unmotivated in class. Our feelings of self-worth, our relationships with family and friends, and our schoolwork can suffer.

Sleep deprivation can have serious consequences. For example, it has been associated with the oil spill from the *Exxon Valdez* in Alaska in 1989, which had significant environmental consequences, and the nuclear accident at Chernobyl in 1986, which cost more than 50,000 lives (Coren, 1996).

Sleep deprivation may be partial, total or chronic. We will consider partial and total sleep deprivation in more detail.

FIGURE 4 Sleep deprivation is linked to the grounding of oil tanker *Exxon Valdez* in 1989, leading to the spill of approximately 41.3 million litres of crude oil into the sea.

partial sleep deprivation
having some sleep in a 24-hour period but not getting enough to meet your needs; may occur for just one night or for several nights and can have serious consequences

Partial sleep deprivation

People who do not get enough sleep are likely to suffer the effects of **partial sleep deprivation**. Partial sleep deprivation is experienced when a person does not get the full amount of sleep they need (poor quantity sleep) or when a person is deprived of one particular stage of sleep (poor quality sleep).

The effects of partial sleep deprivation can vary from one person to the next and include both psychological and physiological effects.

Psychological effects of partial sleep deprivation

The psychological effects of partial sleep deprivation include affective (emotional) disturbances, behavioural difficulties and cognitive difficulties. Examples of each of these effects are given in Table 2.

TABLE 2 Psychological effects of partial sleep deprivation

Psychological effect	Examples
Affective (mood) disturbances	• Mood disturbances: amplified emotional responses, confusion and irritability, feelings of sadness • Previously enjoyed activities seem boring • Lack of motivation • Feelings of fatigue
Behavioural difficulties	• Slowed performance • Clumsiness, injuries • Risk-taking behaviour • Problems performing tasks, especially simple monotonous tasks and those requiring sustained attention or concentration (short performances on more physically or intellectually challenging tasks usually not affected)
Cognitive (concentration) difficulties	• Difficulty paying attention and concentrating • Difficulty processing information • Difficulty thinking and reasoning, poor decision-making • Memory problems • Impaired creativity • Distorted perceptions

Physical effects of partial sleep deprivation

The physical effects of partial sleep deprivation include:

- slower physical reflexes
- hand tremors
- droopy eyelids
- difficulty in focusing the eyes
- a heightened sensitivity to pain
- headaches
- lower energy levels.

There is little change, if any, in heart rate, respiration, blood pressure and body temperature.

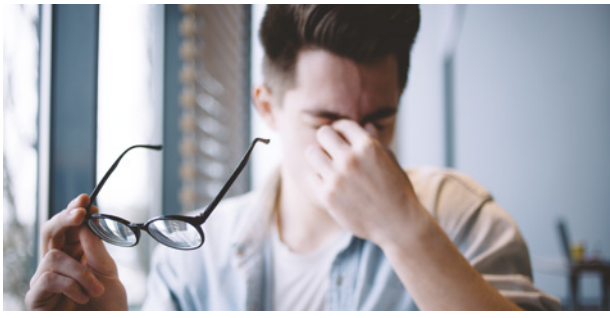


FIGURE 5 People experiencing partial sleep deprivation may have trouble focusing their eyes.

Loss of REM and NREM sleep

Both REM and stage 3 NREM sleep play crucial roles in allowing us to function properly. Depriving someone of these sleep stages can have alarming consequences. Speak to new parents and they will probably tell you about the difficulties of coping with inadequate sleep. They are likely to be REM-sleep deprived, as their sleep is consistently interrupted throughout the night for months on end. When their baby settles into a sleep routine, many parents experience a marked improvement in their psychological and physical wellbeing with no long-lasting ill effects.

FIGURE 6 The exhaustion experienced by new parents is likely related to REM-sleep deprivation.

It has been suggested that REM sleep is more critical for psychological wellbeing, and NREM sleep (especially stage 3 NREM sleep) for physiological wellbeing. Other psychologists argue against this idea (Siegel, 2003). We will look at some of the questions that have been raised in the debate.

REM sleep and the link with memory and learning

FIGURE 7 Dolphins are considered able to learn, yet do not appear to experience REM sleep.

Many psychologists believe that the high level of brain activity during REM sleep helps newly learnt information to be consolidated (transferred) into long-term memory. This leads to the idea that not getting enough REM sleep will cause memory problems. It has been demonstrated that performance on some tasks improves after a marked increase in both REM sleep and stage 3 NREM sleep (Walker & Stickgold, 2006). Other research has failed to find a link between loss of REM sleep and memory problems (Siegel, 2001). People who have brain damage that prevents REM sleep, or who are on medication that prevents REM sleep, do not experience more memory problems than usual. Animals such as dolphins and whales do not appear to have REM sleep but are considered to be intelligent and able to learn.

FIGURE 8 Lack of REM sleep can lead to feelings of irritability.

Lack of REM sleep and the link with mood disturbances

REM sleep interrupts the release of some neurotransmitters (such as norepinephrine) and this might allow the brain receptors to recover and become more sensitive to their release (that is, more likely to react) after a break. Interruptions to the release of these neurotransmitters are likely to affect mood and learning. Being deprived of REM sleep may lead to mood disturbances such as grumpiness, irritability and sadness.

Compensating for loss of REM sleep

REM rebound
the significantly larger amount of time spent in REM sleep than usual that follows a period of being deprived of REM sleep

REM sleep is essential, as demonstrated by **REM rebound**, an effect that follows a loss of REM sleep. When we sleep after being deprived of REM sleep, we experience a significantly larger amount of time in REM sleep – more frequent and longer episodes. It is as if our bodies need to catch up on this loss of REM sleep. Dement (1960) first noticed REM rebound. For five nights, he woke participants each time they entered REM sleep. He found many of the participants experienced significant difficulties, including trouble with their memory, motor coordination and perception of time, and a tendency to hallucinate. Many also reported feeling irritable and anxious. These findings support the value of REM sleep as discussed earlier. When participants were allowed to have REM sleep on the sixth night, they engaged in much more REM sleep than usual, creating a rebound effect.

The effects of loss of NREM sleep

During NREM sleep, the body replenishes itself physically and restores body tissues. It does this in several ways, including via the release of growth hormones. Being deprived of NREM sleep, especially stage 3, may interfere with this process.

Effects of chronic sleep deprivation

Chronic sleep deprivation occurs when partial sleep deprivation is ongoing; that is, not having enough sleep over an extended period of time. Chronic sleep deprivation is associated with both psychological and physiological conditions, including:

chronic sleep deprivation
not getting enough sleep over an extended period of time; long-term sleep deprivation

- depression
- anxiety disorders
- sleep disorders such as insomnia
- obesity
- hypertension (high blood pressure)
- heart disease
- diabetes
- heartburn
- accelerated ageing.

These conditions also suggest a link between sleep loss and stress-related conditions, including cardiovascular diseases, mood disorders and immune deficiencies (Meerlo et al., 2008). Lack of sleep increases the levels of cortisol, a stress-related hormone (related to alertness and discussed in more detail in Module 7) that interferes with immune functioning. After several days of partial sleep deprivation, there will be an effect on immunity (Irwin, 2002). This may explain why we are more susceptible to colds in the lead-up to exams, a time when we are more likely to be sleep deprived. In addition, increased levels of cortisol have been linked to damage of the brain cells responsible for learning and memory (Leproult et al., 1997).

FIGURE 9 Students may find they are increasingly susceptible to colds if they are sleep deprived prior to exams.

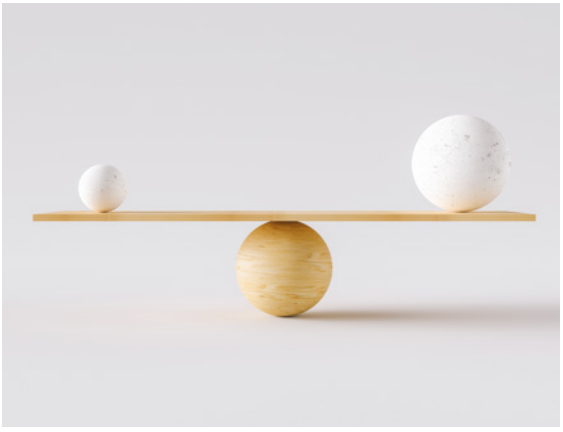


FIGURE 10 Sleep debt can be repaid with a smaller amount of sleep than the loss.

Sleep debt

The accumulated amount of sleep loss from insufficient sleep is known as sleep debt. Not getting enough sleep night after night adds to this sleep debt. The good news is that sleep debt, like other debt, can be repaid. Even better news is that, unlike other debt, it does not accumulate in a direct fashion or attract interest. In other words, if you have been missing out on one hour of sleep for seven nights in a row, you definitely need extra sleep, but not an extra seven hours.

Unfortunately, there is no sleep bank – we cannot open a sleep savings account! Sleeping longer than we need on one day will not counteract the late nights that follow. The best we can do is go to bed early the night before to make sure we are not sleep deprived to begin with.

Recovery from sleep deprivation

Usually, a good night's sleep and being able to sleep in is enough to recover from sleep deprivation. Depending on the amount of sleep deprivation, a few more nights of slightly longer sleep than usual may be required. Most effects of sleep deprivation are temporary and we are likely to fully recover without any long-term psychological or physiological problems.

The difficulty arises when a person may be suffering from a sleep disorder (such as insomnia) or another condition that is affecting their quality of sleep over an extended period of time. Lack of sleep is also often linked with other conditions such as depression and anxiety disorders, and recovering from sleep loss may improve the condition or make it worse. In these cases, people often need professional intervention to help deal with these conditions and recover lost sleep. If a few good nights' sleep do not help you recover from the effects of sleep deprivation, please seek professional help.

FIGURE 11 Fortunately, one or two good nights' sleep can often resolve sleep deprivation.

Total sleep deprivation

total sleep deprivation going without sleep for an entire 24-hour period; may occur for just one night or for several nights

Total sleep deprivation occurs when a person has been deprived of sleep for a period of 24 hours or more, and is rarer than partial sleep deprivation.

You might have thought about staying up all night to study before an exam, believing that this will help your performance. But will it? In one study, college students were either deprived of sleep or allowed to sleep the night before a critical-thinking task (Pilcher & Walters, 1997). Those forced to forego sleep ended up performing poorly on the task compared to the sleepers. More interestingly, those who were sleep deprived thought they had performed better than they actually did, a result not seen in the group that slept.

The good news is that, if we have to stay up all night for one night, we can do so with no serious side effects other than those associated with feeling extremely sleepy at the time (trusting, of course, that we don't engage in activities that could lead to an accident, such as driving a vehicle). We would probably struggle to stay awake for a second night, however, and find it almost impossible after four days. Further days without sleep can cause sleep deprivation psychosis.

Hüber-Weidman (1976) reviewed a large number of studies and summarised the effects of total sleep deprivation. These are shown in Table 3.

TABLE 3 The effects of total sleep deprivation

Nights without sleep	Symptoms
1	Discomfort felt but is tolerable
2	Urge to sleep, especially between 2 am and 4 am (when body temperature is at its lowest)
3	Tasks requiring concentration (sustained attention) are seriously impaired, especially if they are simple, repetitive or boring
4	• Periods of microsleep (about 3 seconds of staring blankly into space and losing awareness) are unavoidable • Irritable and confused • The "hat phenomenon" (a feeling of tightening around the head as though a hat that is too small is being worn)
5	• Still irritable and confused • May become delusional
6	• Possible sleep deprivation psychosis: depersonalisation, with a loss of sense of personal identity and increased difficulty in coping with other people and the environment

FIGURE 12 Recovery from sleep deprivation can be complicated if you experience another condition at the same time, such as insomnia.

FIGURE 13 Staying up all night to study won't improve your marks!

Challenge

Sleep deprivation as torture

Total sleep deprivation has been used in warfare throughout history. The ancient Romans used *tormentum vigilae* (the waking torture) as a method to extract secretive information from their enemies. In the Korean War of 1950–53, North Koreans "brainwashed" captured American pilots by depriving them of sleep. **Discuss** why this may lead to the "torturers" receiving false or incorrect information.

Real-world psychology

Case studies of total sleep deprivation

Extended periods of total sleep deprivation can have severe consequences – even leading to death – which make it ethically impossible to conduct experiments on this subject with human participants. Case studies, however, offer valuable insights into the impact of sleep loss.

Losing the ability to sleep

Lugaresi et al. (1986) documented a case where a 52-year-old man lost the ability to sleep, resulting in exhaustion and a fatal lung infection. An autopsy revealed damage to the suprachiasmatic nucleus, the brain region governing the internal clock. The connection between sleep loss and death remains unclear, however, complicated by potential contributions from stress.

Staying awake for 264 hours

Randy Gardner's 1964 Guinness world record of staying awake for 264 consecutive hours provides another case study. Monitored by Gulevich et al. (1966), Gardner experienced mood changes, concentration difficulties, short-term memory problems, delusions, hallucinations, disorientation, finger tremors and slurred speech. Following a press conference, he collapsed into a 15-hour sleep.

Although Gardner missed around 85 hours of sleep during his world-record attempt, he only recovered about 25 per cent of the loss in subsequent nights, challenging the notion that complete sleep catch-up is essential. Interestingly, his post-record-attempt sleep consisted of increased REM and stage 3 NREM sleep, suggesting their significance. Gardner recovered about 70 per cent and 50 per cent of these stages, with minimal increases in other sleep stages.

Apply your understanding

1 **Identify** three symptoms experienced by Randy Gardner when sleep deprived. (3 marks)
2 **Explain** why it is ethically impossible to investigate the link between total sleep deprivation and death with human participants. (1 mark)

Check your learning 8.5

Check your learning 8.5: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** how each of the following influence an individual's need for sleep
   a age (1 mark)
   b genetics. (1 mark)
2 **Explain** how lifestyle choices can affect the amount of sleep you get each night. Think about work, social life, school, sport and other activities such as reading or using the computer. (1 mark)
3 **Identify** three psychological effects and three physical effects of partial sleep deprivation. (3 marks)
4 **Describe** the psychological effects of loss of REM sleep. (2 marks)
5 **Explain** the notion of REM rebound. (1 mark)

Analytical processes

6 **Distinguish** between chronic sleep deprivation and partial sleep deprivation. (1 mark)
7 **Compare** the psychological and physical effects of partial and total sleep deprivation. (2 marks)
8 Sas has been staying up late with friends recently, and sometimes hasn't slept at all. He is more irritable than usual and is often confused. He feels that he is wearing a hat, despite having checked that he is not.
   a **Identify** the type of sleep deprivation that Sas is experiencing. (1 mark)
   b **Determine** how many nights of sleep Sas has missed. (1 mark)

MODULE 8

Lesson 8.6
Review: Sleep

Summary

8.1
- Sleep is a naturally occurring state of altered consciousness that follows a predictable sequence of stages. It is divided into non-rapid eye movement (NREM) sleep and rapid eye movement (REM) sleep. NREM sleep is further divided into three stages. Physiological activity is different during each stage for NREM sleep and REM sleep.
- Stage 1 NREM (N1) sleep is very light sleep from which people are easily awakened.
- Stage 2 NREM (N2) sleep is still light sleep, but deeper than N1 sleep. We spend most time in this stage.
- Stage 3 NREM (N3) sleep is the deepest stage.
- REM sleep is lighter than N3 sleep and characterised by rapid eye movements, increased brain activity and vivid dreaming.
- The percentage of time spent in REM sleep increases and NREM sleep decreases as the night progresses.

8.2
- Sleep patterns change across the lifespan according to requirements for normal development, and physiological processes.
- Cycles of REM and NREM sleep are predictable according to a person's age. While the basic structure of sleep cycles (alternating between REM and NREM) remains consistent across ages, the proportion and characteristics of each stage can vary significantly.
- Adolescents typically experience delayed sleep phase onset.

8.3
- Practical: Factors that influence sleep

8.4
- The evolutionary theory of sleep focuses on when and why different species sleep, with regards to survival.
- The restoration theory of sleep focuses on why sleep is important for daily physical and psychological functioning.
- The theories work together and both have attracted criticism as explanations for the purpose and function of sleep.

8.5
- Age, lifestyle and genetics all affect how much sleep a person needs.
- Partial sleep deprivation occurs when a person does not get the amount of sleep they need (poor quantity) or when they are deprived of a sleep stage (poor quality).
- Partial sleep deprivation has affective, behavioural and cognitive effects, as well as physiological effects. Tasks requiring concentration (sustained attention) are impaired. Mood can be low.
- Chronic sleep deprivation occurs when partial sleep deprivation is ongoing. It is linked with serious conditions.
- Total sleep deprivation occurs when a person has no sleep in a 24-hour or longer period.
- In cases of total sleep deprivation, tasks requiring concentration (sustained attention) are seriously impaired. Mood can be irritable and confused.

Review questions 8.6A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

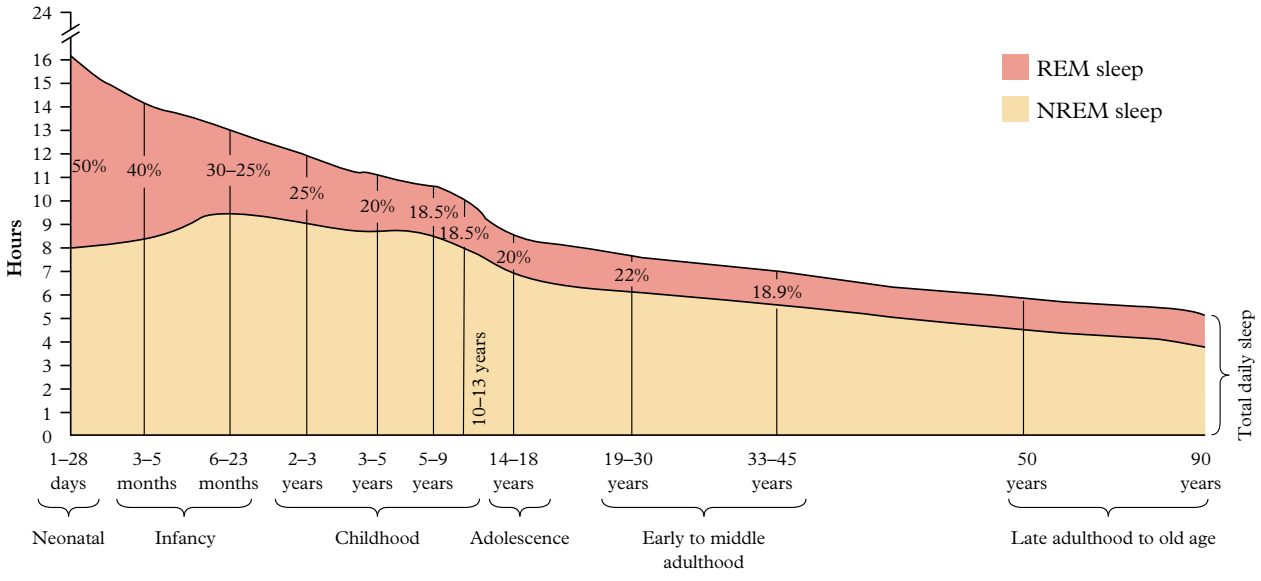
1 The amount of time we spend in NREM sleep during the night
   - **A** remains stable.
   - **B** increases.
   - **C** decreases.
   - **D** fluctuates.

2 What is sleep?
   - **A** A deliberately induced altered state of consciousness
   - **B** A natural altered state of consciousness
   - **C** Part of normal waking consciousness
   - **D** An unconscious state

3 Look at the figure and determine which statement is true.
   - **A** Infants spend more time in REM than adolescents.
   - **B** Adults need more sleep than neonates.
   - **C** Those in old age experience more NREM sleep than children.
   - **D** Children need the same amount of REM sleep as infants.

4 In a normal night's sleep, an adult will go through one cycle, from stage 1 to stage 3 NREM sleep and through the first REM sleep period in approximately
   - **A** 20 minutes.
   - **B** 50 minutes.
   - **C** 90 minutes.
   - **D** 200 minutes.

5 Which of the following statements is true of stage 3 NREM sleep?
   - **A** It usually occurs in only the first two cycles of NREM–REM sleep.
   - **B** It is known as light-wave sleep.
   - **C** It is relatively easy to wake a person during this stage of sleep.
   - **D** It increases in length throughout a night's sleep.



6 When compared to sleep needs in late childhood, an adolescent tends to
   A need less sleep and sleep time tends to be delayed.
   B need less sleep and sleep time tends to be earlier.
   C need more sleep and sleep time tends to be delayed.
   D need more sleep and sleep time tends to be earlier.

7 Which theory argues that sleep serves to restore energy to our bodies after the physical and emotional fatigue that occurs when we are awake?
   A Evolutionary theory
   B Restoration theory
   C Restoration and evolutionary theories
   D Dream theories

8 Which of the following statements supports the evolutionary theory of sleep?
   A Animals that are more susceptible to predators tend to sleep for longer periods than those that are less susceptible.
   B Animals with higher metabolic rates need more sleep than those with lower ones.
   C Growth hormone is released during stage 3 NREM sleep and this aids growth.
   D Sleeping enhances mood and can aid memory.

9 One of the limitations of the restoration theory of sleep is it assumes that
   A sleep is useful but not essential.
   B sleep is a way that species can hide from predators.
   C sleep enhances mood.
   D more sleep is required when people are physically active.

10 The amount of sleep a person needs
   A remains stable throughout life.
   B varies depending on age, lifestyle and genetics.
   C is greatest during late adulthood.
   D increases with an inactive lifestyle.

11 Having some but not enough sleep in a 24-hour period is called
   A partial sleep deprivation and going without sleep for an entire 24-hour period is called total sleep deprivation.
   B total sleep deprivation and going without sleep for an entire 24-hour period is called partial sleep deprivation.
   C partial sleep deprivation and going without sleep for an entire 24-hour period is called partial sleep deprivation.
   D total sleep deprivation and going without sleep for an entire 24-hour period is called total sleep deprivation.

12 What are common physical effects of sleep deprivation?
   A Increased immune function and metabolic rate
   B Reduced appetite and weight gain
   C Impaired immune function and increased risk of obesity
   D Enhanced cardiovascular health and decreased blood pressure

13 Which cognitive function is most affected by sleep deprivation?
   A Logical reasoning
   B Visual perception
   C Verbal fluency
   D Sustained attention

14 Which psychological symptom is commonly associated with sleep deprivation?
   A Increased motivation
   B Reduced anxiety
   C Heightened emotional reactivity
   D Improved memory consolidation

Review questions 8.6B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

15 **Explain** why sleep is considered an altered state of consciousness. (1 mark)

16 **Identify** and describe the three stages of NREM sleep. (3 marks)

17 **Describe** REM sleep. (1 mark)

18 Alice is 3 months old and spends about 14 hours a day sleeping.

- **a** **Identify** the proportion of Alice's sleep that is typically spent in REM. (1 mark)
- **b** **Describe** how Alice's sleep patterns will likely change when she is a teenager. (1 mark)
- **c** **Describe** Alice's likely sleep patterns when she reaches adulthood. (1 mark)

19 **Explain** sleep debt and how it can be overcome. (2 marks)

20 **Explain** how partial sleep deprivation can impact our affect (mood), behaviour and cognition (concentration). Give an example of each. (3 marks)

21 Liat is a healthy 1-year-old baby, Nancy is a healthy 30-year-old adult, and Arthur is a healthy 82-year-old adult. **Describe** how you would expect their sleep patterns to differ. Refer to total sleep time and proportions of time spent in REM and NREM sleep. (3 marks)

22 **Identify** the amount of sleep a teenager needs and **explain** why teenagers rarely get the amount of sleep they require. (2 marks)

23 **Describe** how sleep deprivation can affect immune function. (1 mark)

Analytical processes

24 **Compare** the restoration and evolutionary theories of sleep. (2 marks)

25 **Contrast** NREM and REM sleep. (1 mark)

26 **Distinguish** an adolescent sleep–wake cycle from an adult sleep–wake cycle. You could construct a diagram to illustrate this. (1 mark)

27 Mohammad is 26 years old and sleeps for about 7 hours each night. Referring to the proportion of REM and NREM sleep, **predict** what is expected to happen to Mohammad's sleep patterns as he approaches old age. (1 mark)

Knowledge utilisation

28 Patricia had been asleep for about 2 hours when there was a loud noise outside her house. **Determine** whether Patricia would have woken up quicky and easily. **Justify** your answer with reference to the REM and NREM sleep stages. (2 marks)

29 Despite much sleep research, the exact purpose of sleep is still unclear.

- **a** **Identify** two theories that attempt to explain the purpose and function of sleep. (2 marks)
- **b** For each theory, **evaluate** one piece of evidence that supports the theory and one criticism of each theory. (4 marks)
- **c** **Explain** if it is possible that both of these theories can be used to help explain the purpose of sleep. **Justify** your answer. (2 marks)

30 The restoration theory of sleep suggests that sleep can enhance mood and increase immunity to disease. **Propose** a suitable methodology to investigate this. (1 mark)

Data drill

The effect of stress on sleep

Scientists conducted a study to test whether the stress experienced in school can affect sleep quality. They hypothesised that there is a relationship between normal hours of sleep and perceived stress.

Sample size: 20 participants

Design: Independent measures design

Methodology: Participants were asked to complete a sleep questionnaire.

Participants were asked two questions on the questionnaire, as shown below:

1 How many hours do you sleep on a typical weeknight?

2 Do you have a problem with feeling stressed?

The second question was answered using a 5-point scale:

Not at all	Occasionally	Sometimes	Often	Very often
1	2	3	4	5

Raw data is presented in Table 1 and the processed data in Figure 1.

TABLE 1 Raw data

Hours of sleep	Stress level
6	4
7	4
7	2
7	3
8	1
7	3
8	2
6	2
7	3
6	3

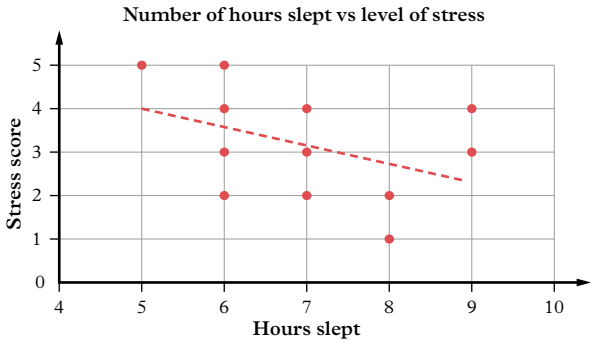


FIGURE 1 Relationship between the number of hours slept and level of stress

Researchers used the Pearson r test to analyse the data and the values of $r = -0.44$, $p = 0.06$

Apply understanding

1 **Identify** the stress score of the participant who typically has 5 hours of sleep per weeknight. (1 mark)

2 **Calculate** the mean number of hours of sleep for the dataset. Show your working. Round to 1 decimal place. (2 marks)

Analyse data

3 **Identify** one characteristic that makes it appropriate to use a Pearson r statistical test to analyse the data. (1 mark)

4 **Identify,** with reference to the correlation coefficient, the strength and direction of the relationship between stress and sleep. (2 marks)

Interpret evidence

5 **Infer** what the results of the statistical test show. (2 marks)

6 **Draw a conclusion** about the relationship between stress experienced at school and sleep quality. Use data to support your answer. (2 marks)

Module 8 checklist: Sleep

Quizlet: Revise key terms online to test your understanding

MODULE 9

Sleep disorders

Introduction

While many of us experience difficulty sleeping from time to time, some experience it on a continual basis. Understanding ways to minimise the effects of sleep disruptions and knowing when to seek help are important. In this chapter, we consider a range of sleep disorders and look at possible interventions to treat them. Tips are included that focus on improving sleep quality.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to sleep disorders before you start.

Subject matter

Science understanding

→ Compare common sleep disorders, including narcolepsy, sleep-onset insomnia, sleep apnoea and sleepwalking.

→ Describe treatment interventions for sleep disorders, including cognitive behavioural therapy for insomnia, and bright light therapy for circadian phase disorders.

Science inquiry skills

→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
- descriptive statistics
- parametric inferential statistics

→ select, synthesise and use evidence to
  - draw conclusions, using *p*-values to infer significance, allowing for the possibility of type I and II errors

→ judge the reliability and validity of the experimental process

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Lesson 9.1
Circadian phase disorders

Learning intentions and success criteria

Key ideas

- → Circadian phase disorders are sleep disorders where a person's internal sleep–wake clock is disrupted.
- → Examples of circadian phase disorders include the effects of shift work and jet lag, which are both caused by environmental, or external, factors.

Introducing circadian phase disorders

"How did you sleep?" This common question indicates that most people understand the importance of good sleep and that poor sleep can lead to problems. There are more than 80 different types of sleep disorder, some quite widespread and others rare. It is common for a person to experience more than one sleep problem.

What happens when our sleep–wake cycle is disturbed? In this lesson we discuss **circadian phase disorders**, sleep disorders in which a person's circadian rhythms (internal sleep–wake clock) are disrupted. The delayed sleep–wake phase shift in adolescents is one example of a circadian phase disorder (Lesson 8.2).

circadian phase disorder
a sleep disorder that affects a person's internal sleep–wake clock, resulting in disturbed sleep

Circadian phase disorders result in disturbed sleep and consequential daytime sleepiness and, therefore, negatively affect a range of personal, work, school, social and safety aspects of life.

In this lesson, we explore two key factors that can disrupt our circadian rhythms and lead to a circadian phase disorder: shift work and jet lag.

FIGURE 1 Nurses and doctors often work rotating shifts, which can result in sleep deprivation.

Shift work

In our 24/7 society, working night shifts is increasingly common and plays an important role in certain industries. Shift work refers to only working night shifts; only working early morning shifts; or working rotating shifts; for example, rotating through morning shift, afternoon shift and night shift – typically in a forward "staying awake later" direction. Most people who do shift work experience sleep deprivation. For some shift workers, these effects are an ongoing problem that interferes with work, family and/or other aspects of life.

Effects of shift work

While the disruption to adolescent sleep patterns is largely due to internal (biological, unrelated to the external environment) factors, shift work disruptions are mainly caused by external (environmental) factors. Working at night conflicts with our natural body clock, forcing people to be awake when they should be sleeping. If the shift worker's body clock cannot adjust sufficiently, sleep is interrupted, which can result in chronic sleep deprivation, leading to excessive sleepiness, insomnia or a host of other serious issues. This can become very dangerous, not only for the

individual but for the community, especially where shift workers are in demanding roles that require quick and important decision-making, such as in transport, medical and emergency responses.

Counteracting the effects of shift work

For shift workers, keeping the bedroom dark and quiet to help daytime sleep (e.g. using daylight-blocking blinds, wearing a blackout mask, turning the phone off and wearing earplugs) and maintaining a sleep schedule of daytime sleep, even during days off, may help. On days off, if they undertake standard daytime activities, they may need to wear dark sunglasses.

Rotating shift work

Findings to date highlight the need to monitor shift workers' health and wellbeing on a regular basis, especially if they have been doing it for a number of years. Rotating shift work has particular challenges. Studies on the best way to rotate shift work are inconclusive. Current research is investigating the role of the duration and length of rotating shifts, the interplay between shift work and individual characteristics, and recovery patterns once shift work has ceased. The effects on psychological (cognitive, affective and behavioural) and physiological aspects continue to be explored as well as other possible risk factor variables, such as vitamin D deficiency.

Jet lag

Travel is common in our society. People travel great distances for holidays, business, sport and other activities. This travel can include crossing one or several different time zones.

We can experience **jet lag** when travelling across time zones. Our sleep–wake cycle is disrupted and we can find it difficult to adjust and function at our best in the new time zone. This is particularly true when we travel in an easterly direction. With a natural body clock of just over 24 hours, we find it easier to stay up (delay sleep) than to sleep earlier (advance sleep).

jet lag
the disruption of the sleep–wake cycle when travelling across time zones

For example, if we hop on a plane in Brisbane at 4 pm (2 pm Perth time), we should arrive in Perth around 7.40 pm (9.40 pm Brisbane time). While the trip takes approximately 5 hours and 40 minutes, it looks shorter because of the different time zones. We are likely to adjust to this new time zone quickly, as staying awake for longer is easier than going to bed earlier. In other words, this change is more compatible with our natural circadian rhythm.

FIGURE 2 Jet lag is common when we fly across time zones.

Going home is a different story! Leaving Perth at 4 pm (6 pm Brisbane time) lands you in Brisbane around 10.40 pm (8.40 pm Perth time). While the flight is quicker at 4 hours 40 minutes – due to favourable wind (jetstream) currents – the likelihood of being able to fall asleep quickly is reduced. We may experience some jet lag and take a bit longer to adjust.

Perth to Brisbane is a reasonably short flight compared to many international flights from Australia. Flying further, across many time zones, creates a bigger circadian rhythm disruption and more pronounced jet lag.

Effects of jet lag

It can take days for our body clocks to align (resynchronise) to the new time zone, especially after longer international flights. Jet lag causes fatigue and grumpiness, difficulty sleeping, being awake and being tired at the wrong times, and many other sleep-deprivation effects (as discussed in Lesson 8.5). Someone experiencing jet lag is therefore more prone to accidents, making it something pilots must work hard to avoid!

Minimising jet lag

Here are some things you can do to try and minimise jet lag.

Before you leave:

- Schedule your arrival in the late afternoon and stay up until 10 pm.
- Start adjusting to the new time zone before you leave the old time zone, by waking and sleeping closer to the times of your destination.

When you arrive:

- Avoid stimulants such as coffee.
- Resist the desire to sleep during the day; if you must take a nap, make it a short one and set an alarm or get someone to wake you.
- Create a dark and quiet sleep zone, and use a sleep mask and earphones.
- Go outside and/or sit under bright light to help your body detect the light and wake.
- When you go to bed, set an alarm to wake you up in the morning. This may help you to stay calm and not worry that you will oversleep.

If jet lag persists, seek professional help. Medications, such as melatonin, are now available and are particularly effective in treating jet lag.

FIGURE 3 Pilots work hard to avoid or minimise jet lag.

FIGURE 4 There are things you can do to minimise jet lag when you travel across time zones.

Challenge

Plan a holiday

Imagine you are planning a holiday that requires travelling on a plane across several time zones. Pick a place to visit, and work out the time differences. Check the flight departure and arrival times. Will travelling to or travelling from the destination (or both) be more disruptive to your body's natural circadian rhythm? Select a flight to depart and another to return that may help minimise the effects of jet lag.

Check your learning 9.1

Check your learning 9.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the characteristics of a circadian phase disorder. (1 mark)

2 **Describe** the effect of jet lag on circadian rhythms. (1 mark)

Analytical processes

3 **Compare** the effects of shift work and jet lag on the sleep–wake cycle. (2 marks)

Knowledge utilisation

4 Toni is a nurse who often works between midnight and 6 am. Recently Toni's shift has changed to 8 am until 5 pm. Toni is struggling to sleep between 6 pm and 7 am. **Propose** how Toni could adjust her sleep routine. (2 marks)

5 Imagine that you have friends or family visiting from England. **Design** a methodology to help them avoid jet lag. (1 mark)

6 **Discuss** the potential long-term health consequences of chronic circadian phase disorders caused by shift work. (2 marks)

Lesson 9.2
Common sleep disorders

Key ideas

- → Narcolepsy is characterised by sudden and unexpected sleeping. People with narcolepsy experience REM sleep before NREM sleep, and can enter REM sleep directly from wakefulness.
- → Sleep-onset insomnia is characterised by difficulty falling asleep at the beginning of the night. It can be acute or chronic.
- → Sleep apnoea is characterised by interrupted breathing during sleep. Most commonly it is obstructive, where the airways fail to open due to a blockage.
- → Sleepwalking occurs during stage 3 NREM sleep. Sleepwalkers generally perform automatic processes or routine activities.

Learning intentions and success criteria

Introducing common sleep disorders

Sleep disorders, such as circadian phase disorders, relate to shifts in our sleep–wake cycles. Other sleep disorders relate to issues around falling asleep and staying asleep and abnormal behaviours during sleep. Many sleep disorders can be comorbid, meaning that they can occur with another physiological and/or psychological condition. In this lesson, we will introduce narcolepsy, insomnia, sleep apnoea and sleepwalking.

sleep disorders changes in sleep–wake cycles that typically have negative effects

FIGURE 1 Common sleep disorders are related to problems falling and staying asleep, and abnormal behaviours during sleep.

Narcolepsy

narcolepsy
a sleep disorder that causes sudden and unexpected sleeping

Imagine suddenly falling asleep, without warning, during the day. This is not just drifting off to sleep when you are bored in class, but falling completely asleep at a time when you are alert and in the middle of doing something such as talking with friends. This condition is called **narcolepsy**. Narcolepsy is a debilitating sleep disorder that causes sudden sleep attacks during the day. It does not matter how long the person has slept the night before, the sleep attacks still occur. Narcolepsy is thought to affect males and females equally.

FIGURE 2 People with narcolepsy can experience sudden sleep attacks during the day, even when they have had enough sleep the night before.

Effects of narcolepsy

People with narcolepsy lapse into REM sleep quickly, sometimes directly from wakefulness, and usually experience loss of muscle control. They may have REM (dreamlike) hallucinations. As part of their narcolepsy, some people experience cataplexy, in which they remain conscious but physically paralysed. Cataplexy is often triggered by strong emotional responses and must be incredibly frightening. On top of this, the dreamlike hallucinations are usually very vivid and impactful.

Narcolepsy is not just related to sudden REM sleep attacks in the day. When people with narcolepsy go to sleep at night, their night sleep begins with REM sleep, rather than going through the traditional NREM stages prior to the first REM sleep. They often sleep around the same amount as the average person, but still experience extreme sleepiness during the day. Narcolepsy can have significant consequences for a person's personal and work relationships, and can prevent them from doing many everyday activities, such as driving a vehicle.

FIGURE 3 It is not safe for people with narcolepsy to drive a vehicle.

Managing narcolepsy

There is no widely accepted treatment for narcolepsy, but people with the condition can adopt a number of behavioural measures, such as sticking to routine sleep schedules, carrying out regular exercise and following a healthy diet. People with narcolepsy often schedule naps during the day, and avoid alcohol, caffeine and heavy meals, and other conditions that may encourage sleep, such as working in a hot, stuffy room. It can be difficult to avoid the strong emotional responses that may trigger sleep attacks, but learning about these triggers and ways to monitor responses may help.

FIGURE 4 Following a healthy diet and exercising can help manage narcolepsy.

Insomnia

Insomnia refers to persistent trouble with sleep. It is not the occasional sleeping problem that most of us experience from time to time. People with insomnia can have trouble falling asleep or maintaining sleep, even when they have the opportunity to do so. When they sleep, they often feel dissatisfied with the experience. They are likely to suffer sleep-deprivation effects such as fatigue, low energy, moodiness and trouble concentrating. Insomnia can negatively affect school and work and other activities. There are different types of insomnia that people may experience, including:

- **sleep-onset insomnia**: trouble falling asleep at the beginning of the night (takes 30 minutes or more)
- **sleep-maintaining insomnia**: difficulty staying asleep
- **early-morning awakening insomnia**: trouble with waking up too early and not being able to go back to sleep.

The following content is relevant to all types of insomnia, including sleep-onset insomnia, unless otherwise noted.

insomnia
a sleep disorder characterised by difficulties falling asleep, staying asleep and waking up at the right time

sleep-onset insomnia
a form of insomnia characterised by difficulty falling asleep at the beginning of the night

sleep-maintaining insomnia
a form of insomnia characterised by difficulty staying asleep throughout the night

early-morning awakening insomnia
a form of insomnia characterised by problems with waking up too early and not being able to go back to sleep

Acute and chronic insomnia

We can have acute episodes of insomnia that come on and resolve reasonably quickly, which may coincide with a stressful or emotional period, such as exam time or being told some bad news. However, insomnia can also be a chronic condition, meaning periods of sleeping difficulty occur at least three times a week over three months or longer. Chronic insomnia can arise for a number of reasons, including persistent stress, pain, shift work, or changes in habits, medications or the sleep environment. Often insomnia, including sleep-onset insomnia, is comorbid (exists alongside) with other physiological and/or psychological conditions.

Prevalence of insomnia

Insomnia is the most common sleep disorder, with 10 to 30 per cent of the adult population experiencing it at any one time. While both males and females can experience insomnia, there is an increased risk for females, the elderly and new parents. Adolescents and young adults are more likely to experience sleep-onset insomnia, while sleep-maintaining and early-morning awakening insomnia are more common in the elderly.

Diagnosis of insomnia

Diagnosis of insomnia usually involves use of a sleep diary, a sleep inventory (questionnaire about sleep), blood tests and perhaps a sleep laboratory study. Chronic sleep-onset insomnia may be diagnosed as a delayed circadian phase disorder if the person also has great difficulty waking up in the morning.

FIGURE 5 Stressful periods or events, such as receiving bad news, can lead to acute sleep-onset insomnia.

FIGURE 6 Sleep-onset insomnia is more common in adolescents and young adults.

Sleep diary	Name: Start date:						
Day of week:	**Day 1** Sun	**Day 2** Mon	**Day 3** Tues	**Day 4** Wed	**Day 5** Thur	**Day 6** Fri	**Day 7** Sat
What time did you get into bed?	am pm	am pm	am pm	am pm	am pm	am pm	am pm
What time did you try to go to sleep?	am pm	am pm	am pm	am pm	am pm	am pm	am pm
How long did it take you to fall asleep?	hrs mins	hrs mins	hrs mins	hrs mins	hrs mins	hrs mins	hrs mins
What time did you wake up this morning?	am pm	am pm	am pm	am pm	am pm	am pm	am pm
How many times did you wake up during the night?							
What was the total amount of time you were awake?							
What was the total amount of time you slept?	hrs mins	hrs mins	hrs mins	hrs mins	hrs mins	hrs mins	hrs mins
How would you rate your sleep quality?							
Very poor	☐	☐	☐	☐	☐	☐	☐
Poor	☐	☐	☐	☐	☐	☐	☐
Fair	☐	☐	☐	☐	☐	☐	☐
Good	☐	☐	☐	☐	☐	☐	☐
Very good	☐	☐	☐	☐	☐	☐	☐

FIGURE 7 Section of a sample sleep diary produced by the Sleep Foundation. Note the questions about falling and staying asleep, and quantity and quality of sleep.

Treatment for insomnia

There can be multiple approaches to the treatment of insomnia, including sleep-onset insomnia, and we will discuss cognitive behavioural therapy (CBT) in relation to this in Lesson 9.3. Approaches to treatment include:

- behavioural strategies, such as improving **sleep hygiene** or having good sleep habits, and learning relaxation
- cognitive strategies, such as learning to deal with negative thoughts and feelings about sleeping
- medical intervention, although only for a short time due to the need to limit and monitor the use of medications.

sleep hygiene
habits and strategies that can improve the quality and quantity of sleep

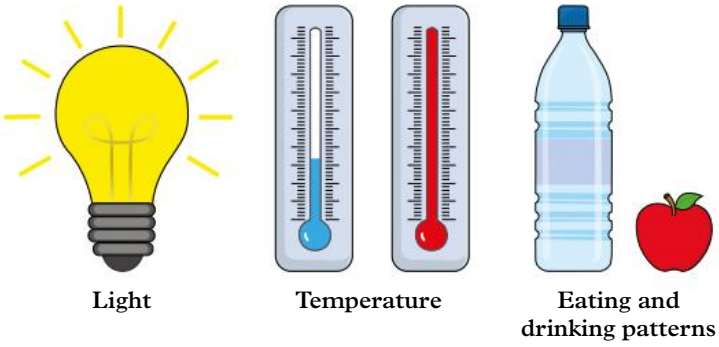


FIGURE 8 Improving sleep hygiene by modifying your exposure to light and high and low temperatures, and avoiding large meals before sleep can help prevent or resolve insomnia.

Sleep apnoea

Sleep apnoea, a sleep-related breathing disorder, refers to the interruption of breathing during sleep. Breathing stops briefly, but repeatedly, for periods from 10 seconds to up to a minute or more. Typically, the person then wakes, gasping for breath, and resumes breathing.

There are different forms of sleep apnoea, with obstructive sleep apnoea being the most common. In this case, the blockage is physical, with the airways failing to open. Another form, central sleep apnoea, is caused by the brain failing to adequately control breathing.

sleep apnoea
a type of sleep disorder characterised by the interruption of breathing during sleep

Effects of sleep apnoea

Sleep apnoea is linked to chronic snoring, and the constant disruption to sleep due to stopped breathing leads to low blood-oxygen levels. In turn, if it is left untreated, hypertension (high blood pressure), heart disease, and mood and memory problems can become major issues. Sleepiness during the day, and other sleep-deprivation effects, are also experienced and insomnia may result. Excessive sleepiness can make a person prone to accidents and affect work, recreation and relationships. It is estimated that about 10 per cent of people with sleep apnoea also experience other sleep disorders, such as sleepwalking.

FIGURE 9 As with any sleep disorder, untreated sleep apnoea can lead to accidents in the workplace.

Prevalence of sleep apnoea

Sleep apnoea affects all ages and both sexes. The systematic review of 24 studies conducted by Senaratna et al. (2017) shows that prevalence of moderate to severe obstructive sleep apnoea can range from 6 to 17 per cent in the general adult population. When including milder forms of obstructive sleep apnoea, prevalence ranges more broadly from 9 to 38 per cent. The prevalence of obstructive sleep apnoea in children is estimated at 2 to 3 per cent. Children who snore habitually may have obstructive sleep apnoea, and doctors may recommend the removal of enlarged tonsils and adenoids to open the airways. Those at risk of developing sleep apnoea include people with small upper airways or a large tongue or tonsils, people over 40 years of age, and people who are overweight and/or from certain ethnic backgrounds such as Hispanic and Pacific Islanders. Sleep apnoea can also run in families.

Diagnosing sleep apnoea

When diagnosing sleep apnoea, key issues to consider include a person's fatigue levels during the day, the quality and quantity of their sleep and, importantly, whether or not their partner or family members think they snore. Sleep diaries are also important and a sleep study performed at a sleep laboratory or at home may be involved.

Treatments for sleep apnoea

One of the most common and effective treatments for sleep apnoea is a CPAP (continuous positive airway pressure) device. It works by delivering a constant stream of pressurised air through a mask worn over the nose or nose and mouth during sleep. This continuous airflow helps to keep the airways open, preventing pauses in breathing and loud snoring. The increased air pressure from the CPAP device ensures that the individual receives a steady supply of oxygen, promoting restful and uninterrupted sleep.

Some behavioural changes are also recommended to help relieve symptoms of sleep apnoea. Losing weight, avoiding alcohol, and not sleeping on one's back can help. Some medications can make symptoms worse and all should be checked with a specialist.

FIGURE 10 Children who snore are likely to have obstructive sleep apnoea due to enlarged tonsils.

FIGURE 11 This person wears a CPAP mask that covers the nose only. Some masks cover both the nose and mouth.

Challenge

CPAP devices

A CPAP device is commonly used to treat sleep apnoea. **Investigate** the benefits and drawbacks of using a CPAP machine to treat sleep apnoea.

Sleepwalking

Sleepwalking, or somnambulism, is a sleep disorder that captures the interest of a lot of people. Sleepwalking occurs during stage 3 NREM sleep. About 7 per cent of children sleepwalk and 2 per cent of adults (Neveus et al., 2001; Ohayon et al., 1999), which suggests many "grow out of" sleepwalking. Sleepwalking can run in families, suggesting a genetic link. A sleepwalking episode is sometimes tied to a strong emotional event, illness, stress, alcohol or medication.

sleepwalking
a type of sleep disorder characterised by walking or completing routine activities during the night

Sleepwalkers

Most sleepwalkers follow routine activities that are automatic and require very little conscious awareness, such as walking down a corridor, brushing their teeth or going to the toilet. Most often stare blankly as they sleepwalk and do not respond to other people. Contrary to popular belief, sleepwalkers are not acting out their dreams as there is very little, if any, dreaming during stage 3 NREM sleep.

Sometimes during a sleepwalking episode, people may behave in ways that could be considered unacceptable. More commonly, this can include children going to the toilet in a cupboard, and less commonly, it can include people driving while sleepwalking.

It is a common misconception that it is dangerous to wake sleepwalkers. However, it can actually be dangerous not to wake a sleepwalker as they may harm themselves while walking. They are likely to be startled and disoriented if woken because they are in stage 3 NREM sleep. Typically, a sleepwalker will return to bed after their episode and will be unlikely to remember their sleepwalking activities when they wake.

FIGURE 12 Popular representations of sleepwalking often perpetuate misconceptions, such as that sleepwalkers walk with their eyes closed and arms held in front of them.

Managing sleepwalking

There is not a lot that can be done to prevent sleepwalking. Removing or reducing triggers for sleepwalking, such as particular medications, dealing productively with stress and considering diet and lifestyle, may help reduce the frequency of sleepwalking. The most important thing is to keep the sleep environment safe. Parents of children who sleepwalk, and people who sleepwalk, should ensure that they put any dangerous kitchen items away, and lock all doors and windows before sleep so that they are unlikely to leave their home if they sleepwalk.

Real-world psychology

Sleepwalker, age 15, found curled up on crane

She was more of a steep walker than a sleepwalker.

A passer-by could barely believe his eyes when he saw a body curled up on the counterweight of a 130-foot crane at 2.00 am.

The rescue operation his 999 call set in play revealed that the body belonged to a 15-year-old girl … who was fast asleep and blissfully unaware of her perilous predicament.

A fireman scaled the structure, on a building site in South-East London, and sat with the snoozing teenager while he anxiously discussed with colleagues below what to do next.

Fearful of waking her in case she should panic and fall, he attempted to secure her in position and conducted a cursory body search, finding a mobile phone. It is understood he found a number for her parents in the phone's memory. They were told the astonishing story, and then rang her on the mobile themselves to wake her.

A specialist fire rescue team, based at Battersea, arrived at the site and used a hydraulic ladder to carry the girl down. She was delivered safely to the ground and her parents came to collect her.

No one knows how she managed to climb up the crane. But Dr Irshaad Ebrahim, of the London Sleep Centre, said he was not surprised. Anything you can do while awake, you can do while sleepwalking, he said. And, of course, without the fear factor. "I treat people who have driven cars, ridden horses and even attempted to fly a helicopter while asleep," he said.

"However, this is one of the more unusual cases I've come across. Up to 10 per cent of adolescents sleepwalk, so her age is a common factor. Sleepwalking is nothing to do with dreaming because it occurs in a non-dreaming sleep state."

The girl apparently walked unnoticed out of her home in Dulwich to the building site nearby. The crane was switched off and in a stationary position.

After reaching the top she somehow crawled around 40 feet horizontally to the end of the counterweight section of the crane.

A London Fire Brigade spokesman, who attended the incident, said: "It was tense for a while.

"One of our guys had to wait up there with her, making sure she was all right and couldn't fall.

"She was fast asleep until we got one of her relatives to phone her. That woke her."

The girl did not need medical treatment and her name has not been released by emergency services.

The incident happened in the early hours of Saturday, June 25. The medical term for sleepwalking is somnambulism. Experts say it is common for sleepwalkers to go outside or up stairs.

But it is a myth that waking a sleepwalker will seriously harm them, they say, though they might become confused or hysterical.

Dr Neil Stanley, of Surrey University's psychopharmacology research unit, said:

"… People do all manner of odd things when they are sleepwalking, including driving 20 kilometres and killing their parents."

Source: Olinka Koster and Tahira Yaqoob (*Daily Mail*, 2005)

FIGURE 13 The counterweight of a crane balances the weight of the object being lifted so the crane doesn't tip over.

Apply your understanding

1 **Identify** the stage of sleep the girl was most likely in when she began sleepwalking. (1 mark)

2 **Explain** why the fireman hesitated to wake the sleepwalker. (1 mark)

3 **Propose** two steps the girl's family could take to prevent a similar episode occurring in the future. (2 marks)

Comparing common sleep disorders

There is a broad range of sleep disorders, and each one presents complex challenges. Table 1 compares the four common sleep disorders covered in this lesson: narcolepsy, sleep-onset insomnia, sleep apnoea and sleepwalking.

TABLE 1 Comparing sleep disorders

Feature	Narcolepsy	Sleep-onset insomnia	Sleep apnoea	Sleepwalking
Definition	A sleep disorder that causes sudden and unexpected sleeping	Type of insomnia that causes difficulty falling asleep	A sleep disorder that involves periods of the cessation of breathing during sleep	The act of walking or completing routine activities while asleep
Effects/ Symptoms	• Sleepiness during the daytime • Loss of muscle control • REM hallucinations • Can experience cataplexy • Beginning nighttime sleep with REM	• Inability or excessive time to fall asleep at the start of the night • Unsatisfactory sleep • Excessive daytime sleepiness • Fatigue • Low energy • Moodiness	• Cessation of breathing for periods of the night • Gasping for breath during the night • Excessive daytime sleepiness • Chronic snoring • Can lead to hypertension, heart disease, mood and memory problems	• Walking during the night • Completing routine acts during the night, e.g. brushing one's teeth, going to the toilet • Excessive daytime sleepiness
Prevalence	• Males and females thought to be equally affected • Relatively rare compared to other sleep disorders	• More common in females • Prevalence of approximately 10 to 30% in adults	• Occurs in both adults and children • Prevalence of approximately 6 to 17% in adults (moderate to severe) • Prevalence of approximately 2 to 3% in children	• More common in children • Prevalence of approximately 7% in children • Prevalence of approximately 2% in adults
Cause	• Can run in families • Highly emotional events • Could be triggered by medications or illnesses	• Can run in families • Stressful or highly emotional events • Can be triggered by medications or illnesses	• Obstructive sleep apnoea – caused by a physical obstruction to breathing (could be weight, or the inability of the airways to open) • Central sleep apnoea – caused by the brain failing to adequately control breathing	• Triggered by a highly emotional event • Stress • Alcohol • Medications • Diet and lifestyle
Treatment	• Maintaining a routine sleep schedule • Regular exercise • Healthy diet • Scheduling naps during the day • Avoiding alcohol and caffeine	• Cognitive behavioural therapy (CBT) • Maintaining a sleep routine • Relaxation techniques • Learning to deal with negative thoughts and emotions • Medical intervention	• CPAP device • Diet changes • Exercise • Weight loss • Avoiding alcohol • Medication	• Keeping a safe sleep environment • Maintaining a sleep routine • Avoiding alcohol • Diet and lifestyle reviews

It is important to remember that all sleep disorders can cause effects of sleep deprivation, which can impact school, work, relationships, social problems, health issues and safety.

Check your learning 9.2

Check your learning 9.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** when sleepwalking is likely to occur with reference to age, emotional state and stage of sleep. (3 marks)
2 **Describe** the effects of narcolepsy, sleep-onset insomnia, sleep apnoea and sleepwalking. (4 marks)

Analytical processes

3 **Contrast** narcolepsy and sleepwalking. (1 mark)
4 **Discriminate** between obstructive and central sleep apnoea. (1 mark)
5 **Compare** the causes of narcolepsy, sleep-onset insomnia, sleep apnoea and sleepwalking. (3 marks)

Lesson 9.3
Treatments for sleep disorders

Learning intentions and success criteria

Key ideas

→ Cognitive behavioural therapy is commonly used to treat insomnia. It involves changing a person's thoughts and behaviours related to sleep to make sleep more likely.
→ Bright light therapy is used to treat circadian phase disorders. People are exposed to bright light regularly to reset their sleep–wake cycle.
→ Tips for a better night's sleep include having a regular, relaxing bedtime routine, avoiding stimulating foods after 3 pm and avoiding stimulating activities right before bed.

Introducing treatments for sleep disorders

There are a number of interventions that can be attempted to manage sleep disorders, and sleep psychologists and other health professionals are likely to take a multipronged approach. In this lesson, we will focus on cognitive behavioural therapy to treat insomnia, bright light therapy to treat circadian phase disorders, and tips we can all follow to improve our sleep.

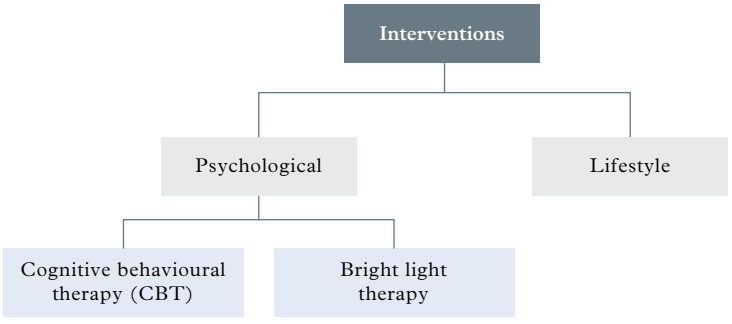


FIGURE 1 Some of the interventions that can help people get a good night's sleep.

Cognitive behavioural therapy

Using **cognitive behavioural therapy (CBT)** to treat insomnia assumes that our behaviours and cognitions (thoughts and feelings) with regard to sleep influence each other strongly. It recognises, for example, that we can get into a nasty cycle where our poor sleep behaviours lead to negative thoughts and emotions about sleep, which then influence the poor sleep behaviours further. CBT seeks to establish an alternative healthy sleep cycle so that sleep can become automatic, natural and restful.

cognitive behavioural therapy (CBT) a form of psychotherapy that focuses on breaking unhealthy patterns of thinking or behaving and replacing them with positive habits and coping skills

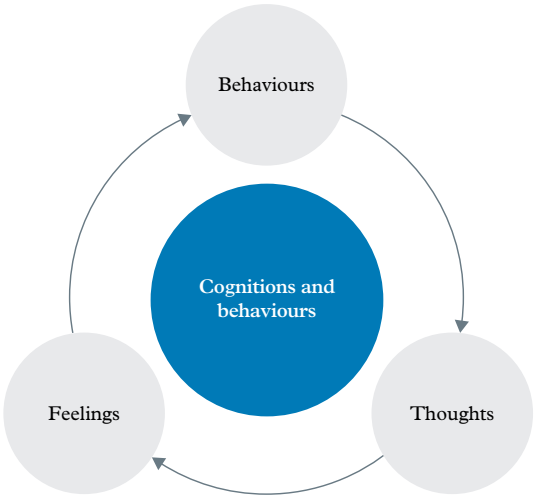


FIGURE 2 Cognitions influence behaviours, which in turn influence cognitions.

Study tip

Cognitive behavioural therapy has a variety of uses. Go to Lesson 15.2 to learn more about the use of CBT to treat psychological disorders.

CBT in practice

A sleep psychologist is likely to ask their client to complete a sleep questionnaire to assess their sleep and lifestyle habits, along with their attitudes towards sleep. They will then devise an individualised program to change these habits and attitudes for the better. The client may also be asked to keep a sleep diary to record their sleep behaviours and cognitions about sleep.

In their sessions with the psychologist, clients may be taught specific behaviours to facilitate good sleep, such as:

- maintaining regular sleep–wake times
- avoiding long naps during the day
- following a healthy diet and exercise program
- avoiding stimulating activities such as exercise, coffee and electronic screens in the couple of hours before going to bed.

The psychologist might also recommend that the client ensures that their bedroom environment is conducive to good sleep, such as having window dressings that block out the light and a good pillow. The sleep psychologist is likely to want to monitor and reassess the effectiveness of the CBT program on a regular basis.

Effectiveness of CBT for treating sleep-onset insomnia

It usually takes six to eight weekly sessions of CBT for the client to learn new cognitions and behaviours to support their sleep in the long-term. The effectiveness of the program lies in the psychologist's ability to target the problematic behaviours and cognitions, and the client's commitment to change. The results of CBT to date have been very positive and it is typically the preferred option for treating insomnia.

FIGURE 3 A sleep psychologist will work with a client to change unhealthy sleep behaviours and attitudes.

Skill drill

Case study of DM

Science inquiry skill: Evaluating evidence (Lesson 1.8)

Psychologists can gain information about psychological phenomena in different ways. These include laboratory experiments, where the researcher manipulates and controls the variables, and case studies, where the researcher observes phenomena naturally.

DM visited his GP with complaints of lethargy, daytime sleepiness and a general feeling of being physically and mentally unwell. DM was diagnosed with insomnia and his GP recommended that DM visit a sleep psychologist. The sleep psychologist suggested that DM try cognitive behavioural therapy for insomnia (CBT-I). The aim of CBT-I is to improve behaviours and sleep habits by identifying and then changing the thought patterns and behaviours that affect a person's ability to sleep.

By asking DM to keep a sleep diary for 2 weeks, the sleep psychologist identified that DM was under extra stress at work, and having ice cream and coffee after dinner. DM was also watching TV in bed and checking his computer for emails right before he was trying to sleep. DM was averaging 4 to 5 hours of sleep per night. The sleep psychologist created a CBT-I plan for DM. The plan included sleep regulation, restriction and hygiene. It suggested that DM should keep his sleep space dark and quiet, and remove TVs and computers. DM was also told to keep a consistent bedtime and to only go to bed when he was going to sleep. DM was also told not to eat or drink anything other than water for 3 hours before bedtime. DM followed this plan for 8 weeks.

Practise your skills

1 **Identify** a strength of using a case study for this investigation. (1 mark)
2 **Identify** a limitation of using a case study for this investigation. (1 mark)
3 **Identify** if the findings from a case study are qualitative or quantitative or both. **Explain** your response. (2 marks)

Bright light therapy to treat circadian phase disorders

Bright light therapy is used to treat people experiencing circadian phase disorders to advance or delay sleep, depending on the type of circadian phase disorder. People with delayed sleep–wake phase disorder have bright light therapy administered to them in the morning, when the body wants to sleep. People experiencing advanced sleep–wake phase disorder are likely to have bright light therapy in the evening, in an attempt to delay sleep. The bright light therapy signals to the brain's **suprachiasmatic nucleus** that it is daylight, effectively acting as a **zeitgeber** (an external cue or stimulus that helps regulate the body's circadian rhythms). In turn, the suprachiasmatic nucleus can adjust the body clock, including ceasing the release of melatonin from the pineal gland.

People with jet lag may benefit from bright light therapy in the morning when they travel west to east, or in the evening when they travel from east to west.

Shift workers often need to sleep during daylight hours. It can be very hard to correct the body's response to a shift-work schedule, especially if it changes regularly or the worker wants to revert to standard daytime activities on their days off. However, bright light therapy may help to keep them awake during their night shift if they use it in the evenings as they go off to work.

bright light therapy
the use of a high-intensity light to advance or delay sleep and therefore treat circadian phase disorders

suprachiasmatic nucleus (SCN)
located in the hypothalamus where the left and right optic nerves cross paths, it controls circadian rhythms in response to external stimuli

zeitgeber
external or environmental cue that affects the sleep–wake cycle, such as the level of light in a room

Side effects of bright light therapy

Although the side effects of bright light therapy are minimal, a specialist is required to ensure that the exposure is safe and consistent. It is not uncommon for the subject of the treatment to sustain eye irritations, dry skin, headaches and nausea, especially at the start of treatment. There should be limits to the intensity of and time in front of the bright light. The therapy should begin slowly, with exposure gradually increasing as the body gets used to it.

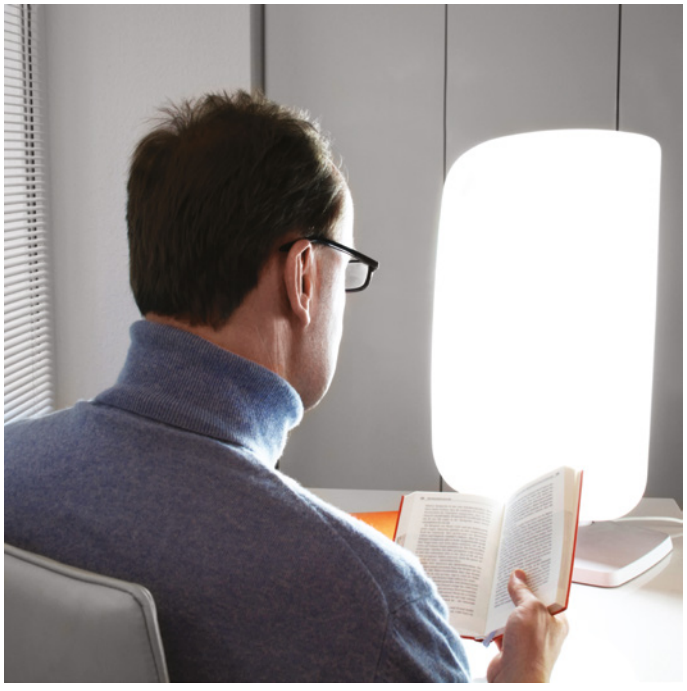


FIGURE 4 Bright light therapy is used to treat circadian phase disorders.

Bright light therapy in practice

Bright light therapy requires a high-intensity light (between 2000 and 10,000 lux). Different types of lights can be used, although light boxes are the most common. The light box contains many light tubes, and plugs into the wall from where it emits blue light; that is, light that approximates daylight. A person needs to be near the box but they don't need to look at it, and can often complete everyday activities at the same time.

Other types of high-intensity lights include desk lamps that look like a typical lamp or light visors that can be worn like a normal visor and shine light on the person's forehead. Dawn simulators may also be used. These lights gradually increase the light within a room, in an attempt to mimic sunrise, or gradually decrease it to mimic sunset.

Suggested dosages for bright light therapy have been outlined by Chesson and colleagues (1999) and are shown in Table 1.

TABLE 1 Bright light therapy treatments for various circadian phase disorders

Circadian phase disorder	Timing of therapy	Light intensity (lux)	Effect
Delayed phase sleep–wake disorder	Early morning (6 to 9 am)	2,000–2,500	• Earlier release of melatonin • Shifts circadian phase forward
Advanced sleep–wake phase disorder	Evening (8 to 11 pm)	2,500–4,000	• Delayed release of melatonin • Shifts the circadian phase backwards
Circadian phase disorder as a result of shift work	• For at least 3 hours in the evening before starting night shift • Light-reducing eyewear after the night shift and avoiding light before sleep during the day	5,000–10,000	• Delayed release of melatonin • Shifts the circadian phase backwards • Reduced light exposure at the end of the night shift supports the natural release of melatonin

Real-world psychology

"I tried light therapy and it made a huge difference in my life"

In January 2018, *Women's Health* magazine published an article by Lauren Bedosky, where she discusses her experience with bright light therapy as a treatment for delayed phase sleep–wake disorder.

Bedosky used a light box for 3 weeks, following the directions of researcher Phyllis Zee, Director, Center for Circadian and Sleep Medicine at Northwestern University in the United States. Bedosky turned on the light box when she woke between 9 am and 10 am each day and typically used it for 30 minutes. Zee advises that it is critical to do the treatment within 1 hour of waking to kick-start the sleep–wake cycle.

Again, on Zee's advice, Bedosky sat 30 to 45 centimetres away from the light box. Sitting too close to the box would have caused her pupils to constrict (get smaller) and not allow much light in.

Although Bedosky didn't feel different for the first few days of using the light box, after consistent use over 1 week, she reported experiencing benefits such as increased energy levels, improved focus, and a shift in her sleep pattern, where she fell asleep earlier than usual.

Bedosky's article emphasises the importance of regular and timely use of light therapy to see its effects.

Apply your understanding

1 **Describe** the effects of the sleep disorder that Bedosky was treating with light therapy. (1 mark)

2 **Deduce** the effect of using a light box later than within the first hour of waking. (1 mark)

Tips for a better night's sleep

Sleep is important and, whether or not we have a sleep disorder, all of us can take steps to improve our sleep quality. Understanding sleep–wake cycle shifts and the need for adequate sleep can help teenagers avoid sleep deprivation. Just an extra 30 minutes of sleep each night can make a significant difference. You need to be patient and persistent because it takes about 4 weeks to set up an earlier sleep time, but the potential benefits are worth it. Practices designed to improve our ability to fall and stay asleep are referred to as sleep hygiene. Read the tips for a better night's sleep and start improving the quality of your sleep.

- Follow a regular routine. Go to bed at the same time and get up at the same time each day, even on the weekends.
- Have a relaxing bedtime routine such as a bath followed by a drink of warm milk.
- Try to limit your weekend sleep-ins to Saturday morning only. Staying up late and sleeping in too much is likely to shift your sleep–wake cycle. You will go to bed later on Sunday and find it hard to get up on Monday morning.
- Avoid stimulating activities just before bedtime, such as computer games, arguments, physical exercise, loud music, homework and television. Turn off all screens well before bedtime.
- Avoid caffeinated products, especially after 3 pm (skip that can of Coke or late-night coffee).
- Don't worry if you can't sleep straight away. It is normal to take 15 minutes or more to fall asleep at night. Also remember that sleeping poorly one night is not the end of the world – you will probably find you sleep better the following night.
- Keep your room dark at night and brighten it when you want to wake up in the morning by opening curtains or turning on lights.

It is important to take sleep as seriously as the other aspects of your health and wellbeing. If you are having persistent trouble sleeping, then it is time to seek professional help. Your family doctor, psychologist or school counsellor is a good starting point.

Check your learning 9.3

Check your learning 9.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the experience of daily bright light therapy. (1 mark)

2 **Explain** how bright light therapy assists those with circadian phase disorders. (1 mark)

3 **Explain** how cognitive behavioural therapy (CBT) is used to treat insomnia. (1 mark)

Analytical processes

4 **Identify** one strength and one limitation of using cognitive behavioural therapy (CBT) in helping those with sleep disorders. (2 marks)

5 **Identify** one strength and one limitation of using bright light therapy in helping those with sleep disorders. (2 marks)

Knowledge utilisation

6 Hamid has been struggling to fall asleep for the past 2 months. Typically, Hamid arrives at school early to train for basketball, but recently he has been too tired. **Propose** a treatment strategy that may assist Hamid. (1 mark)

MODULE 9

Lesson 9.4
Review: Sleep disorders

Summary

9.1
- Circadian phase disorders are sleep disorders where a person's internal sleep–wake clock is disrupted.
- Examples include the adolescent sleep–wake phase shift, and the effects of shift work and jet lag, which are both caused by environmental, or external, factors.

9.2
- Narcolepsy is characterised by sudden and unexpected sleeping. People with narcolepsy experience REM sleep before NREM sleep, and can enter REM sleep directly from wakefulness.
- Sleep-onset insomnia is characterised by difficulty falling asleep at the beginning of the night. It can be acute or chronic.
- Sleep apnoea is characterised by interrupted breathing during sleep. Most commonly it is obstructive, where the airways fail to open due to a blockage.
- Sleepwalking occurs during stage 3 NREM sleep. Sleepwalkers generally perform automatic processes or routine activities.

9.3
- Cognitive behavioural therapy is commonly used to treat insomnia. It involves changing a person's thoughts and behaviours related to sleep to make sleep more likely.
- Bright light therapy is used to treat circadian phase disorders. People are exposed to bright light regularly to reset their sleep–wake cycle.
- Tips for a better night's sleep include having a regular, relaxing bedtime routine, avoiding stimulating foods after 3 pm, and avoiding stimulating activities right before bed.

Review questions 9.4A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 Which of the following is linked to a circadian phase disorder?
- **A** Narcolepsy
- **B** Sleepwalking
- **C** Adolescent sleep–wake cycles
- **D** Shift work

2 Which of the following is classified as a sleep disorder?
- **A** Jet lag
- **B** Shift work
- **C** Sleep apnoea
- **D** NREM disorder

3 Jim sometimes gets out of bed during the night and walks through the house. He does not respond when his sisters speak to him.
- **A** Jim is experiencing sleepwalking, which usually occurs during REM sleep.
- **B** Jim is experiencing narcolepsy, which usually occurs during stage 3 NREM sleep.
- **C** Jim is experiencing sleepwalking, which usually occurs during stage 3 NREM sleep.
- **D** Jim is experiencing narcolepsy, which usually occurs during REM sleep.

4 Renata finds it very difficult to fall asleep at the beginning of the night. She sees a sleep psychologist, who determines that she is experiencing
   A sleep-maintaining insomnia and suggests she starts a bright light therapy treatment program.
   B sleep-maintaining insomnia and suggests she starts a cognitive behavioural therapy treatment program.
   C sleep-onset insomnia and suggests she starts a bright light therapy treatment program.
   D sleep-onset insomnia and suggests she starts a cognitive behavioural therapy treatment program.

5 Which of the following brain structures is primarily responsible for controlling our internal body clock?
   A The frontal lobe
   B The pineal gland
   C The hippocampus
   D The suprachiasmatic nucleus

6 A person diagnosed with sleep-onset insomnia is likely to
   A go straight to sleep upon going to bed.
   B take at least 30 minutes to fall asleep.
   C function normally on very few hours of sleep.
   D suddenly collapse into REM sleep in the middle of the day.

7 Which is the most common of the sleep disorders?
   A Sleepwalking
   B Narcolepsy
   C Insomnia
   D Sleep apnoea

8 A circadian phase disorder is best described as
   A a sleep disorder that affects a person's internal sleep–wake clock.
   B a sleep disorder that maintains a person's internal sleep–wake clock.
   C a sleep disorder that disrupts someone's natural daily rhythm.
   D a sleep disorder that causes someone to struggle to fall asleep.

9 Sleep apnoea can be best treated using
   A bright light therapy.
   B cognitive behavioural therapy.
   C a CPAP device.
   D a consistent bedtime.

10 Which of the following are caused by all sleep disorders?
   A Excessive daytime sleepiness and waking during the night
   B Excessive daytime sleepiness and REM hallucinations
   C Excessive daytime sleepiness and chronic snoring
   D Excessive daytime sleepiness and sleep deprivation

11 Cognitive behavioural therapy
   A focuses on changing unhealthy thoughts and behaviour to positive and healthy thoughts and behaviour.
   B focuses on how the brain thinks.
   C involves the use of a bright light to advance or delay sleep.
   D wearing a device to assist breathing.

12 **Identify** the most appropriate definition of insomnia.
   A When an individual struggles to stay awake in the middle of the day
   B When an individual has difficulty falling or staying asleep
   C When an individual cannot fall asleep at the start of the night
   D When an individual cannot stay asleep throughout the night

13 A sleepwalker should
   A be woken when found.
   B keep the environment around them safe and secure.
   C review their diet and lifestyle.
   D all of the above.

Review questions 9.4B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

14 **Describe** sleepwalking. (1 mark)

15 **Describe** sleep-onset insomnia. (1 mark)

16 **Explain** what someone with narcolepsy experiences. (1 mark)

17 Cognitive behavioural therapy is often successfully used to treat insomnia. **Describe** cognitive behavioural therapy. (1 mark)

18 **Explain** how bright light therapy works to treat circadian phase disorders. Refer to the sleep–wake cycle in your answer. (1 mark)

19 **Describe** how bright light therapy is usually administered. Relate the timing of the bright light therapy to delayed sleep–wake phase disorder, advanced sleep–wake phase disorder, shift work and jet lag. (4 marks)

Analytical processes

20 **Differentiate** between insomnia and sleep apnoea. (1 mark)

21 **Compare** the effects of narcolepsy and sleepwalking. (2 marks)

22 Tina, a 45-year-old female, suspects she is experiencing a sleep disorder. She is often tired even though she routinely has 8 hours of sleep. Her partner reports that she keeps him awake with her snoring at night.

- **a** **Deduce** the sleep disorder that Tina is likely to be experiencing. (1 mark)
- **c** **Identify** the two possible causes of Tina's symptoms. (2 marks)
- **b** **Explain** why Tina is tired even after 8 hours of sleep each night. (1 mark)
- **d** **Identify** a suitable treatment for Tina's disorder. (1 mark)

Knowledge utilisation

23 Bright light therapy is likely to be only one part of the treatment plan for circadian phase disorders. **Propose** what else may be part of a treatment plan and **explain** why. (2 marks)

24 Alejandro is a 9-year-old boy. In the middle of the night, Alejandro's mother has seen him going to the fridge, and also brushing his teeth. Alejandro always stares straight ahead while completing these actions and doesn't really appear aware of what he is doing. His mother is concerned about him moving around without being awake.

- **a** **Identify** what Alejandro is likely to be experiencing. (1 mark)
- **b** **Describe** the stage of sleep this typically occurs in. (1 mark)
- **c** **Propose** what Alejandro and his mother can do to ensure that he sleeps safely. (1 mark)

25 You have now learnt about the importance of sleep. Consider how our way of life is affecting our sleeping habits. **Predict** whether a higher incidence of sleep problems may be diagnosed in the future. **Justify** your answer. (2 marks)

Data drill

The effectiveness of CBT for delayed sleep phase disorder

Researchers investigated the effectiveness of cognitive behavioural therapy (CBT) for adolescents diagnosed with delayed sleep phase disorder (DSPD). Using a repeated measures design, they conducted a controlled trial of CBT intervention (8 weeks of treatment). Ten adolescents diagnosed with DSPD participated in the trial. Participants completed a questionnaire to assess the number of hours of sleep before and after treatment over a 6-day period. A paired *t*-test was used to analyse the data, which determined a *p*-value of 0.00217.

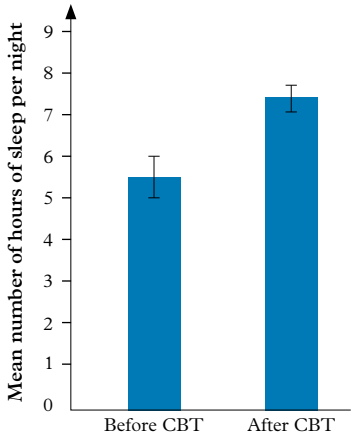


FIGURE 1 The mean number of hours of sleep per night before and after CBT treatment, with standard error bars

TABLE 1 Mean and standard deviation of the number of hours of sleep before and after CBT treatment

Descriptive statistics	Before CBT	After CBT
Mean		
Standard deviation	1.51	0.97

Apply understanding

1 **Determine** the mean hours of sleep for participants before CBT. (1 mark)

2 **Determine** the mean hours of sleep for participants after CBT. (1 mark)

Analyse data

3 **Identify** one characteristic of the data that makes it appropriate to use a paired *t*-test for analysis. (1 mark)

4 **Contrast** the standard deviations of the before CBT results and the after CBT results. (1 mark)

Interpret evidence

5 **Determine** if there is a difference in the hours of sleep between the before CBT group and the after CBT group, with reference to error bars in Figure 1. (2 marks)

6 **Draw a conclusion** about the effectiveness of CBT in the treatment of DSPD, with reference to the *t*-test. (2 marks)

Module 9 checklist: Sleep disorders

Quizlet: Revise key terms online to test your understanding

UNIT 1

Topic 3 review

Multiple choice

(1 mark each)

1 Consciousness is primarily defined as
- **A** a state of deep sleep.
- **B** a state of physical wakefulness.
- **C** awareness of internal and external events.
- **D** the ability to perform multiple tasks simultaneously.

2 Which neurotransmitter is linked to making us feel sleepy according to the restoration theory of sleep?
- **A** Serotonin
- **B** Dopamine
- **C** Adenosine
- **D** Acetylcholine

3 Which sleep stage is characterised by a relaxed state with hallucinatory images and muscle twitches?
- **A** REM sleep
- **B** Stage 1 NREM sleep
- **C** Stage 2 NREM sleep
- **D** Stage 3 NREM sleep

4 A circadian phase disorder is
- **A** a disorder affecting the body's internal sleep–wake clock.
- **B** a disorder caused by excessive daytime sleepiness.
- **C** a disorder characterised by excessive snoring.
- **D** a disorder related to vivid dreams during sleep.

5 Which sleep disorder involves sudden sleep attacks during the day?
- **A** Sleep apnoea
- **B** Sleepwalking
- **C** Narcolepsy
- **D** Insomnia

6 Which hormone plays a key role in regulating the sleep–wake cycle and is produced by the pineal gland?
- **A** Adrenalin
- **B** Melatonin
- **C** Cortisol
- **D** Insulin

7 What role does the reticular formation play in attention?
- **A** Filtering sensory information
- **B** Regulating circadian rhythms
- **C** Regulating hormone secretion
- **D** Facilitating muscle movements

8 The evolutionary theory of sleep focuses on
- **A** when and why different species sleep in relation to survival.
- **B** the importance of sleep for daily functioning.
- **C** the amount of sleep required for survival.
- **D** the stages of sleep and their functions.

9 Which sleep disorder involves persistent difficulty falling asleep or staying asleep?
- **A** Insomnia
- **B** Narcolepsy
- **C** Sleep apnoea
- **D** Delayed sleep–wake phase disorder

10 What is a potential consequence of untreated sleep apnoea?
- **A** Improved memory function
- **B** Decreased risk of insomnia
- **C** Reduced risk of hypertension
- **D** Increased risk of heart disease

11 Which brainwave pattern is associated with deep NREM sleep?
- **A** Beta waves
- **B** Delta waves
- **C** Alpha waves
- **D** Theta waves

12 How do modern EEGs differ from traditional EEGs in studying brainwave patterns?
- **A** Modern EEGs have fewer electrodes.
- **B** Modern EEGs can only detect alpha waves.
- **C** Modern EEGs recognise more individual frequencies.
- **D** Modern EEGs are less accurate in interpreting brain activity.

13 What is a criticism of the restoration theory of sleep?

A It underestimates the role of neurotransmitters in sleep regulation.

B It overlooks the importance of REM sleep in memory consolidation.

C It fails to explain why certain individuals need less sleep than others.

D It assumes a direct causal relationship between sleep and physical recovery.

14 What physiological process occurs during NREM sleep that helps replenish the body?

A Release of growth hormones

B Increased synthesis of proteins

C Activation of the immune system

D Restoration of neurotransmitter levels

15 What behavioural characteristic of teenagers is attributed to delayed melatonin release?

A Waking up early

B Preference for late bedtime

C Preference for early bedtime

D Increased daytime sleepiness

Short response

16 **Describe** the continuum of arousal. (1 mark)

17 **Identify** the technique used to measure eye muscle movement during sleep. (1 mark)

18 **Describe** the sleep–wake cycle, with reference to the four stages of sleep. (4 marks)

19 **Describe** the sleep–wake shift in adolescence, with reference to how the circadian rhythm changes, and two possible impacts of the shift on adolescent sleep patterns. (3 marks)

20 **Identify** three physical and/or psychological consequences of total and partial sleep deprivation. (3 marks)

21 **Describe** two potential consequences of untreated sleep apnoea on long-term health. (2 marks)

22 **Describe** one treatment intervention for circadian phase disorders. (1 mark)

23 **Explain** how brain structures and hormones regulate and direct consciousness. (2 marks)

24 **Explain** why REM sleep is considered crucial for psychological wellbeing. (1 mark)

25 **Explain** the impact of altered states of consciousness on controlled processes, using an example. (2 marks)

26 **Explain** REM rebound. (1 mark)

27 **Discriminate** between selective and divided attention, using an example. (2 marks)

28 **Contrast** the symptoms of sleep-onset insomnia and sleep apnoea. (1 mark)

29 **Compare** the restoration and evolutionary theories of sleep. (2 marks)

30 **Discuss** two criticisms of the restoration theory of sleep. (2 marks)

TOTAL MARKS

/43 marks

UNIT 1

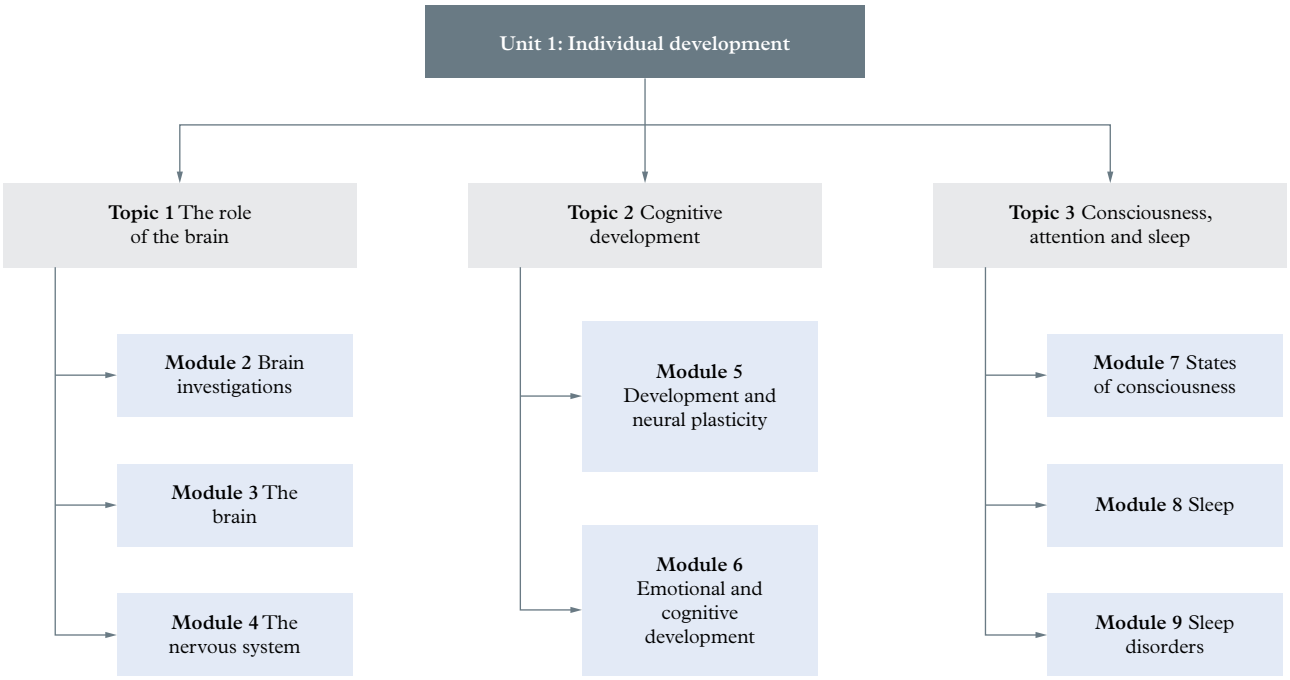
Review

This unit review is designed to help you revise your understanding of key concepts for all the content covered in Unit 1, learn some expert tips for answering exam questions, and practise your skills answering a range of exam-style questions.

Part A: Revisit and revise

Unit 1 overview

The chart shows all the topics in Unit 1 and where you can find information about them in your *Psychology for Queensland Units 1 & 2 Second edition* resource.



Part B: Exam essentials

Now that you have completed your revision for Unit 1, it is time to learn and practise some of the skills you'll need to answer exam questions like a pro! Our expert authors have created the following advice and tips to help you maximise your results on the end-of-year examination.

Exam tip 1: Use the mark allocation as a guide.

Mark allocations for exam questions provide a guide about how much information you should provide in your response. If a question is worth 2 marks, for example, you should assume that you are required to do two things, or provide two pieces of information, to receive full marks.

See it in action

Read the exam-style question and see how the tip has made a difference between a complete and an incomplete response.

Question 1 (2 marks)

Describe the structure of a neuron and the function of the myelin sheath.

Complete response

Identifies that a neuron has five main components and describes how they fit together to form a neuron [1 mark]

A neuron has five main components. Dendrites extend from the cell body. An axon runs from the cell body to axon terminals. The axon is coated in myelin, which forms a sheath around the axon. The myelin sheath insulates the axon to make the transmission of electrical impulses along the axon quick and efficient.

Describes the function of the myelin sheath [1 mark]

Incomplete response

Identifies that a neuron has five main components and describes how they fit together to form a neuron [1 mark]

A neuron has five main components. Dendrites extend from the cell body. An axon runs from the cell body to axon terminals. The axon is coated in myelin, which forms a sheath around the axon.

Notes that the myelin sheath coats the axon, but does not describe its function [0 marks]

Think like an assessor

To maximise your marks on an exam, it can help to think like a QCAA assessor. Consider how many marks each question is worth and what information the assessor is looking for.

A student has given the following response in a practice exam. Imagine you are a QCAA assessor and use the marking guide to mark the response.

Question 2 (2 marks)

Describe phrenology. Refer to Franz Gall in your response.

Phrenology was a pseudoscience based on the belief that mental abilities and personality were controlled by 27 brain organs corresponding to specific abilities and traits. Phrenologists believed that the more an organ was used, the larger it got, and that the skull changed shape to accommodate the changing sizes of the brain organs.

Marking guide

Question 2	• Describes phrenology and provides an accurate description (1 mark) • Refers to Franz Gall in the description and accurately describes his contribution to phrenology (1 mark)

Fix the response

Consider where you did and did not award marks in the response. How could the response be improved? Write your own response to the same question to receive full marks from a QCAA assessor.

Exam tip 2: Only provide the information requested.

The text of a question also provides important information about the expected response. Make sure you only provide the information that is requested. For example, a question requiring you to "Describe" something and give an example is asking for one example. Don't waste time providing two examples; you won't get additional marks and you'll lose time that you could spend answering other questions.

See it in action

Read the exam-style question and see how the tip has made a difference between the two responses.

Question 3 (2 marks)

Describe the function of the hindbrain and provide an example.

Response 1

Identifies the function of the hindbrain [1 mark]

The hindbrain supports bodily functions such as breathing.

Provides one example [1 mark]

Response 2

Identifies the function of the hindbrain [1 mark]

Provides one example [1 mark]

The hindbrain supports bodily functions such as breathing, digestion and voluntary movement.

Provides two additional examples [0 marks]

Think like an assessor

To maximise your marks on an exam, it can help to think like a QCAA assessor. Consider how many marks each question is worth and what information the assessor is looking for.

A student has given the following response in a practice exam. Imagine you are a QCAA assessor and use the marking guide to mark the response.

Question 4 (1 mark)

Contrast sensory neurons and motor neurons.

Sensory neurons and motor neurons both interact with the central nervous system. Sensory neurons send messages to the spinal cord, whereas motor neurons conduct messages away from the spinal cord.

Marking guide

Question 4	Correctly identifies a difference between sensory and motor neurons and uses a contrast word or phrase. (1 mark)

Fix the response

Consider where you did and did not award marks in the response. How could the response be improved? Write your own response to the same question to receive full marks from a QCAA assessor.

Exam tip 3: Justify answers with evidence.

- Exam questions sometimes ask you to "justify" your response. This is an indication that you should provide evidence or reasoning to support your answer.
- The question will usually let you know how you should justify your response. For example, it might ask you to justify your response by referring to a particular study or model, or to evidence provided in the question's stimulus.

See it in action

Read the exam-style question and see how the tip has made a difference between a complete and an incomplete response.

Question 5 (2 marks)

Explain why 16-year-old Melissa struggles to fall asleep before midnight. **Justify** your response with reference to changes in the sleep–wake cycle across the lifespan.

Complete response

Identifies that it is typical for adolescents to become sleepy later in the day than people of different ages [1 mark]

Melissa is an adolescent and it is typical for adolescents to become sleepy later in the day than they used to as younger children. This is because adolescents experience a sleep–wake shift where they release the sleep hormone melatonin later in the day than younger children and adults. This means that they struggle to fall asleep earlier in the evening.

Justifies the response referring to the adolescent sleep–wake shift, one of the changes in the sleep–wake cycle that occurs across the lifespan [1 mark]

Incomplete response

Identifies that it is typical for adolescents to become sleepy later in the day [1 mark]

Melissa is an adolescent and it is typical for adolescents to want to sleep later in the evening. This is because adolescents release the sleep hormone melatonin later in the day.

Identifies that adolescents release melatonin later in the day, but does not relate this to a change in the sleep–wake cycle [0 marks]

Think like an assessor

To maximise your marks on an exam, it can help to think like a QCAA assessor. Consider how many marks each question is worth and what information the assessor is looking for.

A student has given the following response in a practice exam. Imagine you are a QCAA assessor and use the marking guide to mark the response.

Question 6 (2 marks)

Yousef is 30 years old. He has trouble falling asleep and just can't wake up in the morning. **Describe** the treatment you would recommend for Yousef and **justify** your recommendation based on the disorder you believe he has.

I would recommend bright light therapy for Yousef. It appears that he has a circadian phase disorder.

Marking guide

Question 6	• Identifies and describes a suitable treatment (1 mark) • Justifies recommendation by identifying a correct disorder (1 mark)

Fix the response

Consider where you did and did not award marks in the response. How could the response be improved? Write your own response to the same question to receive full marks from a QCAA assessor.

Part C: Exam practice

Now it's time to put the tips and advice you've received into practice while you complete these exam-style questions! During your examination, you will most likely be asked multiple-choice questions, short-response questions, and more complex, multi-part short-response questions. The questions here, in Part C, give you practice at these types of questions.

Multiple choice

(1 mark each)

1 Which neuroimaging technique shows activity patterns within the brain while performing an activity (such as reading)?

A MRI **B** PET **C** EEG **D** fMRI

2 The key components of the peripheral nervous system are

A brain and spinal cord.

B sensory and motor nerves.

C somatic and autonomic nervous systems.

D sympathetic and parasympathetic nervous systems.

3 Changes in the brain that occur as a result of environmental influences, such as learning, are due to a process called

A myelination.

B sensitive periods.

C adaptive plasticity.

D developmental plasticity.

Use the following information to answer questions 4 to 6.

Psychology teacher Ms Smart decided to test a new "attention pill" on her students. She gave one psychology class (Class A) an attention pill, while her other class (Class B) received a sugar pill. Both groups were then given a 20-item concentration test. Class A scored on average 82% while Class B scored on average 67%.

4 What would be a suitable hypothesis for the experiment?

A Will subjects receiving the smart pill perform better on the intelligence test?

B Subjects receiving an attention pill performed on average better than other subjects.

C Subjects receiving a sugar pill will achieve higher on the concentration test than subjects receiving an attention pill.

D Subjects receiving an attention pill will perform better on the concentration test compared to subjects receiving a sugar pill.

5 The independent variable is

A IQ.

B the type of pill received.

C performance on the concentration test.

D which group the subjects were allocated to.

6 Ms Smart should have followed ethical principles prior to conducting the experiment. One such principle would be ensuring "informed consent". What does this mean?

A Subjects can leave the experiment at any time.

B Subjects are informed of the results at the end of the experiment.

C If the subjects are under 18 years of age, their parents must give written consent.

D Subjects sign a consent form after being presented with some information regarding the experiment.

7 At 15 months of age, Henry does not get upset when a stranger approaches. When he is upset, he can be comforted by either a stranger or his mother. According to Ainsworth, Harry is showing

A secure attachment.

B secure avoidant attachment.

C insecure avoidant attachment.

D insecure resistant attachment.

8 Dr Lee finishes his shift and goes to sleep. His sleep pattern is likely to reflect a normal ultradian rhythm, which will show

A more time spent in REM sleep at the start of the night.

B less time spent in NREM sleep at the start of the night.

C NREM/REM sleep cycles of approximately 90 minutes.

D an increasing amount of time in NREM sleep as the night progresses.

Use the following information to answer questions 9 to 11.

In an experiment investigating how sleep deprivation affects memory, one group of participants was kept awake for two days and nights. Another group was told to sleep as they normally would. At the end of that time, all participants were given a learning task and were tested on their recall of the material.

9 In this experiment, the independent variable and dependent variable were, respectively, the
- **A** learning task and presence of two groups.
- **B** presence of two groups and learning task.
- **C** number of hours of sleep deprivation and score on the recall test.
- **D** score on the recall test and number of hours of sleep deprivation.

10 The group that was sleep deprived for two days and nights was the
- **A** control group.
- **B** dependent group.
- **C** independent group.
- **D** experimental group.

11 The most appropriate alternative hypothesis for this experiment would be
- **A** participants will be investigated as to whether sleep deprivation decreases the ability to remember learnt tasks.
- **B** participants who are sleep deprived will perform just as well on the learning task as participants who are not sleep deprived.
- **C** participants who are sleep deprived will perform worse on the learning task compared to participants who are not sleep deprived.
- **D** participants who are sleep deprived will perform better on the learning task compared to participants who are not sleep deprived.

12 Hormones influence human circadian rhythms. Which of the following hormones causes sleepiness when released in the dark?
- **A** Cortisol
- **B** Adrenalin
- **C** Melatonin
- **D** Adenosine

13 James can sing along to music on the radio while driving his car and navigating to his friend's house. Which feature of consciousness does this involve?
- **A** Concentration
- **B** Divided attention
- **C** Selective attention
- **D** Controlled processing

14 Which types of movements are controlled by the somatic nervous system?
- **A** Voluntary muscles
- **B** Spinal cord functioning
- **C** Smooth muscle movements
- **D** Peripheral nervous system movements

15 Which part of the human brain is responsible for the release of melatonin?
- **A** Thalamus
- **B** Pineal gland
- **C** Hypothalamus
- **D** Pituitary gland

16 Which of the following scenarios displays the highest level of awareness?
- **A** Jake is bored in class and falls asleep.
- **B** Sarah is reading a magazine while she is on the bus.
- **C** Chris is watching his favourite movie while eating popcorn.
- **D** Harry is about to jump out of a plane to go tandem skydiving.

17 The device that detects, amplifies and records electrical activity in the brain is the
- **A** electroencephalograph.
- **B** electrocardiograph.
- **C** electrooculograph.
- **D** electromyograph.

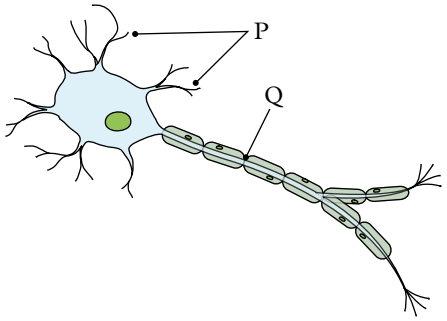
18 The branch-like structures of the neuron that receive neural impulses are called
- **A** axons.
- **B** myelin.
- **C** dendrites.
- **D** the cell body.

19 The sleep stage associated with dreaming is
- **A** REM stage.
- **B** NREM stage 1.
- **C** NREM stage 2.
- **D** NREM stage 3.

20 Which of the following accurately describes a purpose of the restoration theory of sleep?
- **A** Physical and mental functions are repaired.
- **B** Neural and memory functions are repaired.
- **C** Inactivity at night is adaptive to survival.
- **D** Energy is conserved.

Short response

21 Consider the diagram of a neuron.



- **a** **Identify** the parts of the neuron labelled P and Q, and **describe** the function of each (4 marks)
- **b** **Identify** the type of neuron and **describe** its function. (2 marks)

22 **Identify** a role of Geschwind's territory in language production. (1 mark)

23 **Distinguish** between motor neurons and interneurons. (1 mark)

24 **Describe** the arousal continuum. (1 mark)

25 **Differentiate** between enriched and deprived environments, and provide an example of each. (3 marks)

26 **Describe** a treatment intervention for insomnia. (1 mark)

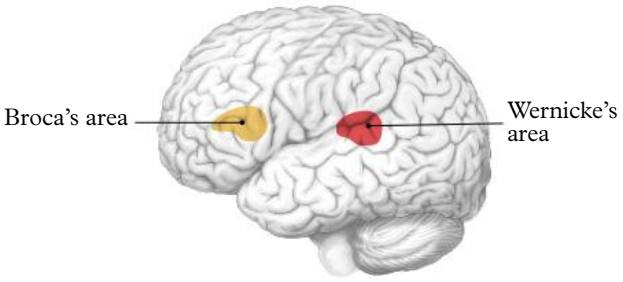
27 **Explain** how brain structures and hormones regulate sleep. (3 marks)

28 **Discriminate** between selective and divided attention using an example. (2 marks)

29 **Compare** narcolepsy and sleep apnoea. (2 marks)

30 **Identify** one strength and one limitation of the sociocultural theory of cognitive development. (2 marks)

31 Aphasia is the impairment of language caused by damage to the brain. Broca's area and Wernicke's area are two parts of the brain that may experience such damage. Their location is shown in the figure.



- **a** **Identify** the difference between Broca's aphasia and Wernicke's aphasia in terms of written and spoken language. (2 marks)
- **b** Given that dance is a language of gestures, **propose** two reasons why a person with damage to Broca's area would find dancing difficult. (2 marks)

32 At birth, the brain has almost all the neurons it will ever have despite being approximately one-quarter the size of an adult's brain. It is also known that the infant brain forms far more neural connections than it will ever use.

- **a** **Describe** the process that accounts for most of the brain's growth in size, including the stage of the lifespan after birth when this process is most intense. (2 marks)
- **b** **Identify** the process that eliminates unwanted neural connections and explain why this process is important. (2 marks)

33 Ciaran was interested in how long it would take people to fall asleep after going for a run. Ciaran used a sample of students from his high school who were aged 13–17. Ciaran had an experimental condition, students who are runners (A); and a control condition, students who never run (B). Ciaran performed a *t*-test comparing the two conditions and the *p*-value was 0.03.

- **a** **Identify** the type of sampling that Ciaran used. (1 mark)
- **b** **Identify** an advantage and a disadvantage of the type of sampling used. (2 marks)
- **c** **Explain** what the *p*-value means for Ciaran's study. (2 marks)

34 Researchers at James Cook University conducted a study to investigate the relationship between number of hours of sleep and amount of exercise completed during the day. Researchers performed the following methodology to test their hypothesis.

Null hypothesis: There is no significant relationship between number of hours of sleep and amount of exercise completed during the day.

Alternative hypothesis: There is a significant relationship between the number of hours of sleep and amount of exercise completed during the day.

Methodology

- Subjects were university psychology students.
- Sample size = 20

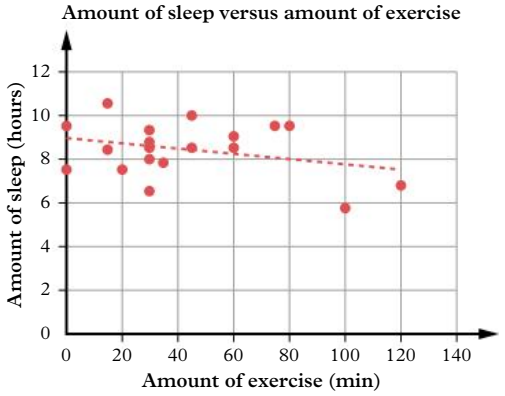


FIGURE 1 The amount of sleep versus amount of exercise recorded for one day

Pearson correlation coefficient = –0.3, $p > 0.05$

- **a** **Identify** the type of investigation being used in this study. (1 mark)
- **b** **Identify** the level of measurement being used. (1 mark)
- **c** **Draw a conclusion** about the relationship between amount of exercise and amount of sleep. **Justify** your response using evidence from the graph. (2 marks)

35 Animal studies have demonstrated an increase in brain activity, particularly in the amygdala, in caregiving fathers. It has been suggested that, although neurobiological processes related to pregnancy and labour trigger maternal caregiving, the human father's brain, similar to other biparental mammals, adapts to the parental role through active involvement in childcare.

Null hypothesis: Primary caregiving males will demonstrate no change in amygdala activity compared to secondary caregiving males.

Alternative hypothesis: Primary caregiving males will demonstrate a change in amygdala activity compared to secondary caregiving males.

Design

- Independent groups
- Participants were allocated to the following conditions:
  - Condition 1: First time, secondary caregiving males
  - Condition 2: First time, primary caregiving males

Methodology

Male participants' brain activity in the amygdala was measured before the child was born as a baseline and then when the child was 6 months old using an MRI scan. The change in amygdala activity at 6 months after the child was born is recorded in Table 1. An unpaired two-sample *t*-test (Table 2) was performed to analyse the data.

TABLE 1 Raw data for the percentage change of amygdala activity of the two caregiving conditions

Condition 1 (Secondary caregiving males)	Condition 2 (Primary caregiving males)
0.4	3.6
0.2	4.2
−0.4	3.7
0.1	3.5
−0.5	3.9
0.3	3.5
0.1	4.0

TABLE 2 Standard deviation scores for the two conditions and *p*-value

Condition	± Standard deviation	*p*-value
Condition 1	0.345	0.0024
Condition 2	0.269	

a **Calculate** the mean for condition 2, rounded to the closest whole number. Show your working. (2 marks)

b **Identify** which condition had the most variability. (1 mark)

c **Infer**, with reference to Table 2, what the inferential statistic result demonstrates. **Justify** your decision. (2 marks)

36 Over the past decade there have been significant gains in the fields of neuroimaging and developmental psychology. However, there is surprisingly little known about the developing human brain or the neural basis of cognitive development.

a **Identify** the last brain region to mature in an individual. (1 mark)

b **Identify** and **describe** the most appropriate neuroimaging technique for observing brain activity in children while they complete memory and attention tasks. (2 marks)

c **Discuss** the information processing theory of cognitive development by explaining the theory and identifying a strength and a limitation. (3 marks)

37 Sleep is necessary for survival and is an important part of your daily routine. It is a complex and dynamic process that affects how you function.

a **Describe** the sleep–wake cycle, with reference to its stages. (4 marks)

b **Describe** two changes to the sleep–wake cycle during adolescence. (2 marks)

c **Compare** the restoration and evolutionary theories of sleep. (2 marks)

TOTAL MARKS
/78 marks

UNIT 2

Individual behaviour

Unit 2 overview

Psychology is the scientific study of mental processes – including thinking, feeling, remembering, learning and reasoning – and behaviour (Burton et al., 2015). Human behaviour can vary depending on context and situation. Other factors, such as cognitive abilities, culture, gender, attitudes and perception, can also influence a person's behaviour.

The concept of intelligent behaviour is explored in Unit 2. An understanding of the different approaches to intelligence and factors that influence intelligence is central to appreciating the role of both genetics (nature) and the environment (nurture) to the development of the self.

Additionally, in this unit, you will learn to distinguish between adaptive and maladaptive behaviour and explore different approaches to normality. Diagnosis of psychological disorders using diagnostic manuals is covered, as well as the risk factors for psychological disorders and the effectiveness of different treatment interventions to support individuals, families and the community. The biopsychosocial approach to understanding psychological disorders is explored.

Finally, the intricate relationships between emotion, motivation and behaviour are investigated. Emotions affect motivation, and motivation, in turn, influences behaviour. You will develop scientific skills to conceptually understand the role that emotion plays in regulating and directing behaviour, as well as the influence motivation has in directing action.

Unit 2 objectives

1. Describe ideas and findings about intelligence, diagnosis, psychological disorders and treatments, and emotion and motivation.
2. Apply understanding of intelligence, diagnosis, psychological disorders and treatments, and emotion and motivation.
3. Analyse data about intelligence, diagnosis, psychological disorders and treatments, and emotion and motivation.
4. Interpret evidence about intelligence, diagnosis, psychological disorders and treatments, and emotion and motivation.
5. Evaluate processes, claims and conclusions about intelligence, diagnosis, psychological disorders and treatments, and emotion and motivation.
6. Investigate phenomena associated with intelligence, diagnosis, psychological disorders and treatments, and emotion and motivation.

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Unit 2 Topics

Topic	Module	
Topic 1 Intelligence	**Module 10**	Understanding intelligence
	Module 11	Measuring intelligence
Topic 2 Diagnosis	**Module 12**	Diagnosis of psychological disorders
Topic 3 Psychological disorders and treatments	**Module 13**	Psychological disorders
	Module 14	Anxiety disorders
	Module 15	Treatment of psychological disorders
Topic 4 Emotion and motivation	**Module 16**	Emotion and wellbeing
	Module 17	Motivation

MODULE 10

Understanding intelligence

Introduction

How to define intelligence has been an ongoing topic of debate among psychologists since the early 1900s, and the debate continues today.

Because "intelligence" is a hypothetical construct, there is no single description of it on which all psychologists agree. The challenge to describe intelligence has been tackled through a range of approaches. Some descriptions are derived from knowledge of the anatomical structure and functioning of the brain. Other descriptions suggest that intelligence comes in several forms, while others take into account cultural contexts when describing intelligence.

In this module, we explore the concept of intelligence and factors that influence intelligence, including the interaction of genetic and environmental factors.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to intelligence before you start.

Subject matter

Science understanding

→ Describe the psychometric approach to intelligence (i.e. intelligence quotient, or IQ).

→ Discuss the significance of common uses of the psychometric approach to intelligence compared to

- the information processing approach
- Sternberg's triarchic theory of intelligence
- Gardner's multiple intelligences
- Goleman's emotional intelligence (EQ).

→ Discuss the extent to which intelligence is inherited, with reference to twin, family and adoption studies, e.g. the Minnesota study of twins reared apart (Bouchard et al. 1990).

Science inquiry skills

→ identify, research and construct questions for investigation
→ identify and operationalise variables to be manipulated, measured and controlled
→ distinguish between types of investigations
→ use appropriate equipment, techniques, procedures and sources to systematically and safely collect primary and secondary data
→ analyse data to identify trends, patterns and relationships; recognising error, uncertainty and limitations of evidence
→ select, synthesise and use evidence to
  • draw conclusions, using *p*-values to infer significance, allowing for the possibility of type I and II errors

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Key studies

Key study summaries

Read a summary of the key study for this module.
→ Bouchard et al. (1990)

Lesson 10.1
Defining intelligence

Learning intentions and success criteria

Key ideas

- → Intelligence is a hypothetical construct that is difficult to define and operationalise.
- → Intelligence quotient (IQ) is a score that can be used to determine a person's intelligence relative to a standardised population.

Introducing intelligence

Intelligence is often associated with desirable human characteristics, such as the capacity to learn, remember, problem-solve and comprehend. Naturally, much of the general population and researchers are interested in understanding how intelligence differs between people, and if it can be changed. However, to understand intelligence and the factors that can influence it, researchers must first be able to define it.

Intelligence as a hypothetical construct

intelligence
can be defined in many ways, including one's capacity for learning, problem-solving, and applying knowledge and skills to adapt to unfamiliar situations

hypothetical construct
a concept that is not directly measurable or observable, but gives rise to measurable phenomena and patterns of data

operational-isation
defining variables in a way that means they can be empirically measured or manipulated in research

Despite the existence of popular ideas about **intelligence**, psychologists consider it to be a **hypothetical construct**: a concept that is not directly measurable or observable, and yet gives rise to measurable phenomena and patterns of data. For research on intelligence to progress, it is important that the concept is **operationalised**, or given an operational definition. An operational definition describes, as specifically as possible, the precise elements of a construct, and the procedures involved in researching and measuring it. Thus, psychologists might infer the existence of the hypothetical construct of intelligence based on test scores and particular kinds of behaviour. For instance, intelligent people are those who are most likely to perform well on academic tests, make mistakes, yet learn and avoid them in future; adjust to a new job; plan; get along with people in a new social setting; find answers to problems; and understand new concepts.

Study tip

Go to Lesson 1.3 to revise operationalisation.

FIGURE 1 Intelligence is a hypothetical construct, just as this image is constructed to represent the artist's idea of intelligence.

Defining intelligence

Intelligence can be defined as involving the application of cognitive skills and knowledge to learn and solve problems (Burton et al., 2015). It is the ability to acquire and apply knowledge and skills in ways that enable one to adapt to new situations.

Intelligent people are usually seen as possessing a high level of **metacognition**; that is, they have an understanding of the way they think when attempting to solve problems, reason, plan or make decisions (Sternberg & Detterman, 1986). For example, some people know that, for them, the strategy of talking through a task is the best way to help them to learn, whereas less intelligent people might simply guess the answer.

metacognition
an understanding and use of the way one thinks when solving problems, reasoning, planning and making decisions

Challenge

Different intelligences

The people pictured here have been identified as possessing a particular ability or intelligence that exceeds most other individuals their age. Their specialised talents are not identical. Conduct quick and brief research on one of these people. In your notes, include details of their family background, childhood and achievements. Based on your brief research, **describe** the factors that you think might have influenced their level of intelligence.

FIGURE 2 Arianne Caoili

FIGURE 3 Michael Kelly

FIGURE 4 Lydia Ko

FIGURE 5 Simon Tedeschi

Introducing approaches to intelligence

Given that "intelligence" is a hypothetical construct, researchers and psychologists have differing perspectives on what it is. This has led to the development of several approaches to study the nature of intelligence. We will look at each of the psychometric approach, information processing approach, Sternberg's triarchic theory, Gardner's multiple intelligences and Goleman's emotional intelligence in the following lessons.

Study tip

The concept of intelligence should not be confused with the intelligence quotient (IQ), which quantifies intelligence by a single numerical score derived from standardised tests. A person's IQ score is compared to a normative population to determine their level of intelligence. Learn more about this in Lesson 10.2.

Check your learning 10.1

Check your learning 10.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** why intelligence is a hypothetical construct. (1 mark)

2 **Explain** two reasons why intelligence is so difficult to define. (2 marks)

Analytical processes

3 **Differentiate** between the concept of intelligence and IQ. (3 marks)

4 **Infer** two reasons why sensitivity is needed when defining intelligence. (2 marks)

Knowledge utilisation

5 Think about the Challenge in this lesson. **Hypothesise** why certain people may have enhanced intelligence in certain areas. (1 mark)

Lesson 10.2
The psychometric approach to intelligence

Learning intentions and success criteria

Key ideas

- → The psychometric approach to intelligence involves quantifying intelligence through the use of standardised tests. Standardised intelligence tests give an intelligence quotient (IQ) score.
- → Psychometric tests are based on factor analysis.
- → The psychometric approach measures the structure of intelligence, but not the processes involved.

psychometric approach (to intelligence) involves quantifying aspects of intelligence through the use of standardised tests developed from factor analysis

intelligence quotient (IQ) standardised score for an individual's intelligence as measured by a specific intelligence test; IQ scores are based on how much an individual's test score deviates from the mean score for the normative sample

Introducing the psychometric approach

The oldest approach to intelligence is the **psychometric approach**, which began in the early twentieth century. French psychologist Alfred Binet and his colleague Théodore Simon developed the first standardised intelligence test to identify children with learning difficulties. This test formed the basis for what we now know as the IQ (**intelligence quotient**) test.

Basis of the approach

The psychometric approach is rooted in the belief that intelligence can be measured much like physical attributes such as height or weight. In the context of intelligence, this involves measuring different factors that are thought to indicate overall intelligence. This approach enables the development of reliable and objective measures of intelligence, which can then be used to inform diagnosis, educational planning, neuropsychological evaluation and vocational guidance.

A key aspect of the psychometric approach is that tests are **standardised**. This means that the tests are administered and scored in a consistent manner. A NAPLAN test is an example of a standardised test. Standardisation increases the reliability and validity of results across different populations and settings.

standardisation
the process of ensuring a test is consistently administered and scored across different individuals and settings

Psychometric tests

Researchers design psychometric tests using a statistical method called **factor analysis**. Factor analysis is used to identify underlying relationships between various items (like questions on a test) and group similar things. For instance, psychologist Charles Spearman proposed that intelligence comprises general intelligence (*g*), which is made up of a cluster of specific abilities (*s*).

factor analysis
a statistical method used to find patterns in data by grouping similar things together

Using factor analysis, researchers can identify different aspects of the broad hypothetical construct of intelligence and group them into several distinct or specific abilities believed to contribute to an individual's overall intelligence. Factors also help to explain why there are individual differences in intelligence. For example, some high-achieving people can be very literate but less able in mathematics, and vice versa.

Modern intelligence tests measure both general and specific abilities, and use these to calculate an overall score of intelligence or IQ.

It is interesting to note that people who do well in one psychometrically-based intelligence test usually do well in others. This has led researchers to believe that all the tests depend on a single underlying ability or intelligence (Spearman's *g*).

Study tip

The term "psychometric" can be broken down into two root words: psycho and metric. The prefix psycho- comes from the Greek word *psyche* which means mind or soul. In modern usage it is associated with mental processes. Metric comes from the Greek word *metron*, which means measure.

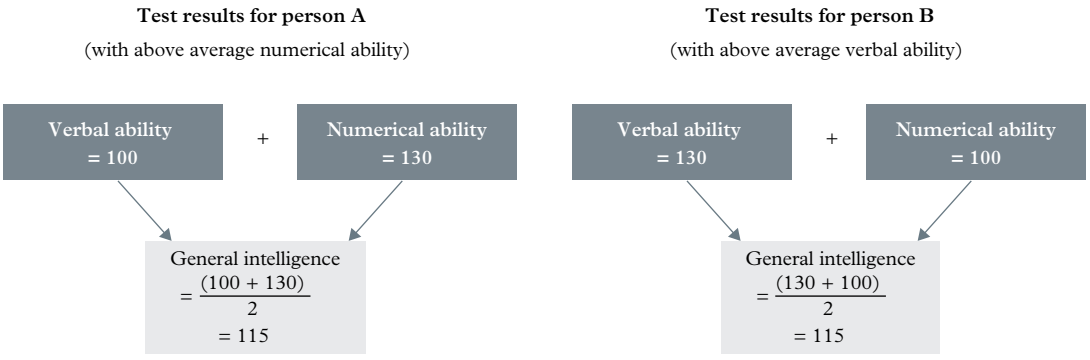


FIGURE 1 In this hypothetical case, person A's and person B's general intelligence scores are composed largely of verbal and numerical abilities. They have the same general intelligence scores but these have come from very different scores for verbal and numerical ability.

Study tip

Psychometric tests of intelligence include the Stanford–Binet scales and Wechsler intelligence scales, which you will learn about in Lesson 11.1.

Evaluation of the psychometric approach

The psychometric approach to describing intelligence using models that are based on factor analysis is useful in helping us to understand the structure of intelligence and to measure intelligence. However, these models do not help us to understand the actual processes of intelligence.

Check your learning 10.2

Check your learning 10.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the psychometric approach to intelligence. (1 mark)

2 **Identify** a key aspect of psychometric tests that affects their reliability. (1 mark)

Analytical processes

3 **Distinguish** between Spearman's concepts of general intelligence (*g*) and specific abilities (*s*). Include an example of each. (3 marks)

Knowledge utilisation

4 **Discuss** the usefulness of the psychometric approach to intelligence by providing an argument for and against the approach. Provide an example for each argument. (4 marks)

Lesson 10.3
The information processing approach to intelligence

Learning intentions and success criteria

Study tip

The information processing approach has been applied by researchers and psychologists to many other cognitive processes such as memory (Unit 3, Topic 3), attention (Unit 1, Topic 3) and cognitive development (Unit 1, Topic 2).

information processing approach to intelligence examines the mental processes that underlie intelligence such as speed of processing, knowledge base and the ability to learn and apply mental strategies

Key ideas

- → The information processing approach to intelligence examines the mental processes that underlie intelligence: speed of processing, knowledge base, and the ability to learn and apply mental strategies.
- → Intelligent behaviour reflects the ability to process information with increased speed and complexity, and intelligence can be enhanced by increasing one's knowledge base and learning mental strategies.
- → The approach can be empirically tested under controlled conditions, but is less focused than others on cultural influences on intelligence.

Introducing the information processing approach

The **information processing approach to intelligence** emerged from the work of several psychologists and researchers in the mid-twentieth century, influenced heavily by the advent of the computer and developments in cognitive psychology. It was developed to explain how the human mind works. Unlike the psychometric approach, which focuses on the results of cognitive processing, the information processing approach focuses on and examines the mental mechanisms involved in encoding, storing and retrieving information. This is like understanding how a computer works (information processing) rather than just assessing its output (psychometric). For example, while a psychometric test might score a person's problem-solving ability, the information processing approach would examine how quickly and efficiently a person can process new information.

The information processing approach to intelligence examines speed of processing, knowledge base, and the ability to learn and apply mental strategies (Burton et al., 2015).

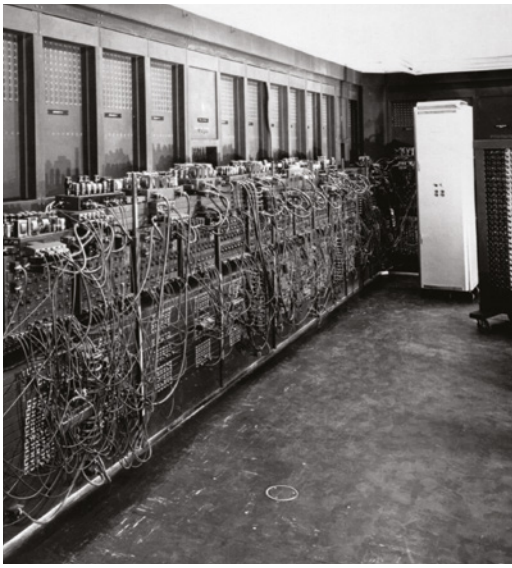


FIGURE 1 The development of the information processing approach to intelligence was heavily influenced by the advent of computers in the mid-twentieth century.

Speed of processing

Speed of processing, or mental speed, refers to how quickly a person can process and respond to stimuli. Research suggests that there is a positive relationship with the speed at which you can complete cognitive or academic tasks, and level of intelligence as measured by standard IQ tests (Burton et al., 2015). Speed of processing positively correlates with measures of academic achievement in both children and university students. Individuals with above-average academic abilities perform cognitive tasks more quickly than their peers (Campione et al., 1982). Conversely, individuals with an intellectual disability respond more slowly than their peers on a variety of cognitive tasks (Nettlebeck & Wilson, 1997).

Research further suggests that speed of processing improves during childhood, but slows during the later years of adulthood (Nettlebeck & Burns, 2010). On a positive note, staying mentally active and engaging in various computer training programs has been shown to strengthen speed of processing on some cognitive tasks (Simpson et al., 2012)..

Knowledge base

Study tip

You learnt about the concept of schemata in Lesson 6.3.

According to information processing theory, the amounts of information stored in working memory and long-term memory are also related to our intelligence. Differences in our knowledge base – including the volume of information and how it is organised and can be accessed for retrieval – influence our intellectual functioning (Burton et al., 2015). A rich knowledge base can enhance cognitive processing by providing a foundation for understanding new information. For instance, someone with extensive knowledge in a particular field can more easily integrate new information in that field due to a well-developed framework (schema) of existing knowledge.

Ability to learn and apply mental strategies

FIGURE 2 The ability to learn and apply mental strategies is seen in the way we approach complex problems.

Mental strategies refer to a person's capacity to acquire new problem-solving strategies and apply them effectively. In computer terms, this would be akin to the ability of a machine-learning algorithm to adapt to new data and improve its performance over time. In practical terms, it can be seen in how a person approaches a complex problem, breaks it down into manageable parts, and applies various cognitive strategies (e.g. rote learning, chunking, trial and error, and metacognition) to solve it. With maturity and experience, the strategies we use to solve problems change and become more sophisticated. For example, **mnemonic strategies** are more likely to be used by adults than children; however, with practice, children can be taught a range of cognitive strategies to remember information and improve their academic performance (Best, 1993).

Evaluation of the information processing approach

An advantage of this approach is that the model allows for the formation of hypotheses that can be tested under controlled experimental conditions. However, it is less focused on understanding the influence of culture on intelligence, compared with other contextual theories.

mnemonic strategies techniques to improve memory retention

Check your learning 10.3

Check your learning 10.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the information processing approach to intelligence. (1 mark)

2 **Identify** one strength and one weakness of the information processing approach to intelligence. (2 marks)

Analytical processes

3 **Apply** the information processing approach to intelligence to the following tasks

a studying for a mathematics exam (1 mark)

b constructing a shed (1 mark)

c running an effective meeting. (1 mark)

Knowledge utilisation

4 **Determine** whether the information processing approach to intelligence suggests that intelligence is fixed. **Justify** your response. (2 marks)

Lesson 10.4
Sternberg's triarchic theory of intelligence

Learning intentions and success criteria

Key ideas

- → Sternberg's definition of intelligence challenges the existence of a single, general intelligence.
- → Sternberg's triarchic theory comprises three subtheories: contextual (relating to adapting to one's external environment), componential (relating to the internal world of information processing) and experiential (relating to interactions between experiences in one's internal and external worlds).
- → Each subtheory relates to one of three dimensions of intelligence: analytical, creative or practical.
- → While the approach recognises the influence of culture on intelligence, it lacks the support of empirical (experimental and observational) evidence.

Introducing Sternberg's triarchic theory

The triarchic theory of intelligence, developed by Robert Sternberg in the 1980s, was groundbreaking at the time because it provided an alternative to the concept of a general intelligence factor measured by psychometric tests (Looti, 2023; Vinney, 2020).

Sternberg (2003) defined intelligence in terms of a person's ability to succeed in life. In this way, while intelligent behaviour may differ between people based on their social environments, the need for adaptation, selection and shaping of environments does not.

Sternberg's subtheories

The triarchic theory of intelligence consists of three (tri) subtheories (Sternberg, 1984):

- **Contextual subtheory** relates intelligence to the external world of the individual. Intelligence is based on a person's ability to adapt, select or shape their environment to better suit their needs.
- **Componential subtheory** relates intelligence to the individual's internal world and the mechanisms that result in intelligence. The mechanisms involve three information processing components:
  - **Metacomponents** are like the directors of our cognitive processes. They involve higher order executive functions such as identifying a problem, planning how to tackle it, allocating mental resources, and monitoring the problem-solving process. For instance, when faced with a complex maths problem, metacomponents help you understand what the problem is asking and plan a method to solve it.
  - **Performance components** are the actors following the director's instructions: they carry out the tasks set by the metacomponents. This includes making inferences, understanding and applying concepts, and executing the strategies needed to solve the problem. Using the maths problem example, performance components would be at work when you apply a formula to find the solution.
  - **Knowledge acquisition** is also activated by metacomponents and involves encoding new information, comparing it to what is already known, and integrating this new information to enhance problem-solving skills. In learning new subject matter, this component helps you understand new concepts by relating them to previously learned material.
- **Experiential subtheory** relates intelligence to the interaction between external and internal worlds ranging from new experiences to routine experiences. Novel, unfamiliar situations require different application of the information processing components than familiar, routine tasks.

metacomponent in the context of Sternberg's componential subtheory, a higher order process that involves planning, monitoring and decision-making

performance component in the context of Sternberg's componential subtheory, related to execution of a task

knowledge acquisition in the context of Sternberg's componential subtheory, used in learning new things

Dimensions of intelligence

Each subtheory of intelligence reflects a particular dimension of intelligence. As the type of problem that an individual faces changes, the skill or dimension of intelligence – analytical, creative or practical – needed to solve the problem changes.

Analytical intelligence (also known as academic intelligence) relates to a person's problem-solving abilities, logical reasoning, and the capacity to analyse. It encompasses the skills necessary for high academic performance and can be assessed through standardised intelligence tests. For example, solving complex maths problems or learning about and comparing the different approaches to intelligence requires you to use your analytical intelligence.

Creative intelligence involves the ability to deal with novel (new) situations by drawing on existing knowledge and skills, and the ability to innovate. A person who can adapt to unfamiliar scenarios, think outside the box, or create art demonstrates high creative intelligence.

Practical intelligence is about applying knowledge based on your experiences to real-world situations. It includes "street smarts" and common sense that enable a person to adapt to changing environments; for example, organising a study group to improve learning outcomes, which requires logistical planning and social understanding.

analytical intelligence in the context of Sternberg's dimensions of intelligence, refers to problem-solving abilities, reasoning, and the ability to analyse

creative intelligence in the context of Sternberg's dimensions of intelligence, refers to innovation, imagination and the ability to generate new ideas

practical intelligence in the context of Sternberg's dimensions of intelligence, refers to the ability to apply existing knowledge and common sense to real-world situations

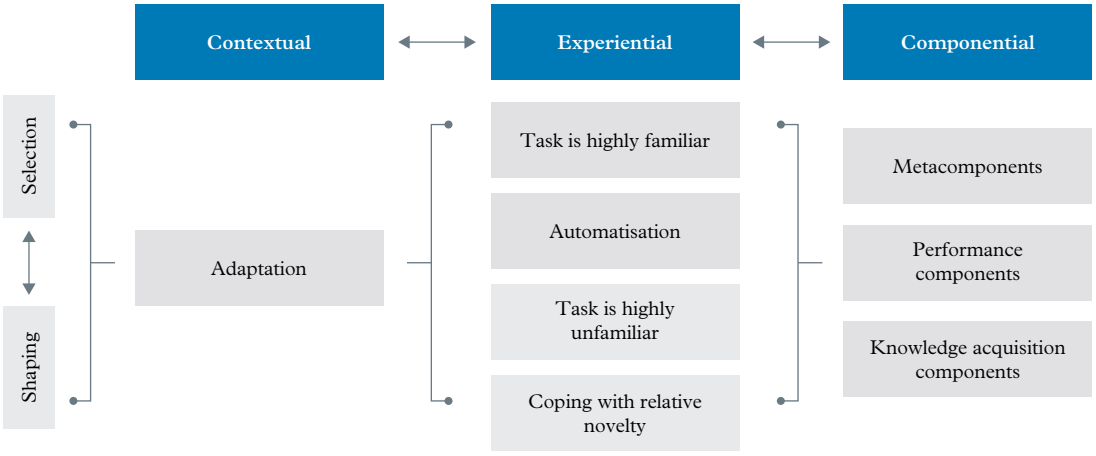


FIGURE 1 Sternberg's triarchic theory of human intelligence identifies several interrelated aspects that describe how individuals adapt, learn, and perform tasks in varying contexts. The contextual aspect involves selection (choosing an environment to suit one's abilities), adaptation (adjusting oneself in the chosen environment) and shaping (modifying the environment to fit one's needs). The experiential aspect differentiates between the processing components required to cope with familiar and unfamiliar tasks. The componential aspect comprises metacomponents (planning and decision-making), performance components (task execution) and knowledge-acquisition components (learning).

FIGURE 2 A person who can create art demonstrates high creative intelligence.

FIGURE 3 Navigating social situations reflects high practical intelligence.

Evaluation of Sternberg's theory

The broader scope of Sternberg's theory makes it more applicable to everyday life and real-world scenarios, recognising that intelligence is not just about academic ability but also about creativity and practical problem-solving. Individuals who score highly in one ability, (e.g. analytical intelligence) may not achieve comparable scores in other domains (e.g. creative or practical intelligence), which supports Sternberg's theory that there are multiple abilities that underlie intelligence (Sternberg, 1988).

Unlike the psychometric approach, the triarchic theory recognises the influence of a person's social context on intelligence; that is, the way people adapt to the demands of surviving within particular cultures and environments. This holistic view is significant in education and workforce development, as it acknowledges the diverse range of skills and abilities required beyond just test-taking or theoretical knowledge, but also for success in other aspects of life.

The triarchic theory of intelligence has been criticised for lack of empirical evidence and its claim that practical intelligence is as good (or better) a predictor of future success as traditional intelligence tests (Gottfredson, 2003).

Check your learning 10.4

Check your learning 10.4: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** each of the three information processing components of Sternberg's theory. (3 marks)
2 **Identify** one strength and one limitation of Sternberg's triarchic theory of intelligence. (2 marks)

Analytical processes

3 **Distinguish** contextual subtheory and experiential subtheory. (1 mark)

Knowledge utilisation

4 **Evaluate** the claim that Sternberg's triarchic theory of intelligence provides the most comprehensive approach to intelligence. (3 marks)

Lesson 10.5
Gardner's theory of multiple intelligences

Key ideas

- Gardner's multiple intelligences proposes that people possess different independent types of intelligence to varying degrees.
- Gardner initially identified eight different types of intelligence: linguistic, logical-mathematical, musical, spatial, bodily-kinaesthetic, naturalistic, interpersonal and intrapersonal.
- Two possible additional types of intelligence are spiritual and existential, although Gardner himself is unsure about their place in his theory.
- There are no standard measuring techniques for assessing Gardner's different intelligences.

Learning intentions and success criteria

Introducing Gardner's theory of multiple intelligences

Similar to Sternberg, Howard Gardner (1983, 1999) challenges the traditional view of a single, general intelligence. However, while Sternberg's theory proposes that the dimensions of intelligence function together as a system, Gardner's theory proposes that the different types of intelligence are unrelated to each other: the **theory of multiple intelligences**. To date, Gardner has identified eight individual intelligences (Table 1) and two "possible" extra intelligences.

theory of multiple intelligences proposes that people possess different, independent types of intelligence to varying degrees

Gardner suggests that people can be very strong in some areas of intelligence, while being less so in others. This theory accepts the wide range of individual human strengths and weaknesses. "It is not a question of 'How smart we are' but 'How we are smart'", he said.

In his research, Gardner examined the evidence on the cognitive abilities of average people, those with brain damage, and also special populations such as prodigies and savants.

This research led him to suggest that humans have a greater number of abilities than just the mathematical and linguistic that are emphasised by traditional intelligence tests in the psychometric approach.

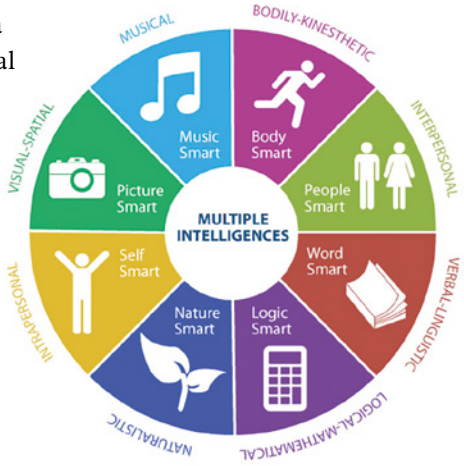


FIGURE 1 Howard Gardner's theory of multiple intelligences.

Gardner's intelligences

Gardner's original intelligences or abilities are described in Table 1. Critics have argued that some of Gardner's abilities are better interpreted as special talents, rather than aspects of intelligence (Mayer et al., 2000).

TABLE 1 Gardner's original (1985) intelligences

Type of intelligence	Description	Examples
Linguistic	Ability to perceive and generate spoken or written language	Reading, writing, poetry, understanding and communicating in the spoken word
Logical-mathematical	Ability to appreciate and use numerical, abstract and logical reasoning to solve problems	Accounting, managing bank accounts, mathematics, science
Musical	Ability to create, communicate and understand meanings made with sound	Singing, playing or composing music
Spatial	Ability to perceive, modify, transform and create visual or spatial images	Architecture, sculpture, reading a map, packing a suitcase or a car, jigsaw puzzles, getting from one place to another
Bodily-kinaesthetic	Ability to use all or part of one's body to solve problems or make something	Athletes, dancers, craftspeople
Naturalistic	Ability to recognise and classify objects in the natural environment	Knowledge of plants and the environment, archaeology
Interpersonal	Ability to recognise, appreciate and dispute feelings, beliefs and intentions of other people	Relating to other people and their behaviour, motives or emotions; necessary for teachers and leaders
Intrapersonal	Ability to understand oneself – emotions, desires, strengths, weaknesses	Self-control, self-understanding, ability to accurately describe oneself to those who know one well

Source: Adapted from Chen & Gardner (2018)

Gardner's two possible additional intelligences

In addition to his original (1983) model, Gardner also raised the possibility of two additional intelligences (1999), which are outlined in Table 2. Gardner himself is still uncertain about the place of spiritual and existential intelligence in his theory (2009); however, it appears that "existential intelligence" is achieving acceptance.

TABLE 2 Gardner's proposed additional (1999) intelligences

Type of intelligence	Description	Examples
Spiritual	Ability to master a set of diffuse and abstract concepts about consciousness and state of being	Meditation and mindfulness practices, counselling and support, rituals and ceremonies
Existential	Ability to think about oneself in relation to the meaning of life, death and love within the physical and psychological worlds	Philosophical debates, scientific research, humanitarian work

Evaluation of Gardner's theory

Gardner's approach is appealing in some ways, but more research is needed to strengthen his theory and to ensure that these multiple intelligences are, in fact, unique and separate from one another. Some researchers have attempted to test Gardner's theory and they found that, with the exception of the bodily-kinaesthetic type, the types of intelligence he identified tend to correlate with each other; meaning they are likely different aspects of the same thing (Kalat, 2008). This suggests that perhaps Spearman's notion of general intelligence (discussed in Lesson 10.2) might still have value as a simple means of describing intelligence.

An advantage of Gardner's theory is that it credits people with having different kinds of intelligence. A disadvantage is that Gardner has not yet developed standard measuring techniques for assessing the different kinds of intelligence, meaning that there is a lack of empirical evidence to support the theory.

Challenge

Multiple intelligences

Investigate one of Gardner's intelligences in more detail. **Devise** a brief task that might be used to test people's ability for this type of intelligence.

Check your learning 10.5

Check your learning 10.5: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** Gardner's theory of multiple intelligences. (1 mark)

2 **Identify** one strength and one limitation of Gardner's theory of multiple intelligences. (2 marks)

Analytical processes

3 **Compare** Gardner's spatial and bodily-kinaesthetic intelligences. Include examples to support your response. (5 marks)

Knowledge utilisation

4 **Determine** which type(s) of intelligence a person in the following professions is likely to be strong in. **Justify** your responses.

a Psychologist (2 marks)

b Fighter pilot (2 marks)

c Priest (2 marks)

d Botanist (2 marks)

Lesson 10.6
Goleman's emotional intelligences

Key ideas

- → Goleman's emotional intelligence is the ability to perceive, use, understand and manage emotions in oneself and in others, and is separate from, but just as important as, cognitive intelligence.
- → According to Goleman, the four domains of self-awareness, self-management, social awareness and relationship management interact to enhance personal and professional relationships.
- → Although measurement tools for emotional intelligence have been developed, they do not have rigorous operational definitions, making it difficult for researchers to validate them in quantitative research.

Learning intentions and success criteria

Introducing Goleman's emotional intelligence

emotional intelligence
the ability to perceive, use, understand and manage emotions in oneself and in others

The notion of **emotional intelligence** was put forward as an aspect of intelligent behaviour that was overlooked by most definitions of intelligence. The idea of emotional intelligence was first proposed by researchers Peter Salovey and John Mayer (1990), but popularised by psychologist, scientific reporter and author Daniel Goleman's best-selling book, *Emotional Intelligence*, in 1995. Similar to Gardner's interpersonal and intrapersonal intelligences, Goleman's emotional intelligence model suggests that emotions are valuable sources of information that can help people operate in a social context. This includes the ability to perceive, use, understand and manage emotions in both ourselves and others, and is a distinct type of intelligence that differs from traditional academic intelligence.

Study tip

In the same way that intelligence is often synonymised with IQ (intelligence quotient; the score of intelligence derived from psychometric tests of intelligence), emotional intelligence is often referred to as EQ, which stands for emotional quotient, the score of emotional intelligence derived from psychometric tests.

FIGURE 1 Goleman's emotional intelligence proposes that emotions are valuable sources of information that can help people operate in a social context.

The four domains of emotional intelligence

Goleman's model of emotional intelligence is divided into four domains: self-awareness, self-management, social awareness, and relationship management (Goleman & Boyatzis, 2017).

self-awareness
in the context of Goleman's emotional intelligence, recognising and understanding one's emotions

- **Self-awareness** is the ability to recognise and understand one's own emotions. It involves being aware of various aspects of oneself, including mood, emotions and feelings, and understanding how these can affect thoughts and behaviour. For example, someone with high self-awareness can recognise when they are feeling stressed and understand how that stress might affect their decision-making.

- **Self-management**, also known as self-regulation, involves the ability to manage one's emotions and behaviours effectively. It includes being able to control impulses, manage emotional reactions to situations, and act with integrity. An example of strong self-management is the ability to stay calm and composed under pressure or in a crisis.
- **Social awareness** encompasses the ability to understand and empathise with others. It involves recognising and interpreting the emotions of others, as well as understanding social networks and dynamics. A person with good social awareness can pick up on the mood in a room or the feelings of colleagues, allowing them to navigate social situations with tact and empathy.
- **Relationship management** involves the ability to maintain and build healthy relationships. Skills in this domain include effective communication, influencing others, conflict management, and inspiring others. For instance, a leader with high relationship management skills can resolve conflicts within their team and motivate their employees towards a common goal.

Goleman suggests that these domains interact with each other and that mastery in each area can lead to better personal and professional outcomes. Emotional intelligence, according to Goleman, is as important as cognitive intelligence for success in life and work.

self-management in the context of Goleman's emotional intelligence, controlling one's emotions and behaviours

social awareness in the context of Goleman's emotional intelligence, the ability to understand and empathise with others

relationship management in the context of Goleman's emotional intelligence, building and maintaining healthy relationships through effective communication and motivational skills

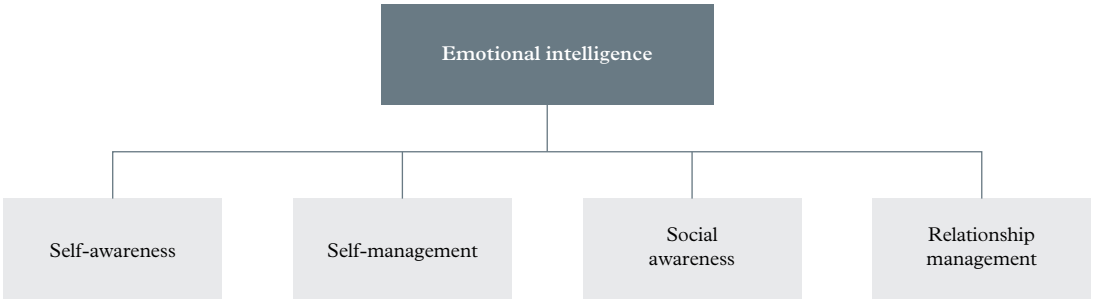


FIGURE 2 The four domains of Goleman's emotional intelligence

Challenge

Emotional intelligence

Daniel Goleman's landmark book, *Emotional Intelligence*, written from his perspective as a science journalist, thrust the concept of emotional intelligence into the spotlight. Drawn from a wealth of research by numerous psychologists, Goleman's work synthesised and interpreted these findings, presenting the idea that our emotional skills are just as crucial as our cognitive abilities, particularly in predicting success and happiness in life.

Investigate how emotional intelligence has been implemented in various sectors such as business, education or mental health services. Consider why the notion of emotional intelligence has resonated so strongly with the public and professional domains.

Questions to guide your research:

1. How have companies used emotional intelligence to improve leadership or employee relations?
2. What role does emotional intelligence play in educational settings, among both students and teachers?
3. How is emotional intelligence being used to enhance mental health therapy or counselling practices?

Measuring emotional intelligence

Various test and instruments have been designed to measure the domains of emotional intelligence as defined in Goleman's model. These tools typically use self-report questionnaires, observer ratings or a combination of both to assess how individuals perceive their own emotional intelligence and how they are perceived by others. For example, Goleman developed the Emotional Competence Inventory (ECI) to assess competencies in the four domains. A more commonly used measure of EQ is the Mayer–Salovey–Caruso Emotional Intelligence Test or MSCEIT (Mayer et al., 2002). Although it is based on a different model of emotional intelligence, it is still relevant as it also assesses the ability to perceive, use, understand and manage emotions.

Emotional intelligence is an aspect of research into intelligence that is in its infancy. There are several views on its definition and measurement, and these views are constantly being amended.

Evaluation of the emotional intelligence approach

Goleman's work significantly contributed to bringing the concept of EQ into the mainstream. His accessible writing style and use of compelling research made it a topic of conversation not only among academics but also in everyday life. Goleman's theory has been applied in many fields, including business, education and psychology. It has helped reshape corporate training programs, classroom curricula, and therapeutic models by emphasising the importance of social and emotional competencies. For instance, emotionally intelligent teaching approaches have been associated with improved student outcomes.

Critics question the existence of emotional intelligence. They argue that it is simply part of general intelligence and one's ability to deal with life situations, or that it is a skill rather than an intelligence (Locke, 2005). Despite the development of EQ assessment tools, accurately measuring emotional intelligence remains a challenge. Self-reported measures can be subjective, and performance-based measures may not capture the full complexity of emotional intelligence. A notable concern about these measures is that they do not have rigorous operational definitions, making it difficult for researchers to validate them in quantitative research.

FIGURE 3 Emotionally intelligent teaching approaches have been associated with improved student outcomes.

Skill drill

Source credibility

Science inquiry skills: Understanding the scientific method (Lesson 1.3); Collecting data (Lesson 1.6)
You have been provided with the following claim: There is only one form of intelligence that matters.

Practise your skills

1 **Create** a research question for this claim that investigates IQ or EQ. (1 mark)
2 **Identify** one source that suggests IQ is important in determining success in life. (1 mark)
3 **Identify** two reasons why this source is or is not credible. (2 marks)

Check your learning 10.6

Check your learning 10.6: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** emotional intelligence (EQ). (1 mark)
2 **Identify** one strength and one limitation of Goleman's emotional intelligence. (2 marks)
3 **Describe** how Goleman's emotional intelligence applies to the following tasks
   a studying for a mathematics exam (1 mark)
   b running an effective meeting. (1 mark)

Analytical processes

4 **Contrast** emotional intelligence and intelligence quotient. (1 mark)
5 **Distinguish** between self-awareness and self-management. (1 mark)

Knowledge utilisation

6 **Discuss** the usefulness of Goleman's theory of emotional intelligence to help a person build and maintain healthy relationships. (3 marks)

Lesson 10.7
Factors that influence intelligence

Key ideas

→ Intelligence is thought to be influenced by the interaction between heritable factors (nature) and environmental factors (nurture), such as education, family context, and personal and environmental health.
→ The estimated extent to which heredity contributes to a psychological trait such as intelligence is expressed as a coefficient from 0 to 1.
→ Family, twin and adoption studies help psychologists untangle the roles of nature and nurture in intelligence.
→ Reaction range refers to variance of individuals' IQ scores based on the interaction between the quality of their environment and their genetic potential.
→ Research suggests that IQ as measured by traditional intelligence tests is influenced by the interaction of biology (nature) and the environment in which we live (nurture).

Learning intentions and success criteria

nature
the internal biological and genetic factors that influence human traits and behaviours such as personality, intelligence and physical attributes

nurture
the environmental influences that influence human behaviours, including all external factors post-birth, such as social interactions, cultural background, education and life experiences

Introducing factors that influence intelligence

What makes one person more intelligent than another? How can there be so much variation in the intellectual ability of a population of humans? Are people from one culture or ethnicity more intelligent than those from another? Can intelligence be improved or weakened?

Much of the research on the factors that influence intelligence has been on the extent to which intelligence is inherited and remains unchanged from birth (**nature**) or shaped by the environment (**nurture**). Research has also focused on the interaction of nature and nurture.

Identification of the influences on intelligence has been controversial because of the enormous social and political implications. In Western societies it is generally desirable to

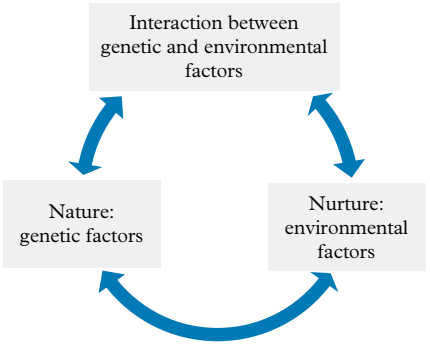


FIGURE 1 Influences on intelligence

have a "high level" of intelligence, often because it is equated with success, and is a source of esteem and social standing. If **heredity** is found to be a strong contributor to a person's intelligence, then it provides the opportunity for racial and ethnic discrimination. If the environment is the strongest contributor, then those people born into socioeconomic deprivation may be disadvantaged in their opportunity for intellectual development.

Heritability coefficients

Before we look at the different genetic and environmental factors that influence intelligence, it is important to understand what is meant by heritability coefficient. The influence of heredity on intelligence is an estimate that is expressed by a **heritability coefficient**.

Heritability estimates quantify the extent to which genetics contributes to individual differences in traits, such as intelligence, within a population. These estimates are derived by comparing the total observable variation of a trait to the portion of variation that can be accounted for by genetic factors.

Like all coefficients, the heritability coefficient is a number between 0 and 1, but it can also be expressed as a percentage. A heritability of 0 implies that genetic differences do not influence the trait at all, while a heritability of 1 suggests that all variation in the trait is due to genetic differences. Typical heritability estimates for intelligence range between 0.5 and 0.7, which can be interpreted as meaning 50 to 70 per cent of the observed variation in intelligence across a population can be attributed to heredity.

The opposite of heritability (nature) is environmentality, where environmentality represents the amount of variance in a trait that can be attributed to external factors (nurture). The sum of heritability and environmentality equals 1, underscoring that all traits are influenced by both genetics and environment to varying degrees (Sternberg, 2012).

Table 1 shows the percentage of variance in intelligence that can be attributed to heredity and the environment, according to the heritability coefficient. Figure 2 shows heritability coefficients as estimates of heritability.

TABLE 1 The heritability coefficient and the influence of heredity and the environment

Heritability coefficient	Variance in intelligence (%): Heredity	Variance in intelligence (%): Environment
0	0	100
0.2	20	80
0.5	50	50
0.8	80	20
1.0	100	0

It is important to remember:

- A heritability coefficient is an estimate only.
- A heritability coefficient is a group statistic; it is not an indication of heritability as it applies to a single individual and should never be meaningfully applied to an individual.
- Most heritability studies have been done in white middle-class communities, which limits the generalisability of the findings to other groups.

heredity
the process by which biological parents transmit physical and psychological traits to their offspring through their genetic material (genes)

Study tip

Heritability estimates look similar to, but are not the same as, correlations. A correlation coefficient represents the strength and direction of a relationship between two variables. On the other hand, heritability estimates involve a different calculation and indicate the proportion of variance of a trait that can be explained by common genetic variants.

heritability coefficient
how much heredity contributes to a trait, expressed as a coefficient from 0 to 1, where 0 means there is no genetic influence and 1 means heredity has 100 per cent influence, i.e. the trait is exclusively determined by genes

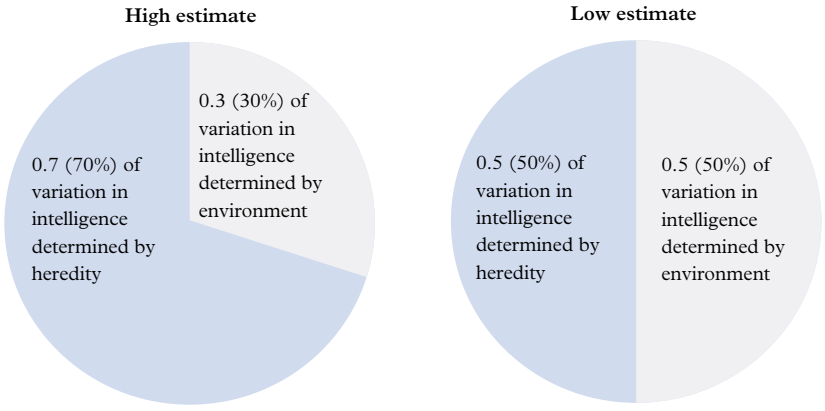


FIGURE 2 Heritability coefficients as estimates of heritability

Study tip

A chromosome is a structure within cells, made of DNA and proteins, that contains genes. These genes are inherited from biological parents and carry the information that determines individual characteristics.

Nature: Biological influences

It is still unclear exactly how heredity influences intelligence. Research has made progress over the past century, especially through the study of twins and adopted children, and is accelerating with the Human Genome Project.

Much of the research on the factors that influence intelligence has been conducted using a psychometric approach to the concept of intelligence, where intelligence tests that give intelligence quotient (IQ) scores (Lesson 10.2) are used to obtain a measure of a person's intelligence.

Genes

Some genetic syndromes can limit intelligence; for example, Down syndrome, which results from the presence of an extra chromosome (Sternberg, 1995). Children born with this genetic syndrome generally have below-average intelligence levels as measured by conventional IQ tests.

Identifying specific "intelligence genes"

The Human Genome Project is providing evidence that different forms of particular genes are related to variation in scores on IQ tests between different people. It is possible that inherited intelligence depends on a combination of a variety of genes, but that it also depends on the interaction of these genes with influences from the environment.

To date, positive heritability of IQ scores simply suggests that, for children born and raised in an identical environment, those with a positive IQ heritability may do better on IQ tests than those who are born with a negative IQ heritability, and this difference can be explained by genes (Kalat, 2008). It is also important to remember that IQ tests measure only some forms of intelligence (Lesson 10.2).

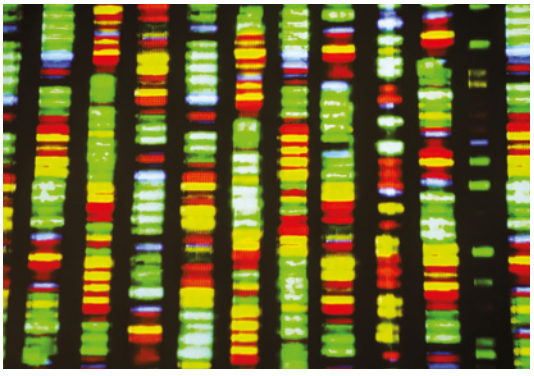


FIGURE 3 The Human Genome Project is providing evidence that different forms of particular genes are related to variation in scores on IQ tests.

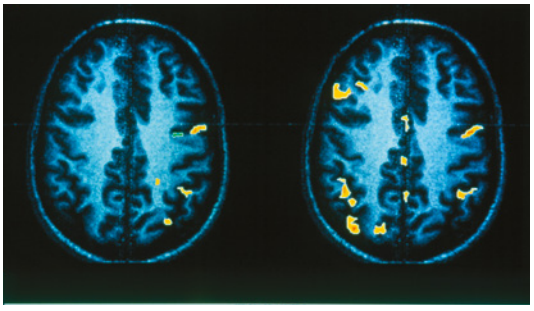


FIGURE 4 Brains of a normal adolescent (left) and a gifted adolescent (right) when undertaking a complex mathematical problem

Neuroanatomy

Recent research in neuroanatomy suggests that mathematically gifted adolescents might possess a specific functional organisation ability compared to adolescents with average mathematical ability (O'Boyle et al., 2005). The research data suggests that gifted adolescents may have stronger processing in the right cerebral hemisphere, and greater communication and brain activation between cerebral hemispheres (Figure 3).

Real-world psychology

Einstein's brain

When genius Albert Einstein died of heart failure in 1955 at the age of 76, his brain was kept at Princeton University after the autopsy. In 1996, his brain characteristics were compared with those of people of normal intelligence who had agreed to donate their bodies to medical research. Einstein's brain was different from that of people of normal intelligence (Witelson et al., 1999).

The yellow and blue areas on the normal brain are parts of the parietal lobe. The blue area, the inferior parietal lobe, is used for visual-spatial thinking, mathematical thought and for imagining how things move in space. The blue area was much larger in Einstein's brain than in a normal brain, and researchers hypothesised that this increased his ability to imagine objects in space (Witelson et al., 1999).

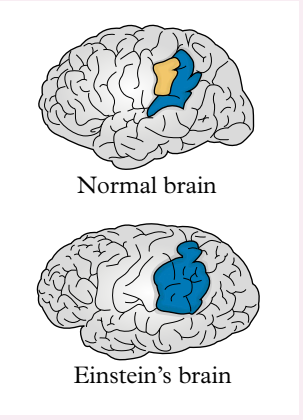


FIGURE 5 Comparison of normal brain characteristics with Einstein's brain

Apply your understanding

1 **Determine** whether the size of Einstein's brain is an example of a biological or environmental influence. **Justify** your response. (2 marks)
2 **Describe** two confounding variables that could influence the findings of this study. (2 marks)
3 Based on your responses to questions 1 and 2, **create** three different research questions that you could investigate. (3 marks)

Introducing family, twin and adoption studies

Research into how much nature and nurture affect psychological traits, like intelligence, often relies on family, twin and adoption studies. Using quasi-experimental designs, researchers can control, to varying extents, the confounding influence of nature or nurture on psychological traits.

Twin studies

monozygotic (MZ) twins
twins who come from the same fertilised egg and thus share all their genetic material

dizygotic (DZ) twins
twins who develop from two separate eggs and share about 50 per cent of their genes

Twin studies are particularly valuable as they allow the highest control over variables. They involve studying both **monozygotic (MZ) twins**, who come from the same fertilised egg and thus share all their genetic material, and **dizygotic (DZ) twins**, who develop from two separate eggs and share about 50 per cent of their genes, similar to regular siblings. By comparing identical twins (MZ) raised together, identical twins raised apart, and fraternal twins (DZ), researchers can explore the influence of shared genes and shared environments on intelligence. If MZ twins, who have identical genes, show more similarity in IQ than DZ twins, this indicates a genetic influence.

FIGURE 6 Family studies on the heritability of intelligence explore twins, siblings and adopted children raised in the same family environment.

Adoption studies and genetic influences

Adoption studies offer another perspective. They allow researchers to study genetically unrelated individuals raised in the same environment and genetically related individuals raised in separate environments. These studies can be insightful; for example, if MZ twins reared apart show similar IQ levels, it suggests a genetic basis for intelligence, as they share genes but not environments. Conversely, differences in IQ among MZ twins raised apart might point to environmental factors.

Real-world psychology

The Minnesota study of twins reared apart

Aim

The Minnesota study of twins reared apart (Bouchard et al., 1990) aimed to explore the contributions of genetic inheritance and environmental factors to intelligence (as measured by IQ scores).

Method

The study recruited monozygotic (identical) twins who were separated early in life and reared apart (MZA), ensuring minimal shared-environment influence. The study included over 100 pairs recruited from North America, Europe, and Asia-Pacific countries.

Materials

Different psychometric tests of intelligence were used to measure IQ scores.

Design

This was a longitudinal correlational study. The study involved only MZ twins, which allowed researchers to control heredity or the influence of nature as a potential confounding variable because MZ twins share 100 per cent of their DNA.

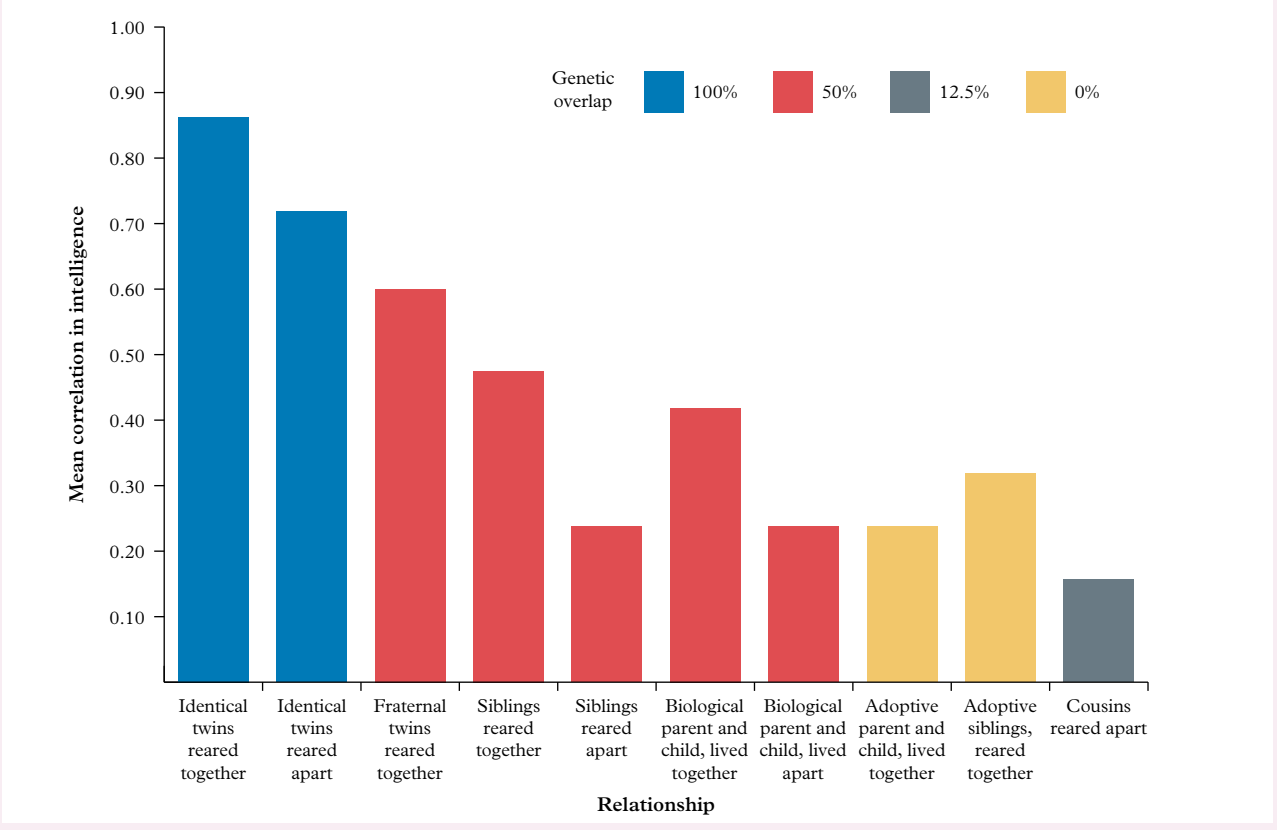


FIGURE 7 Mean IQ score similarity and genetic relationship

By comparing the correlation of IQ scores between the twins reared together (MZT) to those reared apart (MZA), researchers were able to determine heredity or the extent to which intelligence is inherited.

Findings

The study found high correlations between identical twins for intelligence, ranging from 0.76 to 0.88 for twins raised together (MZT) and 0.64 to 0.78 for twins raised in different environments (MZA). Researchers also determined the heritability coefficient of 0.70, indicating that genetic factors account for approximately 70 per cent of the variance in IQ scores.

Conclusion

The heredity score of 0.70 indicates that genes play a larger role in the variance of intelligence between individuals than the environment (nurture). However, the heredity is not 1.0, which indicates that nurture also influences intelligence.

Evaluation

The Minnesota Twin Study is often praised for its unique contribution to understanding the nature vs nurture debate. The longitudinal nature of the study, with high test-retest correlations and large sample size, increases the overall reliability of the findings.

However, the study has also faced criticism, particularly regarding the representativeness of its sample, as most twin studies are based on data from middle-class families, and the assumption that twins reared apart experience completely different environments. Questions have also been raised about the potential influence of the twins' shared prenatal environment and the matching environments that adoptive parents often provide. While heritability estimates do allow researchers to infer the degree of variance in intelligence that can be explained by heredity for a population, the actual influence will differ for each person.

Apply your understanding

1 **Identify** the sampling procedure used in this study. (1 mark)

2 **Evaluate** the internal and external validity of the experimental process. (2 marks)

Nurture: Environmental influences

Heredity certainly influences intelligence, but as we have seen, there is plenty of evidence to show that the environment in which a child is raised will also influence intelligence.

Enriched environmental influences

The development of an individual's intellectual ability may be enhanced by an environment where there are any of the following factors:

- a healthy living environment, including an adequate diet and regular sleep
- good educational opportunities
- family and community who talk and actively interact with children
- during pregnancy, the mother had an adequate diet and did not ingest any toxins
- during pregnancy, the mother did not experience serious illness
- no head injuries or trauma
- no serious illness.

Deprived environmental influences

Study tip

Go to Lesson 5.2 to revise the effects of enriched and deprived environments on learning during infancy, childhood and adolescence.

The reverse is also true. The development of an individual's intellectual ability may be restricted in circumstances where any of the following factors have been present:

- extreme poverty and poor diet during childhood
- inadequate or very limited educational opportunities
- little or no basic parental instruction or talking in the home during early childhood
- during pregnancy, the mother had an inadequate diet or ingested drugs, alcohol or other toxins

FIGURE 8 An adequate diet is a component of an enriched environment that may enhance an individual's intellectual ability.

- during pregnancy, the mother sustained a severe illness that affected the development of her baby
- head injury or brain trauma
- serious illness or seizure.

Adoption studies and environmental influences

Adopted children's intelligence is related to that of their adoptive parents, to a degree. Also, biologically unrelated children raised apart have greater variation in intelligence than biologically unrelated children raised together (Locurto, 1990). This suggests that the environment provided by the parents contributes to the intelligence of the children.

Studies of deprived environments

Social and environmental conditions can influence intelligence (Burton et al., 2015). Researchers studying children raised in orphanages and/or in poverty found that a deprived environment adversely affected the predicted IQ scores of the children (Sherman & Key, 1932; Stoddard, 1943). However, longitudinal research further shows that children who are removed from deprived circumstances and placed into more beneficial situations may have their intelligence enhanced (Scarr & Weinberg, 1977; 1983; Weinberg et al., 1992).

Research suggests that interventions to assist intellectual development are the most beneficial if they are introduced very early in a child's life. It has been found that children who leave deprived orphanages to live in adoptive families show improved intellectual development, especially if the children were under the age of 6 months when the adoption occurred (Beckett et al., 2006; van Ijzendoorn et al., 2005).

Skill drill

Experimental design

Science inquiry skills: Understanding the scientific method (Lesson 1.3); Planning investigations (Lesson 1.4)

Researchers wanted to investigate if children who came from disadvantaged backgrounds could raise their IQ scores through special programs designed to enhance educational success. Researchers reasoned that young children who come from disadvantaged homes may have a lower IQ because they have not been exposed to the cognitive skills and experiences required in a standardised IQ test.

To investigate this, two groups of disadvantaged children were compared, all of whom had IQ scores below 80 (100 is considered the mean). One group (experimental condition) was placed in a special educational intervention program from between the ages of 3 years and 5 years. The other group (control group) were given no additional training and remained in their home environments.

The research found that after only one year, children in the experimental group showed a significant increase in IQ scores compared to the control group. Although these results are promising, after the children left the intervention program and entered public school, their IQ scores started to decline. Figure 9 provides information about the data collected.

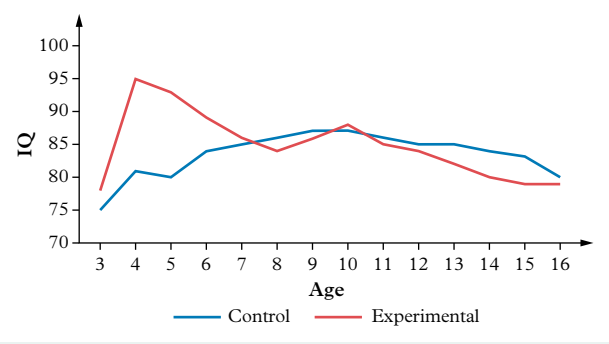


FIGURE 9 IQ scores for children aged 3–16 of experimental and control groups

Practise your skills

1 **Identify** the independent variable and dependent variable. (2 marks)
2 **Identify** the research design used. (1 mark)
3 **Propose** an alternative research design to measure IQ scores. (1 mark)

Nature and nurture: The interaction of heredity and the environment

Heredity and the environment both influence intelligence. It is unclear, however, exactly which aspect of the environment and which particular genes have the greatest influence on intelligence. Rather than looking at each in isolation, researchers have now moved to examining how these factors interact.

There are some clear examples of how heredity and the environment interact to influence the intellectual potential of a child. For example, when a baby is born with the hereditary disease phenylketonuria (PKU), the baby's body is unable to break down the amino acid phenylalanine (a substance in food). If left untreated, this can change cells in the brain, causing intellectual disability. However, this disease can be treated at birth so that its potentially damaging effects are prevented. This is a clear illustration of an immediate effect of the interaction between heredity (the hereditary disease PKU) and the environment (the medical treatment) influencing intelligence.

FIGURE 10 Newborn babies are tested for PKU and treated immediately if the disease is present.

The interaction can also take place in more subtle ways, such as the effects of poor diet or a long-term illness, which may restrict an individual from reaching their intellectual potential. Similarly, the opportunity for a good education and growing up in a supportive community can increase the opportunity for intellectual improvement.

The reaction range

It is possible that genes provide a set of potential abilities, but that interaction with the environment is what fosters, shapes and maximises (or minimises) intellectual potential. In other words, heredity provides the limits to an individual's intellectual potential, whereas the environment provides the opportunity or otherwise to reach the potential within the genetic range.

This suggests that genes place a ceiling on a person's intellectual potential that cannot be exceeded, even in ideal environmental circumstances. This genetic potential is called the **reaction range of intelligence**. The reaction range refers to the amount by which the interaction between heredity and the environment can increase or decrease IQ scores.

reaction range of intelligence
the amount by which IQ scores may vary depending on the interaction of heredity and the environment

Research has suggested that, depending on the interaction, an IQ may decrease or increase by 10 to 15 points (Zigler & Seitz, 1982), or by as much as 20 to 25 IQ points (Bouchard, 1997). This implies that a child born into a deprived environment may have a reduced intellectual potential compared to a child born into an enriched environment.

The reaction range for most people is estimated at 0 to 25 IQ points (Weinberg, 1989).

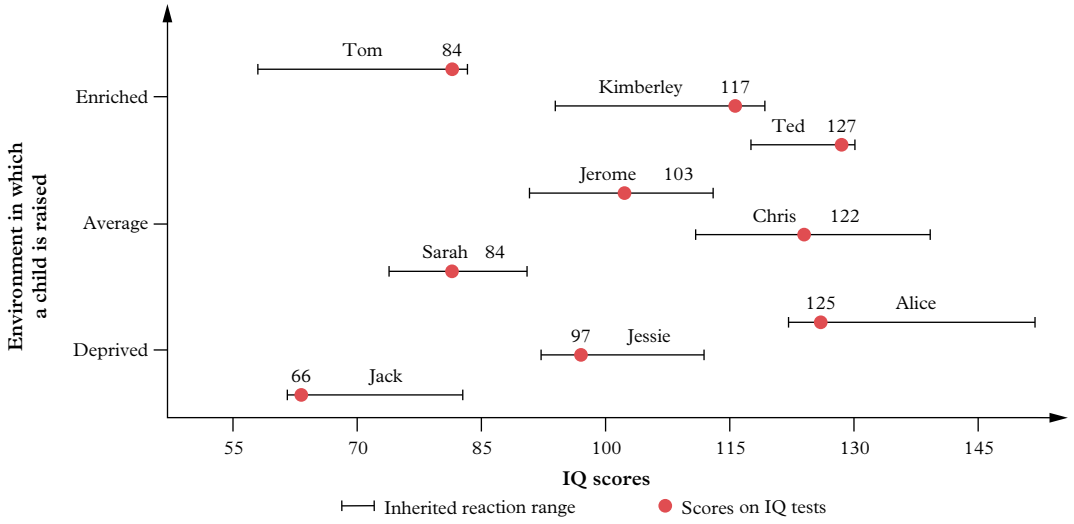


FIGURE 11 The IQ reaction range for the interaction between heredity and environment. Note how a deprived environment influences IQ scores towards the lower end of the inherited reaction range line.

Check your learning 10.7

Check your learning 10.7: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** a social risk associated with research on factors that influence intelligence. (1 mark)
2 **Explain** the term "reaction range" with respect to the interaction between nature and nurture on intelligence. (2 marks)
3 **Identify** two potential biological (nature) and two potential environmental (nurture) influences on intelligence. (4 marks)
4 **Describe** how researchers use adoption studies to investigate intelligence. (1 mark)
5 **Identify**, according to the Minnesota Twin Study, the extent to which intelligence is hereditary. (1 mark)

Analytical processes

6 **Distinguish** between heritability and heritability coefficients. (1 mark)
7 **Contrast** heritability and correlation coefficients. (1 mark)
8 **Interpret** a heritability coefficient of 0.54. (2 marks)

Knowledge utilisation

9 **Evaluate** the social and political influences on identifying intelligence. (3 marks)
10 **Assess** why some researchers are critical of twin studies. (2 marks)
11 **Evaluate** the use of twin studies to investigate intelligence. (3 marks)

MODULE 10

Lesson 10.8

Review: Understanding intelligence

Summary

10.1
- Intelligence is a hypothetical construct that is difficult to define and operationalise.
- Intelligence quotient (IQ) is a score that can be used to determine a person's intelligence relative to a standardised population.

10.2
- The psychometric approach to intelligence involves quantifying intelligence through the use of standardised tests. Standardised intelligence tests give an intelligence quotient (IQ) score.
- Psychometric tests are based on factor analysis.
- The psychometric approach measures the structure of intelligence, but not the processes involved.

10.3
- The information processing approach to intelligence examines the mental processes that underlie intelligence: speed of processing, knowledge base, and the ability to learn and apply mental strategies.
- Intelligent behaviour reflects the ability to process information with increased speed and complexity, and intelligence can be enhanced by increasing one's knowledge base and learning mental strategies.
- The approach can be empirically tested under controlled conditions, but is less focused than others on cultural influences on intelligence.

10.4
- Sternberg's definition of intelligence challenges the existence of a single, general intelligence.
- Sternberg's triarchic theory comprises three subtheories: contextual (relating to adapting to one's external environment), componential (relating to the internal world of information processing) and experiential (relating to interactions between experiences in one's internal and external worlds).
- Each subtheory relates to one of three dimensions of intelligence: analytical, creative or practical.
- While the approach recognises the influence of culture on intelligence, it lacks the support of empirical (experimental and observational) evidence.

10.5
- Gardner's multiple intelligences proposes that people possess different, independent types of intelligence to varying degrees.
- Gardner initially identified eight different types of intelligence: linguistic, logical-mathematical, musical, spatial, bodily-kinaesthetic, naturalistic, interpersonal and intrapersonal.
- Two possible additional types of intelligence are spiritual and existential, although Gardner himself is unsure about their place in his theory.
- There are no standard measuring techniques for assessing Gardner's different intelligences.

10.6
- Goleman's emotional intelligence is the ability to perceive, use, understand and manage emotions in oneself and in others, and is separate from, but just as important as, cognitive intelligence.
- According to Goleman, the four domains of self-awareness, self-management, social awareness and relationship management interact to enhance personal and professional relationships.
- Although measurement tools for emotional intelligence have been developed, they do not have rigorous operational definitions, making it difficult for researchers to validate them in quantitative research.

10.7

- Intelligence is thought to be influenced by the interaction between heritable factors (nature) and environmental factors (nurture), such as education, family context, and personal and environmental health.
- The estimated extent to which heredity contributes to a psychological trait such as intelligence is expressed as a coefficient from 0 to 1.
- Family, twin and adoption studies help psychologists untangle the roles of nature and nurture in intelligence.
- Reaction range refers to variance of individuals' IQ scores based on the interaction between the quality of their environment and their genetic potential.
- Research suggests that IQ as measured by traditional intelligence tests is influenced by the interaction of biology (nature) and the environment in which we live (nurture).

Review questions 10.8A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 Intelligence could be defined as
- **A** the ability to score well on an intelligence test.
- **B** the ability to not repeat past mistakes.
- **C** the ability to solve problems.
- **D** all of the above.

2 What does the term "operationalisation" refer to?
- **A** The selection of participants for a study
- **B** The development of a hypothesis to guide an experiment
- **C** The analysis of data to draw conclusions about a hypothesis
- **D** The process of defining variables in practical, measurable terms

3 The psychometric approach to intelligence primarily measures
- **A** emotional intelligence.
- **B** physical attributes.
- **C** cognitive abilities.
- **D** personality traits.

4 A researcher is studying how quickly individuals can learn and apply a new language. Which approach to intelligence does this best reflect?
- **A** Multiple intelligences model
- **B** Triarchic theory of intelligence
- **C** Psychometric approach to intelligence
- **D** Information processing approach to intelligence

5 The information processing approach to intelligence focuses on
- **A** the output of cognitive processing.
- **B** emotional understanding.
- **C** physical reaction times.
- **D** the underlying cognitive processes of intelligent behaviour.

6 An estimate of the amount by which IQ scores may increase or decrease as a result of the interaction of heredity and the environment is called the
- **A** heritability coefficient.
- **B** reaction range.
- **C** intelligence quotient.
- **D** reliability coefficient.

7 Research suggests that differences in intelligence result from
- **A** environmental factors.
- **B** genetic factors.
- **C** heritability coefficients.
- **D** a combination of environmental and genetic factors.

8 Adoption studies suggest that intelligence
- **A** may be positively influenced by improved environmental circumstances.
- **B** is determined by genes and cannot be changed.
- **C** does not change, regardless of one's environment.
- **D** B and C.

9 What is the name of the approach to intelligence that uses factor analysis to separate intelligence into a number of specific abilities?
- **A** Sternberg's triarchic theory
- **B** The psychometric approach
- **C** Goleman's emotional intelligence
- **D** Gardner's multiple intelligences

10 How does Gardner's theory of multiple intelligences differ from other approaches to intelligence?
- **A** It involves many different forms of intelligence, not just one.
- **B** Gardner believes that all forms of intelligence are related to different parts of the brain.
- **C** Gardner has developed suitable tests of all the different types of intelligence.
- **D** All of the above are correct.

11 What are the three subtheories that make up Sternberg's triarchic theory of intelligence?
- **A** Contextual, componential and experiential
- **B** Practical, analytic and creative
- **C** Metacomponents, performance components and knowledge acquisition
- **D** Encoding, storage and retrieval

12 Gardner's model of intelligence suggests that the form of intelligence that is associated with academic work includes
- **A** linguistic and musical intelligences.
- **B** spatial and musical intelligences.
- **C** logical-mathematical and musical intelligences.
- **D** logical-mathematical and linguistic intelligences.

13 What do critics of the emotional intelligence model argue?
- **A** Emotional intelligence is simply an aspect of general intelligence and should not be separated as a unique form of intelligence.
- **B** It is difficult to develop tests of emotional intelligence.
- **C** Emotional intelligence tests that are available are self-report measures and may not be accurate for this reason.
- **D** All of the above are correct.

14 Knowledge base, the ability to learn and apply mental strategies, and speed of processing are all aspects of
- **A** Sternberg's triarchic theory of intelligence.
- **B** the psychometric approach to intelligence.
- **C** the information processing approach to intelligence.
- **D** Gardner's multiple intelligences.

15 **Identify** a criticism of psychometric measures of intelligence.
- **A** They are too confusing for people.
- **B** They have low reliability.
- **C** They have low validity.
- **D** They do not help us understand the processes of intelligence.

Review questions 10.8B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

16 **Describe** the psychometric approach to intelligence, and identify the most common uses of this approach. (3 marks)

17 Twin studies are used to investigate influences on intelligence.
- **a** **Identify** two reasons why twin studies are helpful in studying intelligence. (2 marks)
- **b** **Describe** two reasons why the results of twin studies of intelligence must be interpreted with caution. (2 marks)

18 **Describe** three ways that Sternberg's theory accounts for individual differences in intelligence. (3 marks)

19 **Explain,** with reference to reaction range, how the interaction between heredity and the environment might affect a person's intellectual development. (2 marks)

20 **Explain** why it is necessary to develop an operational definition for intelligence. (1 mark)

21 **Explain** why the speed of processing is vital to the information processing theory of intelligence. (1 mark)

Analytical processes

22 A manager successfully adapts their business strategy in a rapidly changing market. **Identify** which of Sternberg's dimensions of intelligence this primarily demonstrates. (1 mark)

23 **Compare** self-management and relationship management. (2 marks)

24 **Contrast** Sternberg's triarchic theory and Gardner's multiple intelligence theory. (1 mark)

25 **Apply** three different theories of intelligence to the following tasks.

- **a** Preparing a presentation on climate change (3 marks)
- **b** Learning a new language for a foreign exchange program (3 marks)
- **c** Designing a strategy for a community recycling initiative (3 marks)

26 **Deduce** why it is important to distinguish intelligence from intelligence quotient. (1 mark)

Knowledge utilisation

27 **Assess** the importance of metacognition in one's intellectual functioning. (1 mark)

28 A limitation with Gardner's theory is that the multiple intelligences may not be separate intelligences, but are different names for the same thing.

- **a** **Design** a methodology to distinguish between intrapersonal and interpersonal intelligence. (2 marks)
- **b** **Predict** the results of the methodology designed in part **a**. (1 mark)
- **c** **Describe** why these results are expected and **justify** how they support Gardner's theory. (2 marks)

29 **Discuss** the importance of including both cognitive and emotional intelligence in the educational curriculum. (4 marks)

30 **Predict** how emerging genetic research might alter our understanding of intelligence. **Justify** your response with reference to one or more approaches to intelligence. (4 marks)

Data drill

Psychological factors influence intelligence

The way a person conceptualises intelligence may influence their performance on academic tests (often used as a proxy indicator of intelligence). For example, people can either have a fixed mindset (the belief that intelligence is a static trait) or a growth mindset (the belief that intelligence can be developed) (Dweck, 2006). Analysis of data included a large sample (n = 1594) of students from 13 geographically diverse high schools. Participants were randomly assigned to either the control condition (no intervention) or one of three intervention conditions. All intervention conditions focused on improving students' mindsets. Satisfactory course completion was calculated, derived from students' letter grades. Scores of A, B and C were classified as "satisfactory" completion while other grades were classified as "unsatisfactory". Results are shown in Figure 1.

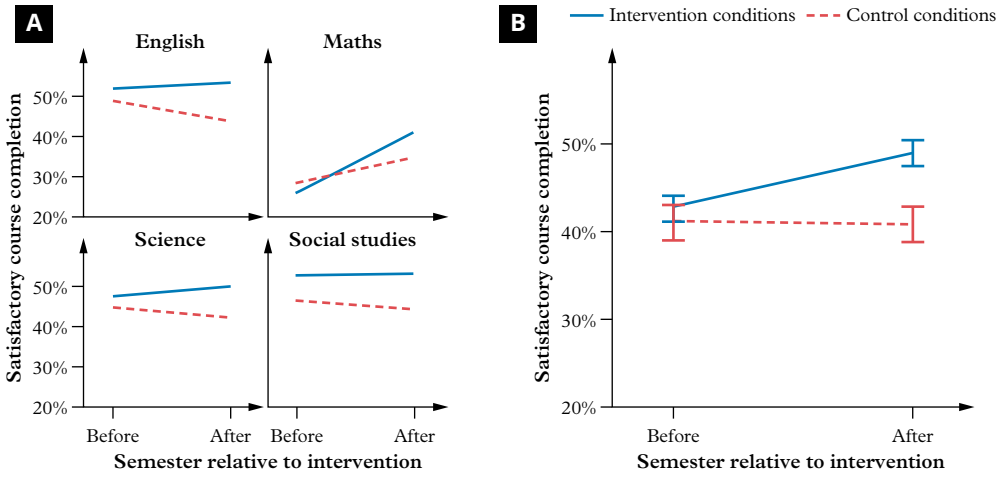


FIGURE 1 The graphs show the average percentage of satisfactory course completion of students in either the control or intervention conditions across core subjects (A) as well as the combined results (B). Error bars represent standard error (SE).

Apply understanding

1 **Identify** the operationalised independent and dependent variables from the experiment. (2 marks)

2 Use Figure 1A to **identify** which subject showed the greatest difference in satisfactory course completion between the control and intervention group. (1 mark)

Analyse data

3 **Describe**, with reference to Figure 1B, the trend in satisfactory course completion between those who completed the intervention and those who did not. (2 marks)

Interpret evidence

4 **Draw a conclusion**, with reference to the error bars, about the effect of a growth mindset on academic performance of participants in the study. (2 marks)

5 **Determine** which course the intervention group showed the greatest improvement in. (1 mark)

Module 10 checklist: Understanding intelligence

Quizlet: Revise key terms online to test your understanding

MODULE 11

Measuring intelligence

Introduction

Many people in Western societies tend to regard intelligence as the possession of a high intelligence quotient (IQ). A person's IQ is typically measured by traditional intelligence tests that emphasise cognitive abilities.

This module will describe some of the tests commonly used for measuring intelligence. The question of the reliability and validity of intelligence tests is also considered.

If you conduct an online search, you will find a variety of readily available IQ or intelligence tests. You may also have seen some in magazines or other print media. It can be fun to take these tests out of curiosity; however, it is important to remember that they cannot be taken seriously and the results are just for interest. Genuine psychometric tests can only be administered and interpreted by qualified psychologists.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to measuring intelligence before you start.

Subject matter

Science understanding

→ Describe common methods by which intelligence is measured with reference to IQ tests and scales, including
- Stanford–Binet scale
- Wechsler's intelligence scales for adults (WAIS-IV) and children (WISC-IV).

→ Discuss the degree to which intelligence tests are valid and reliable.

Science as a human endeavour

→ Consider the validity and reliability of IQ and EQ testing to determine if these tests can be misleading and/or inaccurate.

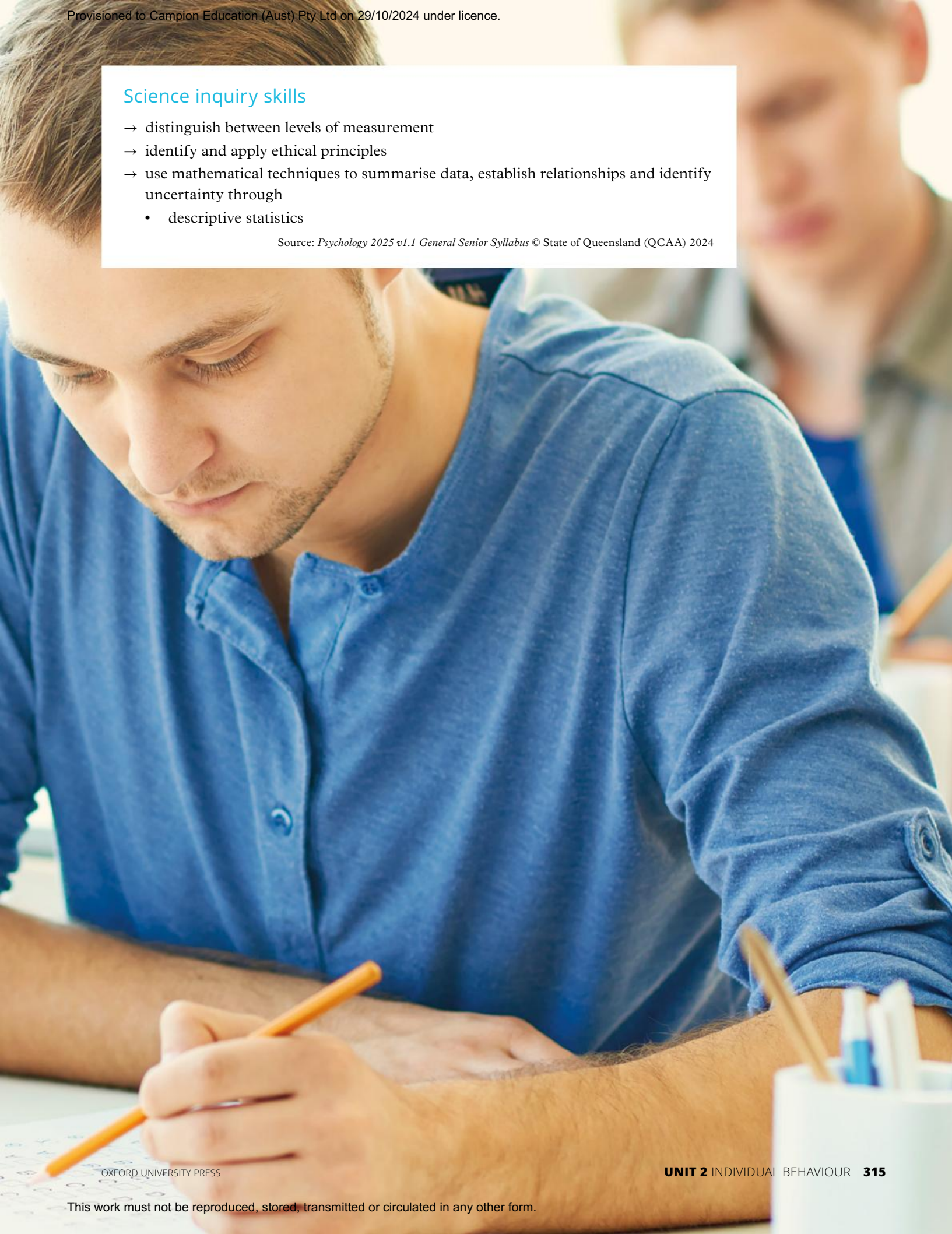
→ Discuss the applicability of theories of intelligence across social and cultural contexts.

→ Evaluate the degree to which intelligence tests are culturally biased.

Science inquiry skills

→ distinguish between levels of measurement
→ identify and apply ethical principles
→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  • descriptive statistics

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024



Lesson 11.1
Measures of intelligence

Key ideas

- → Psychometric tests of intelligence are objective, standardised instruments that measure cognitive abilities believed to be indicative of intelligence.
- → The most used psychometric tests include the Stanford–Binet scale and Wechsler intelligence scales for adults (WAIS-IV) and children (WISC-IV). Both tests use verbal and non-verbal tests to measure different cognitive abilities, as well as an individual's overall intelligence quotient.
- → Intelligence quotient (IQ) derived from psychometric tests compares an individual's test score with the norms of others in their age group.

Learning intentions and success criteria

Introducing psychometric tests

Measuring intelligence is not straightforward. Psychologists use psychometric tests to quantify intellectual abilities and to compare an individual's level of cognitive abilities with others in a given population.

psychometric test a standardised measure of a selected aspect of an individual's behaviour, used to identify individual differences in psychological functioning

As you learnt in Module 10, a **psychometric test** is a standardised instrument designed to measure an individual's specific mental capabilities or behaviours. These tests are scientifically developed and rely on statistical data to interpret individual differences in psychological functioning. Psychometric tests:

- are standardised to provide a way to objectively measure psychological phenomena
- measure one selected aspect of an individual's psychological functioning
- provide a score to allow an individual to be compared with other people
- allow predictions to be made about an individual's future performance or behaviour
- are used by psychologists as a diagnostic tool or as part of an assessment process
- should be administered by a qualified professional.

Psychometric tests generally fall into one of the categories listed in Table 1. They can either be group tests or individual tests.

TABLE 1 Psychometric test categories and what they measure

Type of tests	What they measure
Intelligence tests	Intellectual ability of an individual
Aptitude tests	Specialised skills such as hand–eye coordination
Personality tests	Traits, qualities or behaviours that make up a person's individuality
Achievement tests	A person's learning, success or accomplishment in a subject or task, such as school achievement
Creativity tests	Original thinking and the person's capacity to problem-solve in novel situations
Motivational tests	Interest and drive of an individual
Diagnostic tests	Psychopathology (psychological disorders) and learning deficits
Interest inventories	A person's preference for certain activities or subjects to help in career guidance
Neuropsychological tests	Brain functioning and damage

Standardisation of psychometric tests

Standardisation of psychometric tests is important. It ensures reliability and validity of the test, which allows researchers to make meaningful comparisons between results from different studies; that is, it allows them to compare like with like. Standardisation involves several components:

- **Normative sample**: Once a test has been developed, it is administered to a large sample that represents the demographic characteristics of the population for which the test is intended. These could include age, socioeconomic status, education, culture or any other relevant characteristics depending on the purpose of the test and the target population it aims to serve. The data from this sample serves as a reference point (or "**norm**") that is used to establish a range of scores that are considered normal or typical for the target population. These norms are what subsequent test-takers' scores are compared against. Creating an accurate normative sample is crucial because it ensures that test scores are meaningful and allows for the results to be generalised to the broader population. Over time, tests may be re-normed to account for changes in the population's performance.
- **Raw scores**: As people complete the test, they earn raw scores based on the number of correct responses or the quality of their responses.
- **Scaled scores**: Unadjusted raw scores are converted to a standardised scale with a set mean and standard deviation. This allows for easier comparison of an individual's performance to others.

standardisation
the process of ensuring a test is consistently administered and scored across different individuals and settings

normative sample
a group selected to reflect the demographics of a wider population, used as a benchmark for test score comparisons

norm
established standard of performance derived from the statistical analysis of a normative sample's test results

raw score
the initial, unadjusted score obtained directly from test responses

scaled score
a score that has been converted from a raw score to a consistent scale that allows comparison across different tests or populations

Test administration

Standardisation of test administration and scoring is equally important to ensure reliability and validity of the test. This requires the following:

- Qualified administrators should be suitably trained or qualified to administer the test. Most behaviour assessment procedures require formal training but not a degree. Complicated tests such as the Wechsler Adult Intelligence Scale (WAIS), personality or mental health scales are typically administered by qualified psychologists.
- The scoring of test instruments needs to be standardised to ensure consistency between scorers (inter-rater reliability) and over time (test-retest reliability).
- Tests should always be administered in the same way to all test-takers to ensure consistency and avoid introducing confounding variables. This includes considering and controlling (to the extent possible) the physical setting, time of day, duration of the test, and tools and equipment used, and providing standardised instructions to all participants.

FIGURE 1 Controlled conditions for test administration could include ensuring that test-takers do the test at the same time of day, that they have eaten a meal beforehand and that they have the same time in which to complete the test.

Standardised intelligence quotient tests

Intelligence tests are standardised instruments that measure and quantify a person's general mental ability. As a person completes a test, they earn raw scores based on the number of correct responses or the quality of their responses. Raw scores are then converted to scaled scores used to calculate an overall **intelligence quotient (IQ)**. A person's level of intelligence is then calculated based on how their standardised IQ score deviates from the average intelligence score for the population (normative sample). Scores for intelligence tests are usually standardised with a mean score of 100 IQ points, and a standard deviation of 15 IQ points.

intelligence quotient (IQ) standardised score for an individual's intelligence as measured by a specific intelligence test; IQ scores are based on how much an individual's test score deviates from the mean score for the normative sample

Figure 1 sets out the distribution of IQ scores for a population. Using the 68/95/99.7 rule for standard deviation (SD), this means that 68 per cent of the population obtain an intelligence quotient (IQ) score between 85 and 115, i.e. they fall within 1 SD of the mean IQ for the population, 95 per cent of the population obtain a score between 70 and 130 (2 SD of the mean) and 99.7 per cent have scores between 55 and 145 (3 SD of the mean). So, if an individual has an IQ score of 115, it does not mean that this person answered 115 questions correctly. It means that the individual's raw scores were standardised to an IQ score that is 15 IQ points above the average score (100) for people of the same age, and that this score is at the 84th **percentile**.

percentile measure that indicates the value below which a given percentage of observations in a group fall

There is a variety of different tests for measuring intelligence available to psychologists. Two of the most commonly used modern intelligence tests are the Stanford–Binet intelligence scales and the Wechsler intelligence scales for adults (WAIS-IV) and children (WISC-IV). These tests are based on the psychometric approach (Lesson 10.2), have been carefully designed, and must be administered and scored by qualified psychologists.

Study tip

IQ is so called because originally it was calculated as a division problem:

$$\left(\frac{\text{mental age}}{\text{chronological}}\right) \times 100$$

The answer to a division problem is called a quotient, and although this method is no longer the method used in modern tests, the term "intelligence quotient" remains.

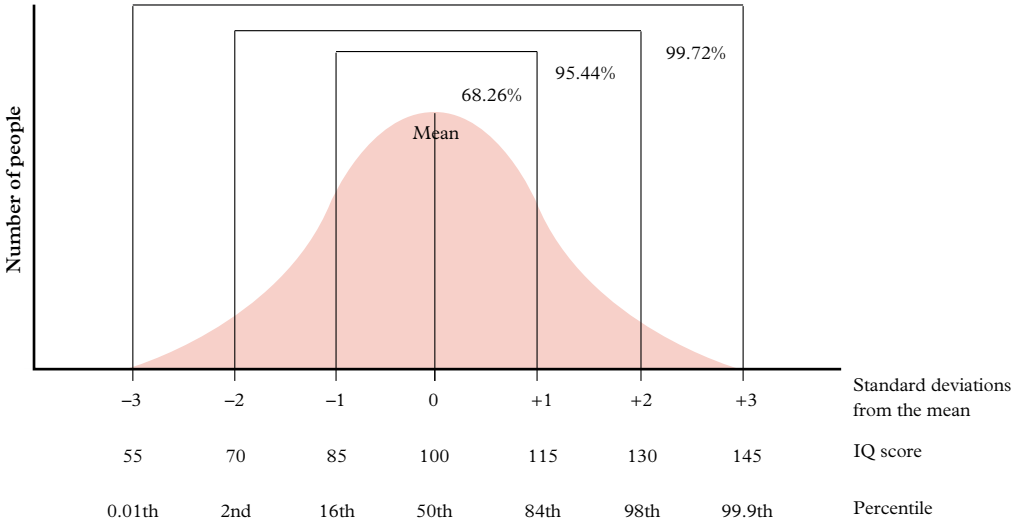


FIGURE 2 Distribution of IQ scores within the general population

Stanford–Binet intelligence scale

The Stanford–Binet intelligence scale test was designed in 1905 by French psychologist Alfred Binet. Binet's test construction was based on the idea of age differentiation, that with increasing age, children increase their cognitive abilities (Kaplan & Saccuzzo, 2017). For example, a psychologist who was testing a 10-year-old child would start by asking the test questions for 9 year olds. If the child was able to answer these questions, the psychologist proceeded to the questions for 10 year olds. If these were answered correctly, then the child was asked the questions for 11 year olds and so on until the child reached a set of age-related questions that they were unable to answer.

The psychologist then computed the intelligence quotient (IQ) score by comparing the child's scores with the norms for 10 year olds set out in the tables provided by the test designers. Children who answered questions intended for an older age group will generally score a higher-than-average IQ, whereas children who were unable to answer the relevant questions for their age group would score a lower-than-average IQ.

The test was later revised in 1916 by Lewis Terman, a professor of psychology at Stanford University, for the US army. It has been revised and adapted based on new research findings several times since then.

FIGURE 3 Alfred Binet's (1857–1911) test construction was based on the idea that children's cognitive abilities increase as they get older.

Stanford–Binet scale, fifth edition

The most recent version of the Stanford–Binet scale, the 2003 fifth edition (SB-5), is structured around five factors:

- fluid reasoning
- knowledge
- quantitative reasoning
- visuospatial reasoning
- working memory.

Each factor has an equally weighted verbal and non-verbal measure (Figure 4). Scoring involves converting raw scores from subtests into scaled scores, which are then used to calculate composite scores for each of the five factors. These factor composite scores are further summed to produce a full-scale IQ score (FSIQ). The scores are norm-referenced, meaning an individual's performance is compared to a normative sample, and standardised with a mean of 100 and standard deviation of 15.

The modern Standford–Binet scale still involves age differentiation but has been improved with the addition of routing. Routing tests are used to determine the level of the participant's ability and guide the examiner to an age-appropriate subtest and level (Kaplan & Saccuzzo, 2017). This makes the testing process more efficient as it doesn't waste time on questions that would be too easy. The level of difficulty increases in an age-scale format.

Wechsler's intelligence scales

Wechsler's intelligence scales were designed in 1939 by David Wechsler, chief psychologist at New York's Bellevue Hospital, and many new versions have since been developed. Like the Stanford–Binet intelligence scale, this test provides a general IQ score plus scores for separate aspects of intelligence.

There are three Wechsler intelligence tests for different age groups:

- Wechsler Adult Intelligence Scales, fourth edition (WAIS-IV) for 16+ years (Figure 5 sets out the indices and related test types)
- Wechsler Intelligence Scales for Children (WISC-IV) for 6 to 17 year olds (Table 2 sets out the indices and sample questions)
- Wechsler Preschool and Primary Scale of Intelligence (WPPSI-III) for 2.5 to 7 year olds.

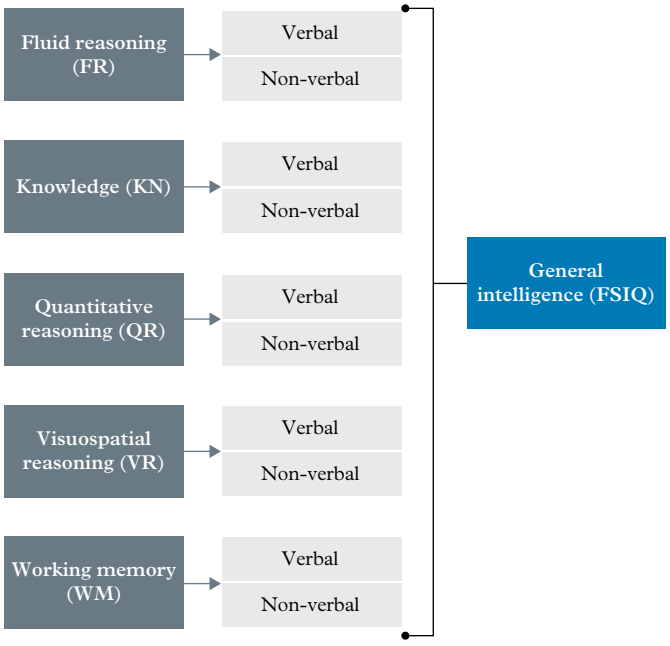


FIGURE 4 The SB-5 consists of 10 individual, age-graded subtests. Verbal and non-verbal test scores combine to give five subtest scores (FR, KN, QR, VR, WM) and these combine to give an overall full-scale IQ (FSIQ) score.

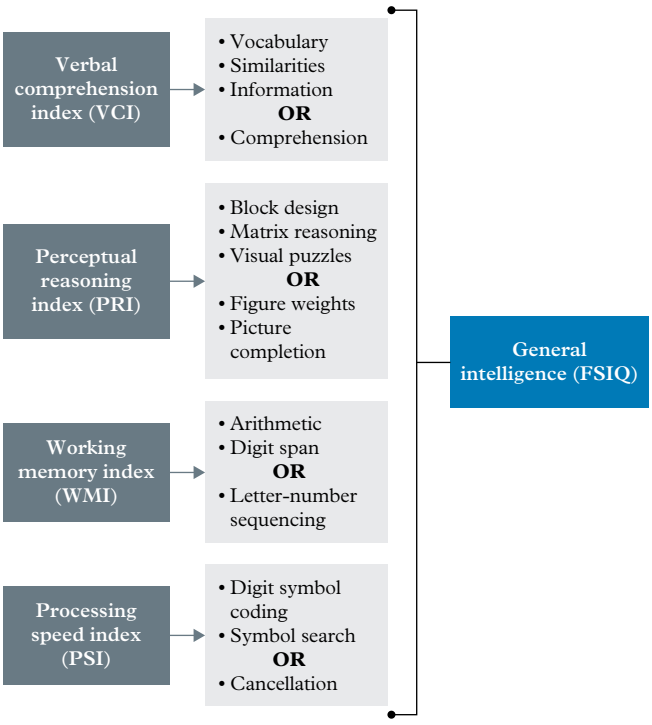


FIGURE 5 The WAIS-IV intelligence tests consist of four factor indices (VCI, PRI, WMI, PSI) that are derived from 10 subtests. Indices are combined to produce an overall full-scale IQ (FSIQ) score.

TABLE 2 Wechsler Intelligence Scales for Children, fourth edition (WISC-IV)

Aspect of intelligence	Task examples
Verbal comprehension index measures the ability to process verbal information and to think and reason with words and previously learned information.	• Describe how two words that represent common objects or concepts are similar. • Name pictures or provide definitions for words. • Answer a series of questions based on understanding of general principles and social situations.
Perceptual reasoning index assesses non-verbal and fluid reasoning, spatial processing and visual-motor integration.	• Copy a set of printed 2D geometric patterns using red and white blocks within a time limit. • Choose one picture from each of two or three rows of pictures presented, to form a group of pictures with a common characteristic. • Complete the missing portion of a picture matrix by selecting one of five options.
Working memory index assesses short-term memory and attention.	• Repeat numbers verbatim as they were stated by the examiner, and then repeat a second series of numbers in reverse order as they were stated by the examiner. • Listen to a sequence of numbers and letters presented orally and recall the letters in alphabetical order and the numbers in the correct sequence.
Processing speed index assesses mental efficiency, including attention, concentration, short-term visual memory and the ability to perform simple, clerical-type tasks quickly.	• Copy symbols that are paired with either geometric shapes or numbers using a key within a specified time limit. • Scan a research group of symbols and indicate the presence or absence of a target symbol or symbols within a specified time limit.

Pattern analysis

The advantage of intelligence tests such as the Stanford–Binet and Wechsler intelligence scales being broken into different aspects of intelligence is that it makes pattern analysis possible. Pattern analysis involves examining the variances between different subtest scores to identify specific cognitive strengths and weaknesses. This can be used for various purposes:

- **Diagnosis of learning disabilities or disorders:** For example, a significantly lower score in working memory compared to other areas might suggest a specific learning disability. Diagnosis will aid in the formulation of an educational plan.
- **Educational planning:** Educators may use patterns in subtest scores to tailor learning approaches to a student's strengths; for instance, relying more on verbal instructions for students with higher verbal comprehension.
- **Neuropsychological evaluation:** Changes in test performance can signal potential neurological issues. For example, in an adult recovering from a brain injury, lower processing speed compared to other indices might indicate the need for cognitive rehabilitation focusing on attention and speed of information processing.
- **Vocational guidance:** Insight into a person's cognitive profile can guide career counselling by aligning job requirements with the individual's cognitive strengths.

Challenge

Binet and Wechsler

Briefly research the backgrounds of Alfred Binet and David Wechsler. **Consider** what aspects of their upbringings might have influenced their interest in, and approach to, the measurement of intelligence.

Check your learning 11.1

Check your learning 11.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** psychometric tests. (1 mark)
2 **Identify** the common methods by which adults' intelligence is measured. (2 marks)
3 **Describe** how the Stanford–Binet and WAIS scales measure intelligence. (2 marks)
4 **Identify** three similarities between the Stanford–Binet, the WAIS and the WISC scales. (3 marks)
5 **Explain** why it might be helpful for psychologists to use percentiles rather than IQ scores when reporting the results of a psychometric test. (1 mark)

Analytical processes

6 **Distinguish** between the Stanford–Binet and WAIS scales and **identify** the significance of the difference. (2 marks)

Knowledge utilisation

7 **Apply** your understanding of the Wechsler intelligence tests to answer the following questions.
   a **Discuss** why it might be important to have separate intelligence tests designed for children and adults. Include one strength, one weakness and one implication of having separate tests. (3 marks)
   b **Evaluate** whether there should be a separate test for adolescents. **Justify** your response. (2 marks)

Lesson 11.2
Reliability and validity of intelligence tests

Key ideas

- → An intelligence test is reliable when the same results can be expected with the same subjects under the same conditions on other occasions.
- → An intelligence test is valid if it measures what it was designed to measure (i.e. intelligence and not familiarity with the English language).
- → There are issues with the way psychometric intelligence tests are conducted and interpreted. These include standardisation, the Flynn effect, global IQ score, predictive issues, cultural and linguistic bias, and other cognitive and non-cognitive factors that influence the reliability and validity of results.

Learning intentions and success criteria

psychometric property
an essential feature that determines the quality of psychological instruments such as measures for reliability and validity

reliability
the extent to which a measure could be expected to produce the same result with the same subject(s) under the same conditions on other occasions

validity
the extent to which a study or instrument accurately measures what it intends to measure

Study tip

Typically, you do not need to memorise the reliability coefficients of each test. Rather, it is important to understand that reliability is measured in different ways and quantified through correlation coefficients, which can be used to assess the degree of reliability of the overall test, indexes or subtests.

Introducing reliability and validity of intelligence tests

Psychometric tests of intelligence can be relatively quick (approximately 2 to 4 hours) and inexpensive ways of obtaining information about the psychological functioning of one or many people. Results from these tests have many real-world applications, such as educational testing, diagnosis or to obtain government support. Thus, it is very important that tests are designed and administered in a way that ensures high quality and fair measurement.

In choosing the most appropriate test, psychologists consider the psychometric properties and sources of potential bias that may affect an individual's performance. **Psychometric properties** are the essential features that determine the quality of psychological instruments. Tests must be checked for **reliability** (consistently accurate measurements) and **validity** (results accurately measure what was intended).

Reliable	Instrument provides consistently accurate measurements.
Valid	Instrument measures what it sets out to measure.

FIGURE 1 An instrument is reliable if it gives consistently accurate measurements, and valid if it measures what it sets out to measure.

Reliability of intelligence tests

The degree of reliability of psychometric tests is indicated by three different measures: internal consistency, inter-rater reliability and test-retest reliability. Intelligence tests like the Stanford–Binet scale (SB-5) and Wechsler Adult Intelligence Scale (WAIS) have high reliability; these are summarised in Table 1. It should be noted that reliabilities for the individual subtests vary to a greater extent. Standardisation, reliability and validity of the Wechsler Intelligence Scales for Children (WISC) are similar to the WAIS (Kaplan & Saccuzzo, 2017).

TABLE 1 Reliability measures for SB-5 (Janzen et al., 2004) and WAIS-IV (Canivez, 2010; Climie & Rostad, 2011) FSIQ and factor index scales

Reliability measure	SB-5	WAIS-IV
Internal consistency	Estimates ranged from 0.95 to 0.98 for FSIQ, and 0.90 to 0.92 for the five factor index scores.	Internal consistency across all age groups was high. Estimates ranged from 0.97 to 0.98 for FSIQ, and 0.87 to 0.98 for the four factor index scores.
Inter-rater reliability	Correlations were adequate ranging from 0.74 to 0.97 (median 0.90).	Average consistency between independent scores was high (0.98 to 0.99).
Test-retest reliability	Test-retest correlations across all age groups ranged from 0.89 to 0.95 for FSIQ and 0.79 to 0.95 for the factor index scores.	Repeated administration of the test yielded high stability. Factor index scores ranged from 0.87 to 0.96, and FSIQ 0.96.

Validity of intelligence tests

Study tip

Go to Lesson 1.8 to revise
- reliability and validity
- internal consistency
- inter-rater reliability
- test-retest reliability.

For an intelligence test to be useful, it must be valid; that is, it must measure what it intended to measure. As with reliability, there are different types of test validity.

- **Face validity** is a superficial assessment of whether an intelligence test appears to measure intelligence. An intelligence test with high face validity might include questions relating to aspects associated with intelligence such as problem-solving, reasoning and memory but should not test content that requires specialised training. The Stanford–Binet and Wechsler intelligence tests have high face validity.
- **Content validity** ensures the test covers the breadth of the construct of "intelligence". A test with strong content validity will include items assessing a variety of cognitive functions, such as verbal skills, abstract thinking and memory. For instance, a well-rounded IQ test will have questions ranging from vocabulary use to spatial reasoning, rather than just focusing on knowledge or numerical skills. The Stanford–Binet and Wechsler intelligence tests measure different cognitive abilities that are highly correlated with the construct of "intelligence".
- **Predictive validity** gauges the test's ability to predict relevant future outcomes. For instance, if students with higher scores on an intelligence test consistently perform better in school, the test has high predictive validity. Researchers have found a moderate positive correlation, between 0.5 and 0.7, between IQ scores and academic grades (Burton et al., 2019).
- **Concurrent validity** refers to the degree to which scores on one measure of intelligence are correlated to scores on another measure taken at the same time.

Each of these validity types contributes to an overall assurance that the intelligence test is a sound, comprehensive tool for measuring the complex construct of intelligence.

Challenge

Evaluate an online intelligence test

Find an intelligence test that is readily available online or in a magazine. It need not be an official test.

a **Examine** the test for evidence of technical detail, such as validity, reliability, norms and standardised procedures.

b **Discuss** consequences of using an intelligence test, such as the one you have found.

Introducing issues in psychometric testing

Various factors can contribute to incorrect measurement or interpretation of a person's true psychological functioning. These are shown in Figure 2 and then discussed.

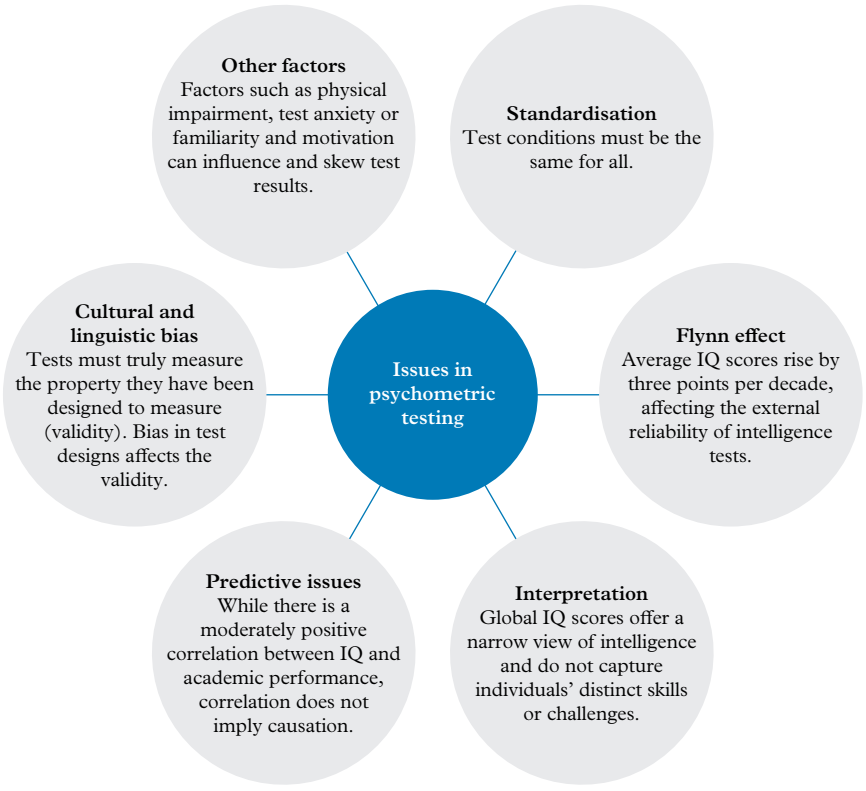


FIGURE 2 Issues in psychometric testing

Standardisation of administering and scoring intelligence tests

Conditions for examinees taking the tests must be standardised (same test conditions for all). Lack of standardised procedures can reduce the reliability and validity of the test. An individual's IQ score is determined based on the age-related norms of the test. If the normative sample is not representative, the test results could be biased and less predictive of how individuals within the intended population might perform.

Flynn effect

Scoring of intelligence tests must include the use of age-appropriate norms (comparing an individual's result with scores of a large group of people of the same age). However, there are issues with normative data.

The Flynn effect, named after James R. Flynn who identified it, refers to the observed rise in average IQ scores over time, across many countries and cultures. This phenomenon, discovered through the analysis of standardised IQ tests over several decades, suggests that intelligence scores increase about three points each decade. The effect challenges the reliability and validity of intelligence testing. It also indicates that test norms can become outdated, potentially skewing assessments if tests are not regularly updated to reflect these changes.

Flynn's findings have sparked debates on the environmental factors influencing intelligence and the nature of intelligence itself (Flynn, 1984). Researchers have suggested that improved education, higher employment demands, and improvements in health and lifestyle could explain increases in intelligence scores (Bratsberg & Rogeberg, 2018).

Interpretation issues: Global IQ score

Even intelligence tests that are well designed are not perfect, and caution must be taken when interpreting scores. There is a trend away from using global IQ scores that are provided in intelligence tests because this is only one measure of "general intellectual functioning". An IQ score is computed to provide one's global or overall level of intelligence, with higher IQ scores assumed to equate to higher levels of intellectual functioning. However, this single score does not explain why an individual may have special skills or talents in different areas such as art or music, or why a child may have difficulty in specific cognitive areas.

Greater understanding about the intellectual functioning of individuals can be ascertained from scores for a range of cognitive abilities rather than from a single, overall IQ score. Performance on an individual intelligence test provides a useful starting point for understanding an individual's cognitive skills and needs; however, it needs to be combined with other sources of information on an individual's intellectual capability (Ortiz et al., 2010). Modern theories, such as Gardner's theory of multiple intelligences (Lesson 10.5), suggest that intelligence consists of many different abilities. This concept of multiple intelligences or cognitive abilities appears to better explain why some individuals excel on some tasks and struggle on others (Ortiz et al., 2010).

FIGURE 3 Greater understanding of the intellectual functioning of individuals can be ascertained from scores for a range of cognitive abilities rather than from a single, overall IQ score.

Predictive issues with IQ tests and academic performance

IQ tests that are formally recognised and administered by qualified psychologists can make reasonably accurate predictions about an individual's potential for learning in school and university, including the ability to understand, remember, follow instructions, use language and solve problems. It must be emphasised, however, that an IQ score does not explain or predict actual academic performance. It is possible for an individual with a high IQ score to perform poorly at school for various reasons; for example, sickness and absence from school, or an unsettled family or social life. It is important to remember that intelligence tests and IQs are measurements and scores, not explanations for academic performance.

Cultural and linguistic bias

A criticism of intelligence tests is that they are culturally and linguistically biased against examinees who do not come from a Western, middle-class, English-speaking background. For this reason, there are ethical concerns when intelligence tests are used to classify people according to intellectual ability. This is because the tests might record a lower IQ for the individual than what the "true" IQ would be if the tests were in the individual's native language and culture.

To illustrate the way in which Western intelligence tests are biased against other cultural and linguistic groups, some mock intelligence tests that are biased in favour of minority groups have been developed. These tests are readily available online.

We will now look at cultural and linguistic bias in more detail.

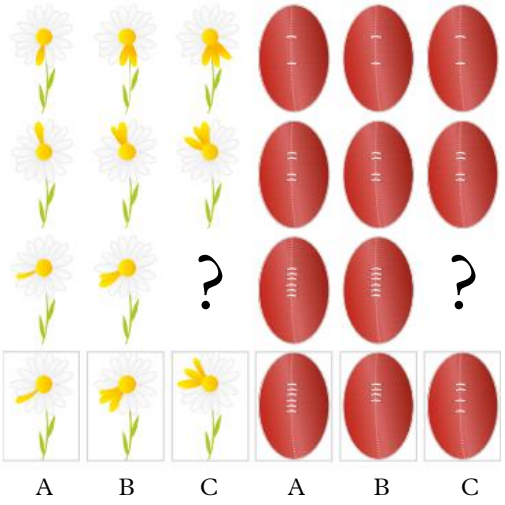


FIGURE 4 Psychologists have tried to overcome bias in tests by developing tests that do not rely on culture or language. In this example, participants are asked to select the most appropriate symbol to replace the question mark.

Cultural bias

cultural bias
when an examinee performs poorly on an intelligence test because some of the questions are about things that are culturally unfamiliar

Cultural bias occurs when examinees may have a normal or higher intellectual ability, but perform poorly on an intelligence test because some of the questions are about things that are unfamiliar to their culture. Intelligence testing is mostly used in Western cultures and tests have been developed in Western settings.

Imagine growing up using only chopsticks (or only a knife and fork) to eat meals, then having a test where you were expected to use a knife and fork (or chopsticks), with which you have no familiarity. It is highly likely that you would perform poorly on such a test because the eating utensils would be strange to you. The same applies when people from non-Western cultures sit intelligence tests that have been designed and developed in a Western context.

FIGURE 5 If an intelligence test is developed outside of your cultural context, it is unlikely that you will perform well. This is cultural bias.

It is possible for people of cultural minorities to be scored as having a lower IQ than they really have. These people might then be treated inappropriately by their education system or other agencies. They might be placed into education programs for those requiring additional support when, in reality, they have normal intelligence but simply did not understand the questions on the test. Psychologists have been trained to ensure this does not happen.

Real-world psychology

Bias in intelligence testing

The culture of Indigenous Australians living a traditional lifestyle might place great value on hunting and fishing skills, whereas the culture of inhabitants of metropolitan or urban Australia might place greater importance on academic performance at school. For this reason, many standard intelligence tests are culturally biased because they are based on Western schooling and knowledge paradigms (Kearins, 1981; 1986).

Judy Kearins' research found that Aboriginal adolescents performed lower than non-Indigenous Australians on standard intelligence tests, but outperformed their non-Indigenous counterparts in all conditions of a visual-spatial memory task.

Apply your understanding

1 **Identify** and describe the type of bias present in Kearins' research. (2 marks)
2 **Discuss** the impact of this bias on the reliability and validity of the findings. (2 marks)

Linguistic bias

Linguistic bias occurs when examinees score poorly on an intelligence test because their first language is different from the language used in the test. For example, the major intelligence tests in Australia are in the English language. Words and expressions used in these tests may be unfamiliar to an examinee from a non-English-speaking background. This will be obvious where the examinee has limited use of English, but it might be less evident in other instances; for example, English-speaking children whose parents or carers don't speak English.

linguistic bias the words in a test are more familiar to examinees who speak one language than those who speak another

Consider the case of two children who have the same level of intellectual ability; one is native English-speaking, with native English-speaking parents. The second child was also born in Australia, but has parents who were born overseas and who speak very little English at home. It is likely that the second child might not have the same depth of vocabulary as the first child. Despite these children having the same intellectual ability, the first child is likely to score a higher IQ on most tests of intelligence than the second child, because the intelligence tests have several subtests that require familiarity with English.

Other influences on intelligence tests

Tests are only one form of assessment and must not be used on their own to form an impression of a person's psychological functioning. A test only takes a sample of a person's psychological functioning on any given day. This is similar to a blood test, which only provides a sample of a person's physiological functioning at a particular time and location. Similarly, when sitting psychometric tests, an individual may be nervous, unwell, tired or distracted. These variables can influence test results from one day to the next.

These are some factors that can influence an individual's performance on an intelligence test:

- **Physical impairment:** Vision or hearing impairment might prevent examinees from performing to the best of their ability. Motor impairment might restrict an individual's ability to use a pencil or to manipulate blocks. Physical impairment must be taken into account by the psychologist because they have the potential to cause the examinee's true intellectual ability to be misrepresented by the scores obtained.

FIGURE 6 Physical impairment that affects test-taking can influence a test score.

- **Test anxiety or shyness:** Some individuals may be shy with the examiner or very nervous about their performance on the test and this could hinder them from doing their best. In this instance, obtained scores would not be truly representative of their ability.
- **Test familiarity:** Some individuals might have sat the very same test within the previous two years. If the psychologist is aware of this, then an alternative test can be used to avoid practice effect. Practice effect is a confounding variable that refers to improvements in test performance due to familiarity with the material or testing procedure, rather than genuine cognitive changes. This can lead to inflated scores that reduce the validity of the test results.
- **Motivation or incentives:** Higher motivation can lead to increased effort and persistence on challenging test items, potentially resulting in higher scores. Conversely, a lack of motivation can result in lower scores that may not accurately reflect the individual's true cognitive abilities. Incentives, whether intrinsic or extrinsic, can also enhance performance by providing a goal for the individual to achieve, thus potentially skewing the results of an intelligence test (Duckworth et al., 2011).

Real-world psychology

Intelligence in the army

In the early twentieth century, Lewis Terman, a Stanford University psychologist, and Robert Yerkes, a Harvard professor, were pioneers in the development of intelligence testing. Terman believed that intelligence was an inherited trait and advocated for classifying individuals by IQ score to determine suitable job roles; for example, employment for people with IQ scores less than 75 should only be unskilled labour; people with scores between 75 and 85 should do semi-skilled labour only; and only people with scores above 100 should be permitted to work in highly skilled jobs.

Yerkes developed tests for army recruits during the First World War, including written exams for literate recruits (Army Alpha), a test for those failing Army Alpha (Army Beta), and an individual test for those failing Army Beta.

Based on test scores, Yerkes concluded that white American males averaged a mental age of 13 and ranked Nordic immigrants as more intelligent than those from Latin and Slavic countries, with Black Americans at the bottom. These findings influenced the restrictive 1924 Immigration Law in the US, which limited immigration from "lesser" European races. However, Stephen Jay Gould's (Gould, 1996) critical review of Yerkes' work highlighted issues such as cultural bias and lack of standardised testing procedures, arguing that his research could not validly determine intelligence levels, class distinctions or heritability of intelligence.

This early research underlined the complexity of measuring intelligence, emphasising individual variations in human traits, and the challenges in defining intelligence due to varying perceptions across different cultures and scholarly communities.

Apply your understanding

1 **Describe** how the cultural contexts were ignored in Yerkes' research into intelligence. (1 mark)
2 **Identify** two sources of uncertainty in Yerkes' research that affected the validity of his conclusions. (2 marks)
3 **Describe** two limitations associated with the approach to intelligence on which Yerkes based his investigation. (2 marks)

FIGURE 7 Robert Yerkes' research was conducted on army recruits, but his findings have been largely discredited.

Advantages of intelligence tests

There are advantages of using psychometric tests in an attempt to establish the level of an individual's intellectual ability.

- Intelligence tests provide a standardised IQ score.
- They are relatively easy, quick and cheap to administer and score.
- If the tests have been properly constructed and administered, they allow for objective inferences to be drawn.
- They enable individuals to be compared against other people their age.
- They are helpful in making predictions about academic performance.
- They can be useful for selection purposes for people best suited to certain tasks or careers, or for particular intervention, such as those with intellectual disability or giftedness.

Disadvantages of intelligence tests

Just as there are advantages of using psychometric tests in an attempt to establish the level of an individual's intellectual ability, there are also disadvantages.

- Intelligence tests are rarely perfect and may disadvantage individuals if they are used inappropriately.
- They must not be used unless there is evidence that they have strong reliability, validity, and standardised testing and scoring procedures.
- They do not take into account individual differences, such as nervousness, personality characteristics, experience in testing and motivation.
- Most intelligence tests tend to measure cognitive abilities and do not include other forms of intelligence, such as those suggested by Gardner and Sternberg (Module 10).
- Intelligence tests tend to be culturally and linguistically biased.
- There is the potential for intelligence test results to be used to label people unfairly, either positively or negatively.

Skill drill

Experimental ethics

Science inquiry skill: Considering ethics and safety (Lesson 1.5)

Recent research has found that the IQ scores of children who regularly eat breakfast are five points higher on average than children who do not eat breakfast. Jal wanted to find out if eating breakfast had an immediate effect on IQ scores. Jal obtained informed parental consent to use a Year 9 Geography class to test her hypothesis. She asked 20 students to come in an hour before school; 10 of them were given a healthy breakfast and the other 10 had no breakfast. When the bell rang, she administered an IQ test to all 20 students.

Practise your skills

1 **Identify** one ethical consideration observed in this study. (1 mark)
2 **Create** an informed consent letter for this study. (6 marks)

Check your learning 11.2

Check your learning 11.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Explain** the importance of each of the following in relation to intelligence tests
   - **a** test norms (1 mark)
   - **b** validity (1 mark)
   - **c** reliability. (1 mark)

2 **Describe** the consequences of using an intelligence test that has
   - **a** low reliability (1 mark)
   - **b** low validity (1 mark)
   - **c** not been administered using standardised procedures. (1 mark)

3 **Explain** cultural bias in an intelligence test. (1 mark)

Analytical processes

4 **Contrast** content and concurrent validity. (1 mark)

Knowledge utilisation

5 **Assess** the impact of the Flynn effect on the validity of IQ tests over time. (3 marks)
6 **Discuss** the reliability of the WAIS-IV test of intelligence. (4 marks)

MODULE 11

Lesson 11.3
Review: Measuring intelligence

Summary

11.1
- Psychometric tests of intelligence are objective, standardised instruments that measure cognitive abilities believed to be indicative of intelligence.
- The most used psychometric tests include the Stanford–Binet scale and Wechsler intelligence scales for adults (WAIS-IV) and children (WISC-IV). Both tests use verbal and non-verbal tests to measure different cognitive abilities, as well as an individual's overall intelligence quotient.
- Intelligence quotient (IQ) derived from psychometric tests compares an individual's test score with the norms of others in their age group.

11.2
- An intelligence test is reliable when the same results can be expected with the same subjects under the same conditions on other occasions.
- An intelligence test is valid if it measures what it was designed to measure (i.e. intelligence and not familiarity with the English language).
- There are issues with the way psychometric intelligence tests are conducted and interpreted. These include standardisation, the Flynn effect, global IQ score, predictive issues, cultural and linguistic bias, and other cognitive and non-cognitive factors that influence the reliability and validity of results.

Review questions 11.3A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 Xunxi took the latest edition of the Stanford–Binet intelligence test, which includes a fluid reasoning index. Xunxi's score on this index fell at the 87th percentile. What does Xunxi's percentile score indicate?
- **A** Xunxi's fluid reasoning abilities are below average for the population.
- **B** Xunxi answered 87 per cent of the fluid reasoning questions correctly.
- **C** Xunxi scored better than 87 per cent of the population on fluid reasoning tasks.
- **D** Xunxi is in the top 13 per cent for fluid reasoning abilities compared to peers of the same age.

2 Which type of reliability would be most directly assessed by having two different psychologists score the same completed WAIS-IV?
- **A** Split-half reliability
- **B** Inter-rater reliability
- **C** Internal consistency
- **D** Test-retest reliability

3 Sam scored highly on the verbal comprehension index but lower on the processing speed index of the WAIS-IV. What might this discrepancy suggest?
- **A** Sam's overall intelligence is low.
- **B** Sam has an intellectual disability.
- **C** Sam has equal abilities in all cognitive domains.
- **D** There may be specific cognitive strengths and weaknesses to consider.

4 Predictive validity in intelligence testing is best demonstrated when
- **A** test scores remain stable over time.
- **B** test content reflects everyday skills.
- **C** different testers give the same score.
- **D** test scores accurately forecast future performance.

5 The Flynn effect is observed when
- **A** IQ scores fluctuate randomly over time.
- **B** IQ scores drop due to environmental factors.
- **C** a test's internal consistency is compromised.
- **D** there is a consistent rise in average IQ scores over generations.

6 What does a high internal consistency coefficient indicate in an intelligence test like the WAIS-IV?
- **A** The test has low validity.
- **B** The test has high validity.
- **C** The test has low reliability.
- **D** The test has high reliability.

7 IQ is typically computed to have a mean (average score) of
- **A** 15 and a standard deviation (which measures dispersion of scores) of 15.
- **B** 100 and a standard deviation (which measures dispersion of scores) of 15.
- **C** 15 and a standard deviation (which measures dispersion of scores) of 100.
- **D** 100 and a standard deviation (which measures dispersion of scores) of 100.

8 On most intelligence tests today, a score of 120 would be
- **A** the mean score.
- **B** above the mean score.
- **C** below the mean score.
- **D** none of the above.

9 What are IQ tests useful for?
- **A** Measuring multiple intelligences
- **B** Measuring emotional intelligence
- **C** Predicting potential for academic performance
- **D** All of the above

10 Which is a concern with IQ tests?
- **A** They are not culturally biased.
- **B** They are not linguistically biased.
- **C** They are unable to predict academic potential.
- **D** They have the potential to be used to label and classify people.

11 Cultural bias in intelligence testing can lead to
- **A** increased face validity.
- **B** inconsistent test results.
- **C** overestimation of an individual's cognitive abilities.
- **D** underestimation of an individual's cognitive abilities.

12 IQ scores are based on
- **A** a fixed measure of intelligence.
- **B** the culture of a person sitting an intelligence test.
- **C** how far a person's intelligence test raw score is from the mean score for the norm group.
- **D** none of the above.

13 Which of the following is a limitation of well-known measures of intelligence such as the Stanford–Binet and Wechsler tests?
- **A** They lack validity and reliability.
- **B** They take into account different cultures.
- **C** They do not assess all types of intelligence.
- **D** They produce scores that cannot be compared between individuals.

14 A student consistently performs well in verbal tasks but struggles with tasks requiring quick responses. Which index of the WAIS might this student have a lower score in?
- **A** Working memory index
- **B** Processing speed index
- **C** Perceptual reasoning index
- **D** Verbal comprehension index

15 What do the Wechsler intelligence scales measure?
- **A** Verbal ability
- **B** Non-verbal ability
- **C** Both verbal and non-verbal ability
- **D** Neither verbal nor non-verbal ability

Review questions 11.3B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

16 **Explain** how an intelligence test is designed. (2 marks)

17 **Describe** the four aspects of intelligence measured by the Wechsler intelligence scale. (4 marks)

18 **Describe** two factors that can influence a person's individual performance on an intelligence test. (2 marks)

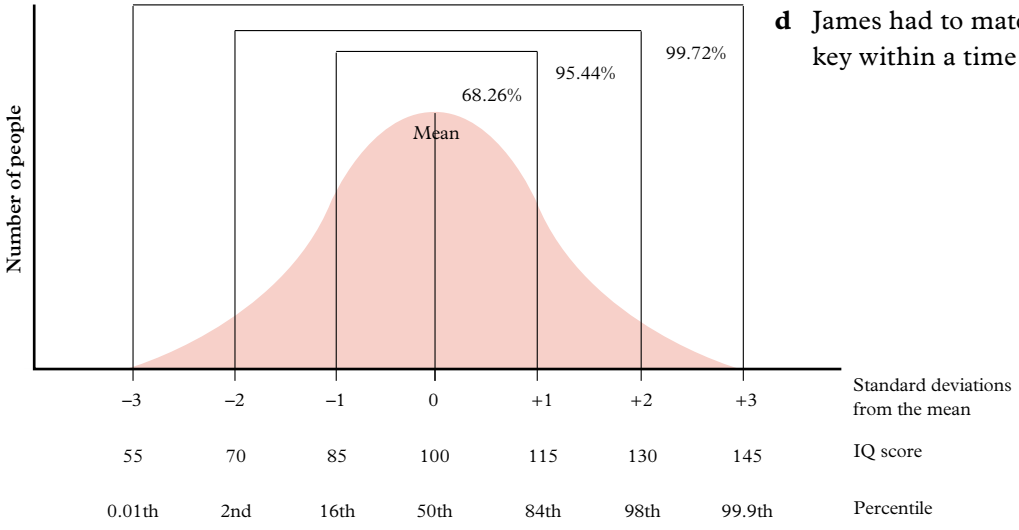
19 **Identify** two ethical considerations for any psychologist using an IQ test. **Describe** why these are important considerations. (4 marks)

20 **Explain** how the intelligence quotient is obtained in modern tests. (2 marks)

21 **Explain** the data shown in the graph with reference to

a standardisation, referring to mean and standard deviation (3 marks)

b percentiles. (2 marks)



Knowledge utilisation

25 Answer the following questions relating to IQ.

a **Identify** two real-world applications where IQ tests are used. **Justify** your response. (3 marks)

b **Identify** two examples of how IQ tests might be misused. **Justify** your response. (3 marks)

26 James was seen engaging in various activities during his assessment day. **Identify** which WAIS-IV subscale is being primarily measured for each activity described. **Justify** your response.

a James was asked to listen to a sequence of numbers and then repeat them backwards. (2 marks)

b He completed a jigsaw puzzle without any reference image. (2 marks)

c He was required to explain the meaning of proverbs and to complete sentences where key words were missing. (2 marks)

d James had to match symbols to numbers using a key within a time limit. (2 marks)

Analytical processes

22 **Differentiate** between inter-rater reliability and test-retest reliability. (1 mark)

23 **Distinguish** between the WISC and the WAIS scales and **describe** the significance of the difference. (2 marks)

24 **Determine** two issues that a psychologist should consider when deciding whether to administer a Wechsler IQ test to a child whose parents do not speak English. (2 marks)

27 Since their creation, intelligence tests have been used negatively, including providing support for racism and barring people from certain types of employment. **Explore** the importance of considering a person's whole being, rather than just their IQ. Use an example in your response. (2 marks)

28 **Discuss** the reliability of the WAIS-IV and SB-5. (2 marks)

29 **Discuss** the validity of the SB-5 and WISC-IV to measure the intelligence of a 5 year old. (2 marks)

Data drill

Interpreting IQ data

Interpreting the range and variance of a data set can reveal its features as well as give an idea of how the data is spread.

The students in a Units 1 & 2 Mathematics class in Mackay, Queensland, agreed to take an IQ test that was similar to the Stanford–Binet IQ test. All participants gave informed consent and parental consent was also obtained. The raw data was calculated and can be seen in Table 1. The standard normal curve for intelligence scores is that about 68 per cent of the population have IQ scores between 85 and 115 (one standard deviation below and one above the mean, which is 100).

TABLE 1 IQ scores obtained from Units 1 & 2 Mathematics students in Mackay

IQ scores	
120	88
115	100
95	98
90	107
100	105
105	106
103	107
107	99
97	102
118	125

Apply understanding

1 **Calculate** the range for this data set. (2 marks)

2 **Identify** the level of measurement used. (1 mark)

Analyse data

3 **Organise** the IQ scores from smallest to largest. (1 mark)

4 **Identify** a characteristic of the data that makes it appropriate to use the mean as a measure of central tendency. (1 mark)

Interpret evidence

5 If roughly 68 per cent of the normal population falls between 85 and 115 on an IQ test, **determine** if this Mathematics class is "normal". (1 mark)

6 **Justify** your response to question **5**. (2 marks)

Module 11 checklist: Measuring intelligence

Quizlet: Revise key terms online to test your understanding

UNIT 2

Topic 1 review

Multiple choice

(1 mark each)

1 Intelligence quotient (IQ) is
- **A** a standardised score reflecting a person's relative intelligence.
- **B** an assessment of practical problem-solving abilities.
- **C** a test of creativity and innovative thinking.
- **D** a measure of emotional and social skills.

2 Which intelligence test is designed specifically for children?
- **A** SB-V
- **B** WAIS-IV
- **C** WISC-IV
- **D** WPPSI-III

3 Considering the pattern analysis in intelligence testing, which scenario best represents its application?
- **A** Standardising test scores across different age groups
- **B** Calculating the overall IQ score from subtest raw scores
- **C** Using variances in subtest scores to diagnose a learning disability
- **D** Comparing IQ scores with a normative sample to determine percentile ranking

4 Which type of validity concerns whether a test appears to measure what it is supposed to measure?
- **A** Face validity
- **B** Content validity
- **C** Predictive validity
- **D** Concurrent validity

5 Which type of reliability would be most directly assessed by having two different psychologists score the same completed WAIS-IV?
- **A** Split-half reliability
- **B** Inter-rater reliability
- **C** Internal consistency
- **D** Test-retest reliability

6 What does a normative sample represent in the context of psychological testing?
- **A** A representative group from the population for which a test is intended
- **B** A random group of people from the general population
- **C** A group that shows the highest performance on a test
- **D** A random group of people with "normal"-level abilities

7 The psychometric approach to intelligence is based on
- **A** the physical attributes of the brain.
- **B** cultural and environmental factors.
- **C** emotional and social competencies.
- **D** cognitive abilities measured by tests.

8 Which term refers to twins who are genetically identical?
- **A** Paternal
- **B** Fraternal
- **C** Dizygotic
- **D** Monozygotic

9 It is important for researchers to regularly update intelligence test norms to
- **A** adjust for changes in population intelligence over time.
- **B** make the tests easier for new generations.
- **C** reduce the costs associated with testing.
- **D** increase the difficulty level of questions.

10 The three subtheories that form Sternberg's triarchic theory are
- **A** speed of processing, knowledge base, and ability to learn and apply mental strategies.
- **B** metacomponents, performance, knowledge acquisition.
- **C** contextual, componential, experiential.
- **D** analytical, practical, creative.

11 When Mark adapts his business model to the changing market, which dimension of Sternberg's triarchic theory is he demonstrating?
- **A** Creative intelligence
- **B** Practical intelligence
- **C** Analytical intelligence
- **D** Emotional intelligence

12 What does the heritability coefficient in intelligence research indicate?
- **A** The observed variation in intelligence across a population that can be attributed to genes
- **B** The strength of the relationship between genes and intelligence
- **C** The exact IQ score that can be attributed to genetic inheritance
- **D** How much an individual's genes influence their intelligence

13 Evaluate the concurrent validity of a new intelligence test by comparing it to an established IQ test's results for the same group of students.
- **A** Low correlation indicates high face validity.
- **B** High correlation suggests high content validity.
- **C** Low correlation confirms high predictive validity.
- **D** High correlation confirms high concurrent validity.

14 During a workshop, a group of psychologists discusses how to best assess the cognitive abilities of individuals who perform poorly on traditional IQ tests but excel in solving real-world problems quickly. They compare the information processing approach to the psychometric approach.
A key strength of the information processing approach that makes it more appropriate than the psychometric approach is that it
- **A** offers a broader range of cognitive skills assessment, including emotional intelligence.
- **B** focuses on understanding the specific mental processes involved in problem-solving.
- **C** provides a numerical IQ score that simplifies ranking individual abilities.
- **D** is universally accepted and has been used for a longer period.

15 Which term refers to the genetic limits of an individual's intelligence potential, influenced by environmental interactions?
- **A** Heritability
- **B** Attachment
- **C** Reaction range
- **D** Environmentality

Short response

16 **Describe** what psychometric tests are. Provide two examples of the two most commonly used psychometric tests of intelligence. (3 marks)

17 Standardisation of test administration and scoring is important to ensure reliability and validity of the test. **Describe** three key aspects of standardised testing. (3 marks)

18 **Compare** predictive and concurrent validity in terms of their application in intelligence testing. (2 marks)

19 A child adopted into a family with a high socioeconomic status shows significant improvement in their IQ score. **Explain** the influence of nature versus nurture on their outcomes. (4 marks)

20 **Discriminate** between Gardner's interpersonal and intrapersonal intelligences. Provide examples to make the difference clear. (3 marks)

21 **Contrast** raw scores and scaled scores derived from psychometric tests. (1 mark)

22 Following a head trauma, an adult's intelligence test scores show significant variations from their pre-injury baseline.
- **a** **Identify** a benefit of using pattern analysis in intelligence testing. (1 mark)
- **b** Tests reveal a decrease in the working memory and processing speed indices. **Apply** your understanding of pattern analysis and **explain** what these results suggest about the impact of the injury on the adult's cognitive functions. (2 marks)

23 **Explain** the significance of having different tests of intelligence for adults and children. (2 marks)

24 **Predict** how emerging genetic research might alter our understanding of intelligence. (3 marks)

25 **Discuss** the advantages and disadvantages of common uses of the psychometric approach to intelligence compared to the information processing approach. (4 marks)

26 A new cognitive test shows consistent results over multiple trials but fails to predict academic performance. **Evaluate** the reliability and validity of the new test. (2 marks)

27 Bouchard and his colleagues (1990) conducted a twin study on the heritability of intelligence. The table summarises the correlation of intelligence scores between monozygotic twins reared together (MZT) and those reared apart (MZA).

	MZT	MZA	Test-retest reliability
WAIS-FSQI	0.88	0.69	0.90

With reference to the data, **discuss** the findings of the Minnesota twin study in terms of

- **a** heredity and intelligence (2 marks)
- **b** environmentality and intelligence (2 marks)
- **c** the reliability of the WAIS. (2 marks)

28 An educational psychologist uses the Stanford–Binet scales to help diagnose a possible learning disability in a student. The student scores 85 on the IQ test.

- **a** **Identify** two features of the SB-5 test of intelligence that make it suitable for diagnostic use. (2 marks)
- **b** **Identify** how many standard deviations they are from the mean. (1 mark)
- **c** **Describe** how the overall (full-scale) intelligence quotient (IQ) is measured on tests like the Stanford–Binet. (3 marks)

29 James is a Year 12 student sitting his final psychology exam in a large, somewhat noisy sports hall. As the exam starts, James feels a rush of anxiety. Acknowledging his anxiety, he reminds himself of his thorough preparation and takes deep calming breaths. Halfway through the exam, James encounters a question that he finds particularly challenging. Instead of panicking or rushing through it, he decides to skip it temporarily and focus on completing the questions he is confident about. During the exam, James notices another student, his friend, seems stressed. After the exam he catches up with his friend to see if they are okay.

Goleman's model of emotional intelligence is divided into four domains. **Describe** each domain with reference to examples from the scenario. (4 marks)

30 Chido is a 28-year-old social worker from Zimbabwe who recently immigrated to Australia. He decided to take an online IQ test that was originally designed and normed in the United States and used in Australia. He scored 100, which is exactly at the mean of the normative sample used for the test. Chido feels that many of the questions were culturally biased towards Western contexts, which he was not familiar with, and this may have affected his result.

- **a** **Identify** which percentile Chido's result of 100 places him in. (1 mark)
- **b** **Discuss** the impact of the culturally specific questions on the validity of Chido's results. (3 marks)
- **c** **Predict** whether Chido's IQ score would likely increase, decrease or stay the same if he were to take a test that had been adapted for people from Zimbabwe. **Justify** your response. (2 marks)

TOTAL MARKS
/67 marks

MODULE 12

Diagnosis of psychological disorders

Introduction

Why is it that we consider some behaviours to be normal and others abnormal? For example, when you're at a concert, it's normal to sing loudly along with the artist on stage, but if you did this in the middle of class, people might think something was wrong with you. Some behaviours are considered "maladaptive" and could indicate that an individual is suffering from a psychological disorder. In this module, we'll look at the various categories of psychological disorders including the schizophrenia spectrum and other psychotic disorders, mood disorders, anxiety disorders and personality disorders. Each type of disorder has a unique set of symptoms that can lead to diagnosis of a psychological disorder.

How we define, diagnose and classify psychological disorders has changed significantly over time, and continues to evolve as we discover new information about the brain and human behaviour. While we have made significant improvements in the way we diagnose psychological disorders, the reliability and validity of the classification systems we use still present challenges.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to diagnosis before you start.

Subject matter

Science understanding

→ Discriminate between adaptive and maladaptive behaviour.

→ Discuss concepts of normality, including
- sociocultural
- functional
- historical
- situational
- medical
- statistical approaches.

→ Describe the concept of psychological disorder.

→ Compare diagnostic manuals in common use, including the *Diagnostic and Statistical Manual of Mental Disorders* (5th edition-TR, 2022), and the *International Classification of Diseases* (11th revision, 2022), discussing the uses that different professions make of these manuals.

→ Describe the main categories of psychological disorders, including the schizophrenia spectrum and other psychotic disorders (e.g. schizophrenia), bipolar and depressive disorders (e.g. depression), anxiety disorders (e.g. phobias) and personality disorders (e.g. antisocial personality disorder).
→ Discuss the reliability and validity of diagnosis.
→ Analyse data identifying the prevalence of psychological disorders in different cultures.

Science as a human endeavour

→ Evaluate the influence of social, cultural and ethical factors on diagnosis.
→ Appreciate that providing a person with a diagnosis can have beneficial/harmful/unintended consequences.

Science inquiry skills

→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  – correlation, e.g. Pearson *r* correlation coefficient
→ analyse data to identify trends, patterns and relationships; recognising error, uncertainty and limitations of evidence
→ select, synthesise and use evidence to
  – draw conclusions, using *p*-values to infer significance, allowing for the possibility of type I and II errors
→ extrapolate findings to determine unknown values, predict outcomes and evaluate claims

Practicals

oxforddigital **These lessons are available on Oxford Digital.**

Lesson 12.3 Cultural differences in the diagnoses of abnormal behaviours

Support for your wellbeing

This module will provide information about mental health and mental disorders. This information is intended for information only and should not be used for diagnosis or treatment. You can seek support for anything discussed in this module by speaking with a family member, friend, teacher or trusted adult. Alternatively, the following organisations can offer support: Beyond Blue, SANE, Lifeline, Kids Help Line, the Black Dog Institute and Headspace. Links are available via Oxford Digital.

Lesson 12.1
Concepts of normality

Key ideas

- → Normal behaviours help a person live well in their society. These behaviours are adaptive.
- → Abnormal behaviours go against the expectations of a person's society. These behaviours are maladaptive.
- → There are several approaches to assessing normality, including situational, sociocultural, historical, statistical, functional and medical approaches.

Learning intentions and success criteria

normality
state of being normal, defined in terms of typical and atypical behaviours, and how some behaviours are adaptive and others are maladaptive

normal behaviour
a behaviour that is accepted within society and is typical for the specific situation or context

maladaptive behaviour
actions or responses that are counterproductive or harmful to an individual's wellbeing, functioning or goals

adaptive behaviour
actions or responses that enable an individual to effectively navigate and cope with the demands of their environment, interact with others and achieve personal goals.

Introducing normality

Defining **normality** can be difficult, as a number of factors need to be considered before such a determination can be made. Typically a behaviour is considered to be **normal behaviour** when it helps a person to assimilate appropriately into their society or culture. In contrast, abnormal or atypical behaviours are viewed as "out of the ordinary". Atypical behaviours go against societal and cultural expectations, may reflect some kind of impairment, or consist of unwelcome behaviours. Behaviours that are unhelpful and impair an individual's functioning are often referred to as **maladaptive**, while those behaviours that enable a person to operate in their community, attend school and relate with others are viewed as **adaptive**. So, what do you consider to be "normal" behaviour? On what would you base your judgments?

Challenge

Act your age!

Have you ever been told to act your age? How do expectations about our behaviour change as we get older? What is the "normal" way to behave?

In small groups, create a role-play to show how expectations about behaviour change over the lifespan. You could show emotions, appearance (clothing, make-up, hairstyles) or manners (table manners, addressing other people).

Use the example from your role-play to **consider** whether normal behaviour relates to age.

Challenge

Is this behaviour normal?

For each of the following situations, **decide** whether the person's behaviour is normal/typical or abnormal/atypical and give reasons for your answer.

1 Joe often urinates in the street.

2 Carla cries loudly during a school assembly.

3 Brendan's hair is so long that it reaches his buttocks.

4 Tao always covers up her face when she goes out.

5 Connor hears voices telling him what to do when he is outside in his garden.

Introducing approaches to normality

When you attempted the second Challenge, did you create a list of factors that helped determine whether or not the behaviour was normal/typical? Look back at each statement. If all the people were 2 years old, would you consider their behaviours normal? Change their ages to 5 or 16 or 36 or 76 – would this alter your answer? In many cases, it probably would.

Normality, which is characterised by typical behaviours, can be determined by evaluating a number of factors. These include the situation in which the behaviour occurs, the person's gender, their cultural, religious and educational background, their physical health, societal rules and influences, and their state of mental health.

A behaviour is generally considered to be "normal" when it is one that is typical for the specific situation or context, and accepted within the society and culture. A behaviour should also allow a person to function independently on a day-to-day basis, as expected for their age. A behaviour should not be personally distressing or self-defeating.

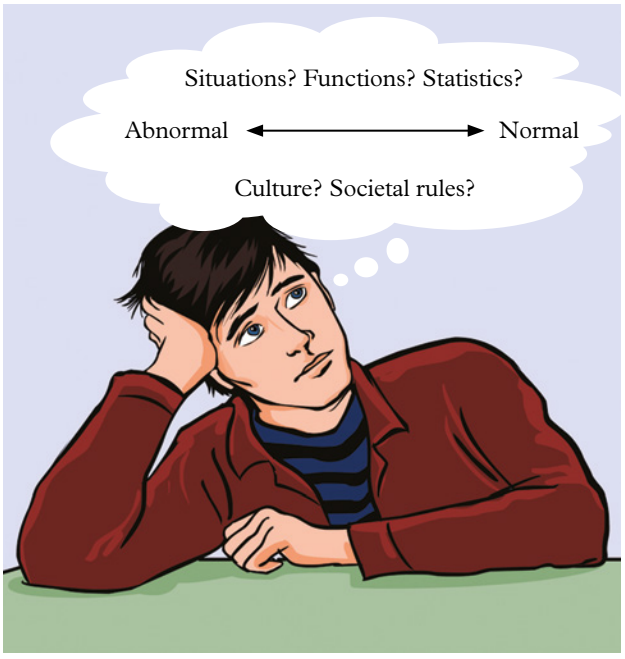


FIGURE 1 Deciding whether a behaviour is "normal" or not is difficult – many factors need to be taken into consideration.

Situational approach to normality

The **situational approach to normality** uses the situation in which a behaviour occurs to determine whether the behaviour is normal. For example, it probably wouldn't be considered normal for you to stand up in school assembly and call out to a friend on the other side of the hall. Calling out could be viewed as normal behaviour, however, if you were playing soccer on the school oval and wanted to pass the ball to your friend.

situational approach to normality determines what is or isn't normal by using situational cues

As we get older, we are expected to be able to recognise the context or situation we are in and to behave appropriately. Situational determinants are also tied up with cultural expectations.

Criticisms of the situational approach

Criticisms of the situational approach to normality include the following:

- The situational approach lacks consistency in defining normality. The same behaviour may be considered normal in one situation and abnormal in another, leading to a lack of clear and consistent criteria for determining normality.
- The situational approach often relies on subjective judgments and interpretations of behaviour, making it challenging to establish objective criteria for normality.
- The situational approach tends to focus on external factors and context. This potentially neglects the importance of individual differences, personality traits, and internal factors in understanding normal behaviour.
- Individuals may exhibit the same behaviour across different situations. This challenges the idea that behaviour is entirely shaped by a specific context. This criticism questions the extent to which situational factors truly determine normality.

FIGURE 2 Is this behaviour normal for this situation?

Sociocultural approach to normality

sociocultural approach to normality suggests what is normal behaviour based on cultural and societal cues

Within a society, there are norms and rules that govern our social behaviour. These social norms and rules can be linked to our ethnic and cultural background. This is known as the **sociocultural approach to normality**. The way we interact with others, the way we dress, what we eat and the way we talk can all be based on societal rules and expectations.

Australia is a multicultural society. Parents from different ethnic backgrounds often have particular expectations of their children. It is likely that within your class, different students are expected to behave in different ways based on cultural or religious influences.

Have you had your ears pierced? If so, when was this done? In Chile, a baby girl usually has her ears pierced after birth, before leaving hospital. Other societies and cultures may shun the thought of ear piercing completely. Body piercing and tattoos may be seen as normal in some societies and risky behaviours or taboo in others.

Eye contact is another example of cultural differences in behaviour. In some cultures, such as in Japan, it is considered rude and offensive for a child to look an adult in the eyes. In Australian mainstream society, a lack of eye contact may be interpreted as showing shyness, disrespect or even deceit.

In some countries it is more acceptable to express emotions than in others. Is it more acceptable in our society for younger or older children to cry? What about for males and females? How has this changed over the years?

FIGURE 3 Is it normal for males to express emotions in your culture?

Criticisms of the sociocultural approach

Criticisms of the sociocultural approach to normality include the following:

- The sociocultural approach may ignore individual experiences within a culture. Assuming that all members of a culture share the same experiences can lead to inaccurate assessments of normality.
- The focus on cultural and social factors may minimise the role of individual psychological and biological/genetic factors in shaping behaviour.
- The sociocultural approach may not consider the changing nature of culture. Culture does not stay the same and its influence on behaviour can also change over time.

Real-world psychology

Prea

Prea is a 25-year-old woman who has stated the following: "At times, I am controlled by a spirit. I can never predict when it will take hold of me. It is very powerful and makes me say and do all sorts of things – some of them I can't even remember. The spirit has been with me since I was 15 years old."

When you read such a statement, you might be inclined to think that Prea is suffering from a psychological disorder such as schizophrenia or dissociative identity disorder, which used to be called multiple personality disorder. But you need to be careful – there is more to Prea's story!

Prea comes from a small village in Sudan. In this society, it is common for females to report spiritual possession – in fact, about 45 per cent of females over 15 years of age report this phenomenon (Boddy, 1988). From a societal and cultural view, Prea is normal!

Apply your understanding

1 **Explain** why individuals from a different culture could assume that Prea has a psychological disorder. (1 mark)

2 **Use** the sociocultural approach to **explain** why Prea's behaviour would be considered normal. (1 mark)

FIGURE 4 Prea comes from Sudan.

Historical approach to normality

The concept of normality is embedded in history and changes over time. For example, at what age do you plan to leave home? Is this different from the age your parents, grandparents and teachers first left home? This is the **historical approach to normality**.

What about fashion? What were your teachers wearing when they were your age? What about your parents and grandparents? Even the way we speak and the language we use changes over time. Try speaking an older style of English, such as that used in a Shakespearean play, and you will probably get odd looks!

historical approach to normality suggests what normal behaviour is based on cues from different periods in time

Criticisms of the historical approach

Criticisms of the historical approach to normality include the following:

- The concept of normality evolves over time. Relying on historical norms might overlook important changes in society's attitudes and expectations. What was once considered abnormal might now be seen as acceptable or even desirable.
- This approach could lead to neglecting the experiences and norms of minority groups and can lead to stigmatisation and discrimination against individuals whose behaviours fall outside historical norms.

FIGURE 5 Fashion changes over time. What will be considered fashionable in 20 years' time?

- Historical norms may not adequately account for the specific historical, social, economic and political contexts that shape behaviours. A narrow focus on historical norms may overlook other contextual factors that contribute to variations in what is considered normal.
- The historical approach might not consider advances in our understanding of mental health and wellbeing. Modern psychological research has led to greater understanding of mental health issues, which may be neglected when relying solely on historical perspectives to classify behaviour.

Statistical approach to normality

How long did you sleep for last night? What mark did you get for your psychology test?

statistical approach to normality identifies normal behaviour by the frequency of the behaviour within a specified population

In the **statistical approach to normality**, normality is defined in terms of the frequency with which a behaviour or characteristic occurs within a population. A set of data is collected, and measures of central tendency (mean, mode and median) and range are calculated to determine the average behaviour or characteristic (Figure 6). Data that lies outside the normal range for the population could be considered abnormal. For example, an extremely tall girl whose family is quite short may not be considered normal, but a tall girl who comes from a tall family is considered normal for that population (her family).

The statistical approach to normality also relates to developmental norms. For example, if a baby does not learn to crawl within the expected time frame, then further investigation might be needed to investigate whether anything is wrong.

Study tip

Go to Lesson 1.7 to revise measures of central tendency and range.

Criticisms of the statistical approach

Criticisms of the statistical approach to normality include the following:

- Defining normality based on statistical averages may not align with psychological wellbeing. Just because a behaviour is statistically common doesn't mean that it is mentally healthy. This approach may overlook the individual experience and context.
- Behaviours are often complex and affected by many variables. Traditional normality tests typically focus on the distribution of a single variable (how often it occurs) and neglect other potential patterns related to other variables in the data.

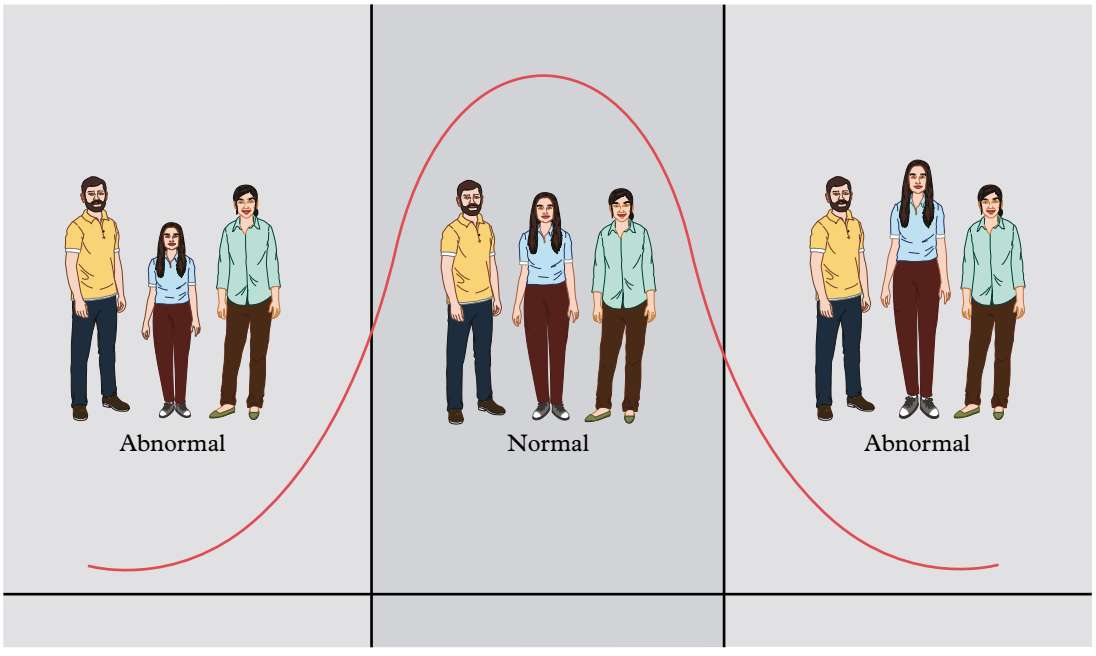


FIGURE 6 People who lie outside a normal range could be considered abnormal.

Functional approach to normality

Psychological dysfunction occurs when there is a breakdown in the way a person thinks, feels and behaves. A person who can think, feel and behave in a manner that allows them to carry out the activities they wish to do and be a productive member of society is considered normal. The **functional approach to normality** suggests that a person can function relatively independently at a level expected for their age.

Most of us have experienced a time when we have not functioned well. For example, you might have avoided a party because you didn't know anyone there. It is when these thoughts, feelings and behaviours become intense and interfere with typical, everyday activities that a psychological disorder may exist.

psychological dysfunction
a breakdown in the way a person thinks, feels and behaves

functional approach to normality
suggests that behaviour is normal if it helps an individual to live independently in an age-appropriate way

Criticisms of the functional approach

Criticisms of the functional approach to normality include the following:

- The determination of normality often relies on subjective judgments and social norms, which can be biased and influenced by cultural, social and historical factors.
- Applying labels such as "normal" or "dysfunctional" can lead to stigmatisation and discrimination against individuals who deviate from perceived norms.
- Focus on functional or adaptive behaviour neglects the evolutionary perspective. Some behaviours that might be considered dysfunctional in a current context could have had adaptive functions in our evolutionary past.
- Mental health is complex and reducing behaviours to functional or dysfunctional oversimplifies psychological wellbeing and may ignore important factors contributing to mental health.

Medical approach to normality

The **medical approach to normality** views a psychological disorder in terms of a physical illness with a possible biological basis. The person's state of mental health is determined by a set of symptoms that may have genetic, biochemical or physical origins. For example, a person experiencing a **mood disorder** such as depression may need anti-depressant medication such as a serotonin re-uptake inhibitor to help relieve the person's symptoms.

medical approach to normality
diagnosing someone with a psychological illness, in the same way a person may be diagnosed with a physical illness

mood disorder
a mood that is severe or persistent and disrupts a person's life or daily functioning

FIGURE 7 The medical approach to normality can prioritise medication as treatment for psychological disorders.

Criticisms of the medical approach

Criticisms of the medical approach to normality include the following:

- Medicalising certain behaviours or experiences by labelling them as psychological disorders may pathologise normal variations in human functioning. This can lead to overdiagnosis and overtreatment of individuals.
- By focusing on biological and neurochemical factors, the medical model tends to overlook the contribution of psychological, social and environmental factors to mental health.
- The medical model often emphasises the use of medication as a primary treatment for psychological disorders. This may lead to an overreliance on medication, and some critics argue that the pharmaceutical industry is contributing to the medicalisation of normal behaviours, as there may be financial incentives to expand the market for psychiatric medication.
- The medical model tends to focus more on diagnosis and treatment than on prevention and mental health promotion.

Summary

Normality is not a fixed or universal concept; it evolves over time with societal changes. What was once considered abnormal may become normalised, and vice versa. The dynamic nature of normality challenges the stability of any fixed approach.

Check your learning 12.1

Check your learning 12.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Define** normal/typical behaviour and provide an example to illustrate your understanding. (2 marks)

2 **Describe** abnormal/atypical behaviour and provide an example to illustrate your understanding. (2 marks)

3 **Describe** the following approaches to normality
   - **a** situational (1 mark)
   - **b** sociocultural (1 mark)
   - **c** historical (1 mark)
   - **d** statistical (1 mark)
   - **e** functional (1 mark)
   - **f** medical. (1 mark)

4 **Explain** why it is challenging to define normality. (1 mark)

Analytical processes

5 **Differentiate** the sociocultural and situational approaches to normality. (1 mark)

6 **Compare** the cultural and historical approaches to normality. (2 marks)

Knowledge utilisation

7 **Evaluate** the usefulness of one approach to normality. (2 marks)

Lesson 12.2
Adaptive and maladaptive behaviours

Key ideas

→ Adaptive behaviours are age-appropriate, everyday living skills that allow us to function in society.

→ Maladaptive behaviours develop as a way of avoiding anxiety and impair our ability to function in society.

→ Early childhood experiences and environments can influence whether we develop adaptive or maladaptive behaviours.

Learning intentions and success criteria

Introducing adaptive behaviours

Did you get up this morning and go to the bathroom? Maybe you had a shower before grabbing breakfast. Did you get a lift to school or did you catch public transport? If you did any or all of these things to get yourself ready, then you are showing adaptive behaviours.

Adaptive behaviours are age-appropriate everyday living skills that can be as basic as walking, talking, dressing on our own, attending school or cooking up a huge bowl of popcorn. Essentially, these are skills that develop through experience, help us to adjust to our environment, assist in our ability to relate to others and allow us to become independent adults who can function effectively within our society and culture. The ability to developmentally cope and adapt is influenced by many factors.

Factors contributing to adaptive behaviours

Factors that influence whether a child will develop adaptive behaviours:

- **Personality predisposition:** According to Geldard and Geldard (2009), coping has little to do with the nature of the specific problem, childhood history or environment. The ability to cope and maintain resilience is largely influenced by personality and temperament.
- **Resilience:** The ability to bounce back from difficult situations or life's problems can be learnt from parental modelling, teachers and/or peers.
- **Secure attachment:** When the relationship with the caregiver is positive, and the child is consistently nurtured and cared for, trust develops, which can be transferred to others as the person develops and grows.
- **Parental interest in education:** This helps the young person develop their sense of belonging within the family structure and school, and enables them to develop positive self-worth.

FIGURE 1 A positive family environment can help a young person to develop adaptive behaviours as they feel safe and loved at home.

- **Happy and secure home environment:** Provides a sense of security, regardless of whether parents live together or apart.
- **Financial security:** Relieves families of financial stressors that can increase tension within the home.

Introducing maladaptive behaviours

In contrast, maladaptive behaviours develop as a negative coping mechanism and originate from early childhood experiences, family situations and environmental stressors. In a way, they can be viewed as **coping mechanisms**. Unfortunately, these behaviours generally interfere with a person's ability to function on a day-to-day basis and impair their adjustment to different situations.

coping mechanism functional or dysfunctional strategy to reduce anxiety or stress

Maladaptive behaviours are sometimes evident when children begin school and can include ritualistic behaviours, self-harm, tantrums, screaming, violent or aggressive behaviour, lack of cooperation, verbally inappropriate behaviour, calling out in class or being disruptive.

Although, developmentally, most children display unwanted and often annoying behaviours, it is those who do not seem to improve or learn to adjust to their environment who are at greater risk of developing maladaptive behaviours.

Influence of early childhood experiences

Stressful and difficult early childhood experiences can affect whether a child develops maladaptive behaviours as well as the child's learning and brain development. The following early childhood experiences can influence the development of maladaptive behaviours:

Study tip

Go to Lesson 6.1 to revise attachment.

- **Avoidant or ambivalent attachment as an infant:** When a baby is born, most of its contact is with its mother or main caregiver. If the baby does not receive consistent nurturing, the child may develop trust issues, which can be carried through to adulthood.
- **Unhelpful parenting:** Parent/guardian/carer uses an inconsistent and harsh parenting style.
- **Parents who prioritise their own needs over those of their children.**
- **Parents who model maladaptive behaviours** such as drinking excessively or taking drugs.
- **Parents who show little interest in their children's educational needs.**
- **Parents who encourage risk-taking behaviours:** YouTube videos often show parents setting up amusing situations involving their children, showing little interest in whether or not their child gets hurt.
- **Marital conflict** can also influence the development of maladaptive behaviours, whether parents live together or not. An environment that is filled with anger and discord makes young people feel insecure and vulnerable. This increases their levels of anxiety, meaning that stress hormones are circulating through their system (fight-flight-freeze response).
- **Violence, abuse and neglect:** Children can develop post-traumatic stress disorder, anxiety and depression.
- **Genetics:** Some people can have a predisposition to psychological and behavioural disorders such as depression, psychosis, ADHD, conduct disorders, learning disabilities and substance abuse.
- **Personality predisposition:** Personality can influence how children deal with stressors. Some personalities are more resilient and positive than others.
- **Trauma, grief and loss:** Illness, death in the family, rejection and abandonment can lead to various maladaptive behaviours.

FIGURE 2 Maladaptive behaviours, such as tantrums, develop as a coping mechanism; however, they typically interfere with a person's ability to function in their day-to-day life.

Influence of environmental stressors

Whether or not a child will develop maladaptive behaviours is also influenced by the following environmental stressors:

- **Poverty and unemployment:** Children in low-income neighbourhoods may grow up in a constant state of uncertainty and instability. The chronic stress of poverty and unemployment can increase children's susceptibility to developing maladaptive behaviours as they struggle to cope with their adverse circumstances.
- **Natural disasters:** The repercussions of living an area prone to natural disasters can include the development of negative coping mechanisms to deal with the associated anxiety and fear, for example, avoidance and withdrawal.

Impact of maladaptive behaviours

Maladaptive behaviours often develop in response to highly stressful situations and are accompanied by physiological arousal or the stress response. When an individual wants to alleviate their anxiety, they try to avoid the situation. This is often more difficult as a small child but, as the person matures, this avoidant behaviour, which is fundamentally aimed at reducing the physiological experience of anxiety, can be redirected to alcohol, drugs, self-harm and isolation. Often, these behaviours are difficult to shift because young people sometimes don't like to seek help and may find it difficult to trust.

Maladaptive behaviours are potentially harmful to a person's emotional and physical wellbeing and can have negative effects on their friends and family. Without treatment, there are negative long-term effects on a person's mental health, which consequently have an impact on future employment and relationships. Ultimately, the presence of most long-term maladaptive behaviours is linked to some form of psychological illness or disorder.

FIGURE 3 Violence, abuse and neglect have a negative impact on young people. Maladaptive behaviours, such as avoidance, usually develop as a coping mechanism.

Check your learning 12.2

Check your learning 12.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** adaptive behaviours. (1 mark)
2 **Explain** maladaptive behaviour using an example. (2 marks)

Analytical processes

3 **Distinguish** between adaptive and maladaptive behaviours, using examples. (3 marks)
4 **Explain** how maladaptive behaviours can influence adaptive behaviours. (1 mark)

Knowledge utilisation

5 Sarah, a high school student, is tasked with completing a routine assignment for her English class. The assignment involves writing a short essay on a given topic. She becomes overwhelmed and starts avoiding the task. She checks her social media, watches TV and engages in other distracting activities, further delaying her progress on the assignment.

Identify the maladaptive behaviour shown by Sarah and **suggest** a strategy to change this behaviour into an adaptive behaviour. (2 marks)

Practical

Lesson 12.3
Practical: Cultural differences in diagnoses of abnormal behaviours

Learning intentions and success criteria

oxforddigital **This practical lesson is available on Oxford Digital. It is also provided as part of a printable resource that can be used in class.**

Lesson 12.4
Diagnosing psychological disorders

Learning intentions and success criteria

Key ideas

- → Psychological disorders are characterised by cognitive and emotional disturbances, and abnormal behaviours.
- → Psychological disorders can be diagnosed using the *Diagnostic and Statistical Manual of Mental Disorders* (5th edition-TR, 2022), and the *International Classification of Diseases* (11th revision, 2022).

The concept of psychological disorder

psychological disorder
any condition characterised by cognitive and emotional disturbances, abnormal behaviours, impaired functioning, or any combination of these

According to the American Psychiatric Association (APA), a **psychological disorder** is "any condition characterized by cognitive and emotional disturbances, abnormal behaviours, impaired functioning, or any combination of these" (APA). Psychological disorders encompass a wide range of conditions, including anxiety disorders, mood disorders (such as depression and bipolar disorder), psychotic disorders (like schizophrenia), eating disorders, personality disorders, and more. These conditions can be caused by a variety of factors, including genetic predisposition, biological factors, environmental stressors, and psychological or social factors.

Psychological disorders are typically recognised by mental health professionals based on established criteria outlined in the World Health Organization's (WHO) *International Classification of Diseases* (ICD) and APA's *Diagnostic and Statistical Manual of Mental Disorders* (DSM). Psychological disorders are also referred to as psychiatric illness, psychiatric disorder, mental disorder and mental illness.

clinician
a professional involved in the diagnosis and treatment of patients; uses diagnostic manuals; in this context a mental health professional

Diagnostic manuals like the ICD and DSM are classification systems that provide a standardised way to diagnose illnesses, including psychological disorders. **Clinicians** use diagnostic manuals to correctly diagnose patients and determine the correct treatment for illnesses.

It is important to note that the concept of psychological disorder has evolved over time and will continue to evolve as our understanding of mental health advances. The fields of psychology and psychiatry continually refine diagnostic criteria, and researchers explore new

insights into the biological, psychological and social factors that contribute to the development and manifestation of these disorders.

The management of psychological disorders often involves a combination of **psychotherapy**, medication and other therapeutic interventions aimed at alleviating symptoms and improving overall wellbeing. Psychological disorders are more successfully treated when the person has protective factors such as family, friends and community support. The presence of risk factors such as social isolation, lack of family or friendships, unemployment, poverty and homelessness can hinder treatment and may affect the long-term management of the person's psychological disorder. You will learn more about protective and risk factors in Module 13.

psychotherapy
a form of psychological support administered by a qualified practitioner, like a psychologist, who uses various communication methods and interactions to evaluate, diagnose and address maladaptive emotional responses, cognitive processes and behavioural patterns

FIGURE 1 One of the roles of a psychologist is to diagnose mental disorders, like depression and anxiety.

FIGURE 2 Psychological disorders can cause cognitive and emotional disturbances that can impair functioning.

Study tip

Psychologists offer non-medical help to enhance mental health and wellbeing. Psychiatrists are medical practitioners specialising in psychological disorders and who can prescribe medications for these disorders.

International Classification of Diseases

The ***International Classification of Diseases* (ICD)** was created and is maintained by WHO as a global standard for classification of all documented health conditions, including behavioural and mental disorders. It is used for health management, epidemiology (the study of the spread of disease) and clinical purposes, and has been revised many times over the years. "Clinical purposes" refers to the application of the ICD in the context of patient care and treatment within clinical settings. An example is a psychiatrist diagnosing a patient with major depressive disorder based on the symptom criteria outlined in the ICD and developing an appropriate treatment plan.

***International Classification of Diseases* (ICD)**
a global standard for classification of all documented health conditions, including behavioural and mental disorders

The current version, ICD-11, was published in 2022. It uses a comprehensive coding system to classify disorders, diseases and their subsets based on their defining characteristics, symptoms and causes. Over 155,000 codes are written in language that is easy to understand and can be accessed digitally. The ICD-11 provides information on causes of morbidity (prevalence of illness within a population) and mortality (incidences of death within a population) over time and between places. The causes, extent and consequences of death and diseases around the world are reported as codes to allow for large-scale research and application.

Diagnostic and Statistical Manual of Mental Disorders

The fifth edition of the *Diagnostic and Statistical Manual of Mental Disorders* (DSM-5) was published by the APA in 2013 and includes over 300 identified psychological disorders. The DSM uses a number of factors to diagnose disorders, including the person's medical condition, psychosocial stressors and the extent to which the person's mental state is interfering with everyday life. In 2022, the DSM-5 went through text revision and the latest version is the ***Diagnostic and Statistical Manual of Mental Disorders* (DSM-5-TR)**.

***Diagnostic and Statistical Manual of Mental Disorders* (DSM-5-TR)**
a diagnostic manual that includes over 300 identified psychological disorders and provides descriptions of diagnostic categories

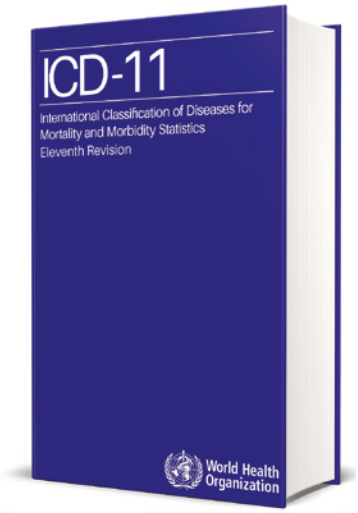


FIGURE 3 The ICD-11 describes diagnostic criteria for physical and psychological disorders.

Comparing the manuals

The DSM-5-TR provides descriptions of diagnostic categories in more detail than the ICD-11 as well as coding methods. While the ICD-11 is used globally, the DSM-5-TR is mostly used in America and Australia with partial acceptance around the world.

Both the ICD-11 and DSM-5-TR are formulated by medical experts for research and share similar codes for diagnosis, but how each condition is defined differs. While the ICD provides codes for all diseases and disorders, the DSM only includes codes for psychological disorders. Unlike the ICD-11, the DSM-5-TR is descriptive – it does not specify the causes of mental disorders or direct the treatment.

There is extensive overlap between the ICD-11 and DSM-5-TR, with many, but not all, mental disorders having virtually identical criteria for diagnosis in the two publications. For example, there are some differences in the diagnostic criteria for ADHD (attention deficit hyperactivity disorder). For instance, the DSM-5-TR features only nine inattention (IA) symptoms while the ICD-11 lists 11, and the ICD-11 features a new IA symptom, "frequently appears to be daydreaming or to have mind elsewhere", which is not listed in the DSM-5-TR.

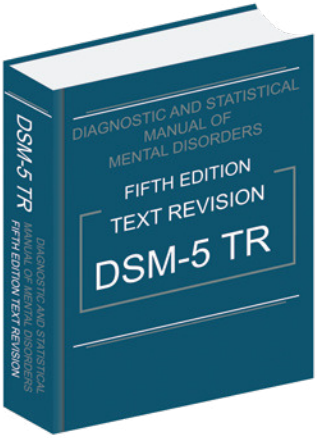


FIGURE 4 The DSM-5-TR describes diagnostic criteria for psychological disorders.

Summary

The similarities between the ICD-11 and DSM-5-TR:

- They both provide a structured framework for classifying and diagnosing various mental disorders with a "single-axial" structure; that is, diagnostic categories are organised within a single classification framework rather than being categorised across multiple axes or dimensions as was the case in previous editions of both manuals.
- Diagnostic criteria for both manuals are formulated by medical experts.
- Criteria for many psychological disorders are the same in both manuals.
- Both classification systems provide a common language and framework for communication and research across different countries and healthcare settings.
- Both manuals undergo periodic revisions and updates to reflect advances in medical knowledge, changes in diagnostic criteria, and updates based on research findings.

Table 1 outlines the differences between the ICD-11 and the DSM-5-TR.

TABLE 1 Differences between the ICD-11 and DSM-5-TR

Feature	ICD-11	DSM-5-TR
Origin	World Health Organization (International)	American Psychiatric Association
Purpose	Used to classify all health conditions including mental disorders	Represents code sets for mental disorders only
Use	Adopted by many nations internationally	Primarily used by American psychiatrists
Languages	Available in all widely spoken languages	English only
Content	Diagnostic criteria do not include social consequences of disorders	Diagnostic criteria include significant impairment in social function
Presentation	Multiple versions for research, clinical work and primary care	A single document
Cost	Broadly available at a very low cost to all WHO member countries with discounts provided to low-income countries	Generates a substantial portion of APA income contributing over US$5 million each year; mostly used by high-income nations including Australia

Real-world psychology

The unintended consequences of diagnosis

Providing a person with a diagnosis can have beneficial and/or harmful and/or unintended consequences. Pasman (2011) investigated the consequences of labelling mental illness through a review of literature and found that people with psychological disorders are often seen as "mentally ill", which places emphasis on the illness, rather than on the person who has the mental illness. This is because there are negative stereotypes associated with having a psychological disorder.

These stereotypes can lead to stigma, where others view someone in a negative way because they have a mental illness, which can lead to disadvantage. For example, the stigma associated with diagnosis may affect a person's ability to get a job or private health insurance. These disadvantages can lead to negative self-esteem, which can foster dysfunctional coping strategies.

The stigma of being labelled mentally ill can, in some cases, cause an individual to develop a mental illness. This is referred to as a **self-fulfilling prophecy**.

FIGURE 5 Stigmatised individuals may feel a sense of shame or guilt, often internalising societal judgments and negative stereotypes associated with their identity or condition.

Despite these negative effects, there are still positive effects of labelling, including allowing a person to accept their diagnosis, which can result in them seeking treatment and acceptance by others.

Apply your understanding

1 **Define** "stigma". (1 mark)
2 **Explain** the concept of self-fulfilling prophecy, using an example from everyday life. (2 marks)
3 **Suggest** strategies that could be used to reduce stigma around mental illness. (2 marks)

Diagnostic manuals in action

self-fulfilling prophecy
where a prediction of an outcome causes the outcome to occur

While the DSM-5-TR is primarily focused on mental health diagnoses and treatment planning, the ICD-11 has a broader application in general healthcare, including medical billing, epidemiology and public health. Both play crucial roles in their respective domains, contributing to effective communication, research and the overall improvement of healthcare systems. Table 2 and Table 3 outline the uses made of the diagnostic manuals by various professionals.

TABLE 2 Uses of the DSM-5-TR

Psychiatrists and psychologists	Clinical social workers and counsellors	Clinical nurses and nurse practitioners	Researchers in psychology and psychiatry
• Acts as the primary tool for diagnosing mental disorders • Guides treatment planning based on specific criteria for various mental health conditions • Facilitates communication among mental health professionals, ensuring a common language for discussing disorders and treatment options	• Provides a framework for understanding and addressing mental health issues • Assists in developing treatment plans and interventions • Enhances communication with clients, as it helps explain the nature and characteristics of their conditions	• Aids in the assessment and understanding of mental health symptoms • Supports collaboration with other healthcare professionals in the holistic care of patients with mental health concerns	• Standardises the classification of mental disorders, enabling consistent research methodologies • Facilitates the comparison of research findings across studies and populations

TABLE 3 Uses of the ICD-11

Physicians and general practitioners	Health information management professionals	Epidemiologists	Public health professionals
• Acts as the primary tool for coding and billing in healthcare settings • Classifies a broad range of diseases and conditions, not limited to mental health • Guides treatment and management decisions based on standardised codes	• Used for accurate documentation, coding, and classification of diseases and health conditions in medical records • Supports healthcare administration, billing, and reimbursement processes	• Provides a standardised system for tracking and reporting diseases and health conditions on a global scale • Aids in the analysis of health trends and the identification of emerging health issues	• Supports health surveillance and monitoring efforts • Facilitates the planning and implementation of public health interventions • Enhances the understanding of the burden of disease (financial and psychosocial costs) in different populations

Advantages of diagnostic manuals

Diagnostic manuals enable psychologists to offer valid explanations for maladaptive behaviour and make reliable predictions for prognosis. They allow diagnosis to be standardised, which helps to ensure that individuals with similar symptoms receive appropriate treatment for those symptoms. Standardising diagnoses helps to improve quality of care for patients by ensuring accurate identification of health conditions, and consistency in care delivery and monitoring of treatment progress. This ultimately leads to more appropriate and effective treatment outcomes for patients.

Diagnostic manuals can also help to guide mental health research by ensuring that different groups of researchers studying particular sets of symptoms study, and apply results to, the same disorder.

The DSM-5-TR and ICD-11 represent the most widely used classification systems for clinical diagnosis of mental disorders. Psychologists and psychiatrists are expected to use the latest DSM-5-TR to diagnose their client's mental disorders. However, these classification systems are not without their critics. Psychologists need to be aware of both the advantages and limitations of the DSM-5-TR so they can responsibly use it in their professional practice to facilitate more reliable diagnoses of mental disorders.

Limitations of diagnostic manuals

It is important to note that diagnostic manuals have limitations due to the complexity of symptoms that patients can present with and which may not fit neatly into diagnostic classifications. This oversimplification of human behaviour can lead to misdiagnosis and incorrect treatment. It is also common for individuals to meet the criteria for more than one disorder. While the DSM-5-TR considers the social impacts of symptoms, manuals generally do not consider the social, cultural and environmental factors that influence mental health.

stigmatisation applying a negative mark to an individual that sets them apart from others; can lead to disadvantage for the individual

Some argue that using diagnostic manuals has led to overdiagnosis, where individuals are diagnosed with disorders they don't have. For example, in the past, there was an increase in children diagnosed with attention deficit hyperactivity disorder (ADHD) due to changes in the diagnostic criteria in the DSM-5-TR (Vande Voort et al., 2014). This type of labelling can also lead to **stigmatisation**, which is a harmful and unintended consequence of diagnosis.

Check your learning 12.4

Check your learning 12.4: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Define** the concept of psychological disorder. (1 mark)
2 **Identify** the two main systems for classifying psychological disorders. (2 marks)
3 **Explain** a benefit of using diagnostic manuals for psychological disorders. (1 mark)

Analytical processes

4 **Compare** the characteristics of the DSM-5-TR and the ICD-11. (2 marks)
5 **Differentiate** between the uses of the DSM-5-TR and the ICD-11. (1 mark)

Knowledge utilisation

6 **Discuss** how diagnostic manuals contribute to the standardisation of mental health diagnoses, and the ways in which this impacts communication between mental health professionals. (2 marks)

Lesson 12.5
Psychological disorders

Key ideas

- → Major classes of psychological disorders categorised by the DSM-5-TR include the schizophrenia spectrum and other psychotic disorders, bipolar and depressive disorders, anxiety disorders and personality disorders.
- → A significant symptom of the schizophrenia spectrum and other psychotic disorders is loss of contact with reality.
- → Significant symptoms of bipolar and depressive disorders include prolonged depression and/or mania.
- → Significant symptoms of anxiety disorders include avoidance behaviours.
- → Significant symptoms of personality disorders include maladaptive behaviours that cause problems in social and work settings.

Learning intentions and success criteria

Introducing classes of psychological disorders

The DSM-5-TR categorises psychological disorders into classes, some of which are listed in Table 1. The classes will be discussed in more detail throughout this lesson.

TABLE 1 DSM-5-TR classes of psychological disorders and examples

DSM-5 Class	Symptoms	Examples
Schizophrenia spectrum and other psychotic disorders	Characterised by the presence of psychotic symptoms including hallucinations, delusions, disorganised speech, bizarre behaviour, or loss of contact with reality	• Brief psychotic disorder • Delusional disorder • Psychotic disorder • Schizoaffective disorder • Schizophrenia • Schizophreniform disorder
Mood disorders	Characterised by periods of extreme and/or prolonged depression or mania or both	• Bipolar disorders • Dysthymia • Major depressive disorder • Substance-induced mood disorder
Anxiety disorders	Characterised by avoidance and anxiety behaviours	• Generalised anxiety disorder • Panic disorder • Selective mutism • Separation anxiety disorder • Social anxiety disorder (social phobia) • Specific phobia
Personality disorders	Characterised by long-standing, inflexible, maladaptive patterns of behaviour beginning early in life and causing personal distress or problems in social and occupational functioning	• Antisocial personality disorder • Avoidant personality disorder • Borderline personality disorder • Narcissistic personality disorder

Introducing schizophrenia spectrum and other psychotic disorders

Schizophrenia spectrum and other psychotic disorders are characterised by having one or more of the following symptoms:

- Disorganised thinking: usually interferes with speech and seen when a person switches from one topic to another suddenly
- **Hallucinations**: involuntary, perceived experiences in the absence of real stimuli and that have the same impact as experiences involving real stimuli; most commonly the hallucinations are auditory rather than visual (Sartorius et al., 1974), for example, hearing voices that are not there
- **Delusions**: fixed beliefs that are difficult to change despite seeing conflicting evidence
- Negative symptoms: the absence or lessening of normal behaviour and function
- Grossly disorganised or abnormal motor behaviour: can include a variety of behaviours like unpredictable agitation (movement) and difficulty performing daily activities.

hallucination
false perception in the absence of sensory stimuli

delusion
fixed but false beliefs that are difficult to change despite the presence of conflicting evidence

Schizophrenia

schizophrenia
characterised by a withdrawal from reality, possible delusions and hallucinations, illogical thinking and disturbances in emotions, behaviours or thinking

Schizophrenia is characterised by a withdrawal from reality, possible delusions and hallucinations, illogical thinking and disturbances in emotions, behaviours or thinking. These signs of disturbance must last for at least six months and affect regular functioning, including interpersonal relationships and self-care, at the onset of symptoms. People with schizophrenia have trouble distinguishing reality from fantasy, and their behaviour may frighten people around them.

Schizophrenia is one of the most common psychiatric disorders but is often misunderstood and stigmatised. It affects about 1 per cent of the adult population, which is approximately 51 million people worldwide. It affects both men (often diagnosed between the late teens and early 20s) and women (often diagnosed between the mid-20s and early 30s).

The specific cause of schizophrenia is still unknown, but there are various factors including genetics and biochemistry involved. For example, dopamine activity is linked to delusions and hallucinations. Among other things, dopamine affects motivation, and the reward and pleasure centres in the brain. You will learn more about dopamine in Unit 3. The symptoms of schizophrenia vary widely among people and can be divided into clusters of positive, negative and cognitive symptoms. These are described in Table 2.

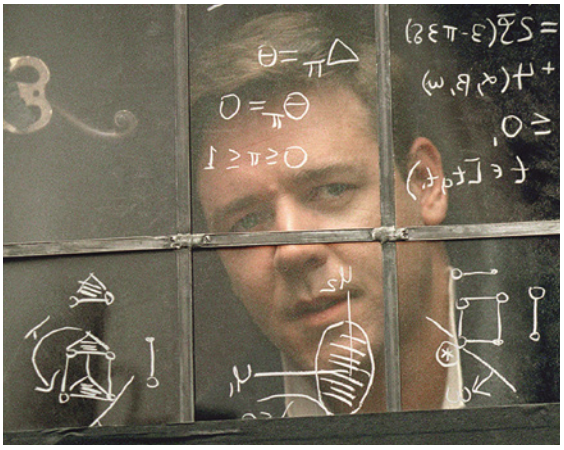


FIGURE 1 Russell Crowe portrayed John Forbes Nash Jr in *A Beautiful Mind*. Nash is a Nobel Prize–winning mathematician who experiences auditory hallucinations as part of his schizophrenia.

TABLE 2 Schizophrenia symptoms

Positive (deviant) symptoms	Negative (deficit) symptoms	Cognitive symptoms
Symptoms that are present when they should be absent, which suggest that a person has lost touch with reality. Positive symptoms include hallucinations, delusions, disorganised speech, and disorganised behaviours.	Symptoms reflect absence of normal characteristics. Negative symptoms include poverty of speech (reduced or brief speech), apathy (reduced or lack of motivation) and blunted affect (reduced ability to show emotions).	Symptoms reflect abnormal thinking such as poor problem-solving and decision-making skills, and poor ability to communicate. Also include disturbed thoughts such as confused thinking and bizarre behaviour.

Introducing mood disorders

Mood disorders are categorised by distorted or inconsistent moods or emotional states, and interfere with a person's ability to function in normal situations. People with mood disorders can experience moments of extreme sadness, emptiness and irritability, or alternative periods of depression and excessive happiness (**mania**). The DSM-5-TR splits mood disorders into two categories: bipolar disorders and depressive disorders.

mood disorder
categorised by distorted or inconsistent moods or emotional states, and interference with a person's ability to function in normal situations

mania
an experience of excessive happiness

Bipolar disorders

Bipolar disorders are classified under the bipolar and related disorders category in the DSM-5-TR, sitting between schizophrenia spectrum disorders and depressive disorders. The symptoms of bipolar disorders can reflect symptoms of both the schizophrenia spectrum and depressive disorders.

There are three disorders in the bipolar category: bipolar I, bipolar II and cyclothymic disorder, which causes extreme fluctuations in a person's energy, mood and ability to function. Cyclothymic disorder is similar to bipolar I and bipolar II, but the symptoms are milder and more continuous.

People with bipolar disorder experience periods of exaggerated euphoria (sense of great happiness or wellbeing, not reflective of reality), delusion, overactivity and excitement (mania), and periods of sadness, guilt and hopelessness (depression). These symptoms fluctuate between extreme highs and lows, and affect approximately 1 per cent of the population.

bipolar disorder
characterised by periods of exaggerated euphoria, delusion, mania and depression

Bipolar I

Bipolar I can exist both with and without psychotic episodes, and people may not experience depressive moods but often do. People with bipolar I must meet the full criteria for manic episodes and have at least three of the following symptoms:

- increased self-esteem
- reduced sleep
- increased talkative behaviour
- racing thoughts
- increased energy
- increased irritability
- reduced attention span
- increased risk-taking behaviour.

Bipolar II

People with bipolar II, on the other hand, experience alternating manic and depressive episodes that are usually less severe and do not disrupt regular functioning. To be diagnosed with bipolar II, a person would need to have experienced a depressive episode and hypomania.

hypomania
a less severe form of mania, where manic symptoms do not affect a person's ability to function in everyday life

Hypomania is a less severe form of mania, where manic symptoms do not affect a person's ability to function in everyday life. Symptoms can even lead to positive outcomes such as increased job performance and participation in goal-directed activities.

A person with bipolar II must experience five or more of the symptoms for major depressive disorder to meet the criteria for a depressive episode. It is common for people with bipolar II to be misdiagnosed with depression because they neglect to report hypomania symptoms. They are also at a higher risk for eating disorders and substance use disorder.

Major depressive disorder

major depressive disorder (MDD)
characterised by persistent feelings of worthlessness, sadness and a lack of desire to engage in activities that were once pleasurable

There are many different types of depression, which have a variety of causes including chemical changes in the brain and adverse life events. **Major depressive disorder (MDD)** is characterised by persistent feelings of worthlessness, sadness and a lack of desire to engage in activities that were once pleasurable.

MDD has a high level of lifetime prevalence; that is, high odds that an individual will be diagnosed with MDD during their lifetime, with one in seven Australians experiencing MDD in their lifetime. According to the Black Dog institute, MDD is the most common non-fatal disability in Australia (Black Dog Institute, n.d.).

FIGURE 2 The symptoms of major depressive disorder. "Somatic" symptoms are physical symptoms.

Symptoms of MDD may include:

- weight gain or loss
- loss of pleasure or interest in activities
- trouble sleeping or feeling tired during the day
- sluggishness
- feeling guilty or worthless
- reduced energy and feeling tired
- restlessness and agitation
- trouble concentrating and/or making decisions
- suicidal thoughts.

To be diagnosed with MDD, a person must exhibit five or more of these symptoms on most days for at least two weeks. At least one of the symptoms must be loss of interest in once pleasurable activities or depressed mood.

Skill drill

Meta-analysis

Science inquiry skill: Evaluating evidence (Lesson 1.8)

A meta-analysis is a systematic review of existing research studies that involves finding research studies that share a similar aim to the one a researcher is investigating. The researcher uses databases to search for published studies and then analyses their results to find general trends.

Strengths of meta-analysis include that it is high in validity because it is quantitative in nature, based on wider research, evidence-based and relatively cheap to complete. Meta-analysis overcomes the limitation of a small sample size and has greater statistical power to generalise findings to the wider population.

Limitations of meta-analysis include that it is both time-consuming and difficult to compare the many research designs used in the studies: this work may require complex statistical skills. There is also an increased risk of publication bias where only positive studies have been published and are available for use in the meta-analysis. The researcher may also be biased in how the search is conducted and which studies are selected.

Practise your skills

1 **Describe** what a meta-analysis is. (1 mark)
2 **Identify** a strength of using meta-analysis in research. (1 mark)
3 **Identify** a limitation of using meta-analysis in research. (1 mark)

Introducing anxiety disorders

Anxiety disorders share characteristics of excessive anxiety, fear and related behavioural disturbances. Anxiety is the anticipation of a future threat and fear of the emotional response to a real or perceived impending threat. You will learn more about anxiety disorders in Module 13.

Specific phobia

A **specific phobia** is categorised by an intense and irrational fear of a specific situation or object. This fear is often overwhelming and excessive, which leads to extreme distress or avoidance of the situation or object. The prevalence of specific phobia ranges from 3 per cent to 15 per cent in the adult population, with twice as many women affected as men. It is also common for people to have multiple specific phobias at the same time and for people to be unable to recognise that their fears are irrational.

specific phobia an intense and irrational fear of a specific situation or object

There are multiple factors that lead to the development of specific phobia, including personality type, with people who exhibit behavioural inhibition (restraint and hesitancy) being more likely to develop anxiety disorders. Traumatic and stressful situations as well as genetic factors also influence the likelihood of a person developing specific phobia.

While fear is something that most people will experience in their lifetime, to be diagnosed with specific phobia, characteristics of the response to a specific situation or object must include the following:

- immediate anxiety response
- excessive and unreasonable fear
- extreme distress or avoidance
- duration of at least six months
- significant impact on regular functioning
- not being caused by another disorder such as agoraphobia (the fear of leaving your own home and/or being in crowded or open spaces where escape is difficult).

Types of specific phobia

The five main types of specific phobia are described in Table 3.

TABLE 3 Types of specific phobia

Phobia	Explanation	Examples
Situational 	Triggered by specific situations	Elevators, driving, enclosed spaces, aeroplanes
Injury 	Related to physical injury or harm	Injections, seeing blood, watching medical procedures
Animal 	Focused on insects or animals	Dogs, spiders or snakes
Natural/ environmental 	Related to weather, nature and environmental situations or events	Heights, storms, water
Other 	All phobias that do not fit into situational, injury, animal or natural/environmental types	Contracting an illness, clowns, loud sounds, choking or vomiting, balloons popping

Generalised anxiety disorder

generalised anxiety disorder (GAD)
a psychological disorder characterised by constant and excessive worrying about events, activities or topics that interferes with daily activities

Generalised anxiety disorder (GAD) is characterised by constant and excessive worrying about a variety of events, activities or topics, which hinders daily activity. The worry must occur on a regular basis for at least six months before a diagnosis can be made (DSM-5-TR).

Worry is excessive, disproportionate to actual risk, and exists when there is no specified threat. This worry is difficult to control, easily transfers from one topic to another, and is paired with at least three of the following cognitive and physical symptoms for adults, or one for children:

- increased soreness in muscles
- easily fatigued (more than usual)
- restlessness or edginess
- difficulties sleeping or disturbed sleep
- irritability
- difficulty concentrating or feelings of the mind going blank.

Many people with GAD can experience physiological symptoms including nausea, sweating or diarrhoea. GAD can be difficult to diagnose because people generally do not experience panic attacks, which is common to most anxiety disorders. This leads to the misconception that a person is simply worrying too much, and their constant worrying is often dismissed or minimised. GAD effects approximately 2.3 per cent of the adult population.

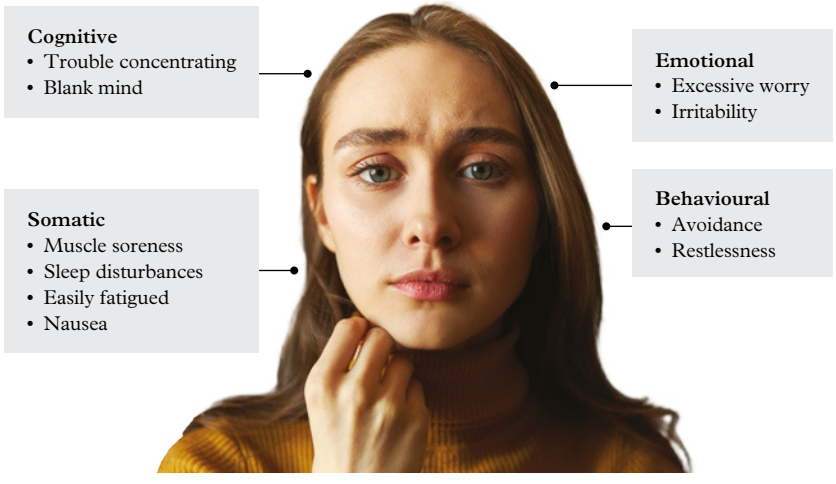


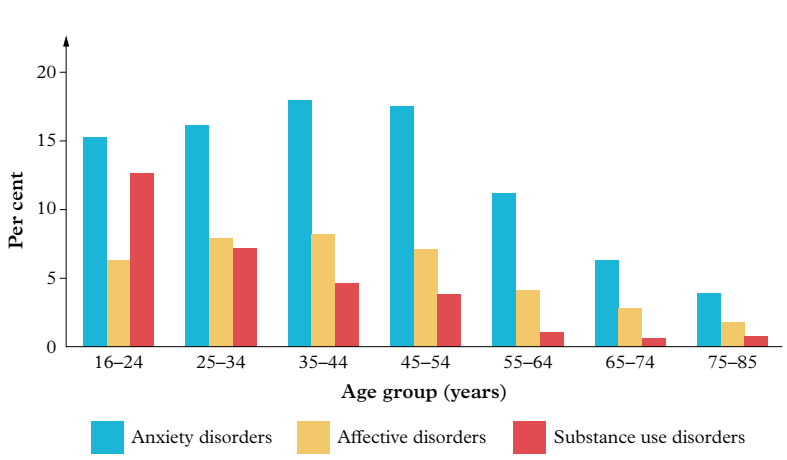
FIGURE 3 The symptoms of generalised anxiety disorder

Skill drill

Interpreting graphs

Science inquiry skill: Processing and analysing data (Lesson 1.7)

Figure 4 shows the percentage of people in Australia who suffer from different psychological disorders in each age group. Anxiety disorders are operationalised, such as when a person has extreme dread or fear of a situation. Affective disorders (mood disorders) represented on this graph are bipolar disorder, depression, PTSD and others. Substance use disorders are operationalised when people experience severe changes in their behaviour due to the use or overuse of some substances.



Source: Mental Health Australia (2019)

FIGURE 4 Prevalence of mental disorders in Australia

Practise your skills

1. **Identify** the percentage of people aged 25–34 in Australia who live with a depressive disorder. (1 mark)
2. **Identify** which mental disorder and age group has the greatest percentage. (2 marks)
3. All but one of the age groups rank the prevalence of the three disorders in the same way. **Identify** the group where the prevalence is not in the same order and **state** the rank of the mental disorders. (2 marks)

Introducing personality disorders

To understand personality disorders, it is important to first define personality. **Personality** is the interactions between the way an individual thinks, feels and behaves, which form the distinct character of the individual. Personality is influenced by an individual's genes, experiences and environment, and typically remains constant over time.

A **personality disorder** is when an individual's thoughts, feelings and behaviours deviate (move away) from what is expected by the society and culture in which they live. Personality disorders typically begin by late adolescence or early adulthood, and cause distress and problems in functioning. These patterns of behaviour and inner experiences diverge significantly from what is expected, and affect at least two ways of thinking in the following areas:

- about oneself and others
- relating to other people
- responding emotionally
- controlling one's behaviour.

People with a personality disorder have great difficulty in dealing with others, tend to be inflexible and have trouble dealing with changes, and often have a narrow view of the world.

Types of personality disorders

There are many different types of personality disorders, each with a specific set of symptoms and behaviours. Most personality disorders fall into the three clusters or categories described in Table 4.

Study tip

When reading a graph, use a ruler to assist you in calculating an exact measurement. You should double-check any problems you solve with a calculator.

personality
lasting and distinctive behaviours, thoughts, motives and emotions that typify how we react and adapt to other people and situations

personality disorder
where a person's thoughts, feelings and behaviour deviate from what is expected by the society and culture in which they live

TABLE 4 Personality disorder clusters

Cluster	Description	Examples
A	Odd or eccentric behaviours	• Paranoid personality disorder • Schizoid personality disorder
B	Emotional, dramatic or erratic behaviours	• Antisocial personality disorder • Borderline personality disorder
C	Fearful and anxious behaviours	• Avoidant personality disorder • Dependent personality disorder

Borderline personality disorder

Borderline personality disorder (BPD) is characterised by patterns of instability in emotion, mood and relationships, and affects approximately 1.6 per cent of the adult population.

People with BPD can feel uncertainty about how they see themselves and may experience intense mood swings related to others, which can result in unstable relationships and emotional pain. Individuals tend to view situations in extremes, either all bad or all good. Their values and interests can change rapidly, and they may act recklessly or impulsively.

The cause of BPD is still unknown, but environmental, social and genetic factors may increase the risk of developing BPD. People with BPD typically exhibit at least five of the following symptoms:

- constant feelings of emptiness
- disturbance in identity with long-lasting or permanent unstable sense of self or self-image
- chronic suicidal behaviour, threats, gestures or self-mutilating behaviour
- avoidance of real or imagined abandonment
- impulsive behaviour in at least two areas that are possibly self-damaging; for example, reckless driving, substance abuse and overspending
- anger that is difficult to control, inappropriate or intense
- unstable mood; for example, irritability or intense episodes of **dysphoria**, which usually last for a few hours
- a pattern of intense and unstable relationships, alternating between extremes of deflation (intense anger or dislike towards a loved one) and idealisation (great admiration for the same person)
- temporary stress-related **paranoid ideation** or severe **dissociative symptoms**.

dysphoria
a feeling of unease or dissatisfaction with life

paranoid ideation
persistent thoughts of mistrust and suspicion

dissociative symptoms
experiences that involve detachment or disconnection from one's feelings, thoughts, identity or environment

Antisocial personality disorder

Antisocial personality disorder (ASPD) is characterised by persistent disregard for, and violation of, the rights of others. People with ASPD often have a high opinion of themselves and may use charm, arrogance and self-assurance to get what they want. They may engage in unlawful, exploitative, manipulative, deceitful and reckless behaviour for personal pleasure or profit, and are indifferent to the harmful effects of their actions on others. People with ASPD may blame their victims for being helpless or foolish, or otherwise rationalise their behaviour. People with ASPD can also be physically aggressive and easily provoked.

Both environmental factors, such as abuse during childhood, and genetic factors influence the development of ASPD. There is strong heritability with an increased risk if you have a first-degree relative (parent, sibling or child) that has the disorder.

antisocial personality disorder (ASPD)
characterised by persistent disregard for, and violation of, the rights of others

Although ASPD cannot be diagnosed before adulthood, children who go on to receive a diagnosis of ASPD often show evidence of conduct disorder before 15 years of age. Conduct disorder is persistent behaviour that violates the rights of others, such as lying, theft and fighting.

To be diagnosed with ASPD, a person must have a persistent disregard for the rights of others and display at least three of the following:

- being deceitful by using aliases, lying repeatedly or conning others for pleasure or personal gain
- disregard for one's own safety or the safety of others
- impulsivity or lack of planning
- lack of remorse through rationalising hurting others or being indifferent to it
- aggression or being easily provoked, which is displayed by getting into physical fights regularly
- disregard for the law by repeatedly committing crimes
- acting irresponsibly on a regular basis.

ASPD affects about 0.5 per cent to 3.5 per cent of the adult population and is more common among men than women. This decreases with age, which suggests that people can learn to change their maladaptive behaviour over time. ASPD is often **comorbid** with substance use disorder, borderline personality disorder and impulse control disorder.

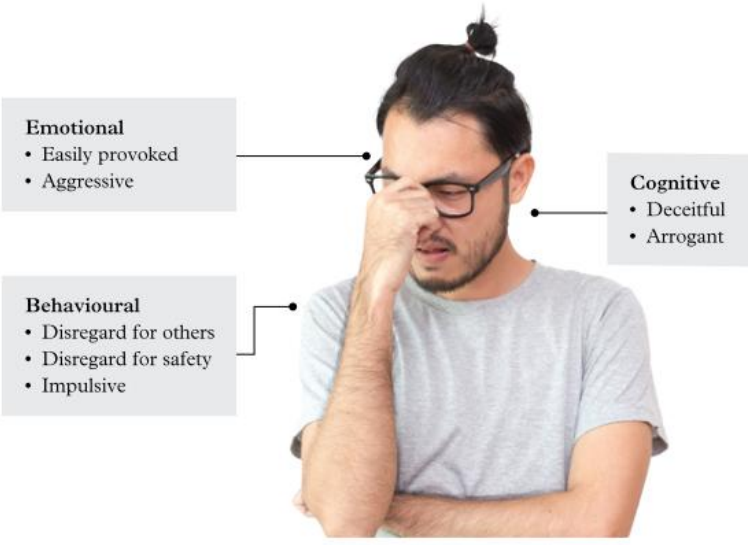


FIGURE 5 The symptoms of antisocial personality disorder

Challenge

Identify psychological disorders

The following are hypothetical cases of people with a lived experience of a psychological disorder. While you are not qualified to make a diagnosis, and there is not enough information included in these simple descriptions, use your knowledge to **identify** the disorder that each case may depict.

1 Jake has not gone to school for the last month. He sits at home in darkness with the curtains closed. He must not turn on a light because he knows they are watching and recording his every thought and move. Voices are telling him that he is no good and he cannot trust anyone.

2 Nurang gets very nervous when he goes to the beach. He doesn't ever go in deeper than his ankles, and is known to run out of the water if he sees a large bunch of seaweed in a wave. Nurang struggles to swim in a pool because he has seen videos of sharks in aquariums and is scared that there may be one in the water.

3 Eden seems to be operating at an all-time low. For the last month, she has barely been able to force herself to leave her bedroom and is often not at school. When she is, she finds it hard to motivate herself and does not feel like talking to others.

comorbid
the presence of more than one medical condition at the same time

Check your learning 12.5

Check your learning 12.5: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** four major categories of psychological disorders in the DSM-5-TR and provide an example of each. (4 marks)
2 **Define** "major depressive disorder". (1 mark)
3 **Explain** two characteristics of depressive disorders. (2 marks)
4 **Describe** three symptoms of generalised anxiety disorder. (3 marks)

Analytical processes

5 For the past two months, Mireille has been telling her parents that there are people out to get her. She describes them as government officials and says that they always talk to her when she is alone. Mireille has stopped using her phone and will no longer check her email. **Deduce** what symptom of schizophrenia Mireille is experiencing. (1 mark)
6 **Infer** why diagnosing someone with a personality disorder is so difficult. (1 mark)
7 Attila has recently lost 5 kg. Attila was not trying to lose weight and has lost interest in playing tennis and basketball, which he used to love. Attila is also struggling to concentrate at school and is feeling extremely guilty. **Apply** your understanding of depressive disorders to Attila and identify the depressive disorder he is experiencing. (1 mark)
8 **Compare** the symptoms of major depressive disorder and bipolar II. (2 marks)

Knowledge utilisation

9 **Discuss** the challenges individuals with antisocial personality disorders face in recognising the rights and feelings of others. (3 marks)
10 **Investigate** the societal implications of personality disorders, including stigma, misconceptions, and challenges in accessing appropriate psychological health care. (3 marks)

Lesson 12.6
Validity and reliability of diagnosis

Learning intentions and success criteria

Key ideas

→ Validity of diagnosis refers to the accuracy of classification systems for diagnosis.
→ Reliability of diagnosis refers to the consistency of diagnosis given a set of symptoms.

Validity of diagnosis

validity of diagnosis refers to how accurately a classification system diagnoses psychological disorders so that diagnosis can lead to effective treatment

Validity of diagnosis refers to how accurate a classification system, such as the DSM and ICD, is in correctly diagnosing psychological disorders so that diagnosis can lead to effective treatment. Determining the validity of diagnosis can be complex for a number of reasons.

First, initial diagnosis relies on self-reported information from individuals that cannot be assessed objectively, or subjective reports made by others about an individual's behaviour. The impact of culture on the reporting of symptoms and the effect this has on diagnosis is

illustrated by studies from Kleinman (1982) and Parker et al. (2001). These are discussed in Real-world Psychology "The cultural context of diagnosis: Validity".

Second, although the success or failure of a treatment can provide valuable information for diagnosis, relying solely on that success or failure to confirm the accuracy of a diagnosis can be problematic. This is because treatments are often designed based on assumptions about the underlying causes or origins of specific disorders. However, these assumptions may not always be accurate or comprehensive. So if a particular treatment for depression is effective for a patient, it doesn't necessarily mean that their initial diagnosis of depression was correct.

In other cases, even though a diagnosis might be correct, the treatment may not be effective for many reasons. For example, a person may not respond well to pharmaceutical treatment (medication). It is also possible for individuals to show significant improvement over time that is not related to treatment stemming from valid diagnosis.

The problems associated with the validity of diagnosis are highlighted in the classic investigation by Rosenhan (1973), discussed in Real-world Psychology "Rosenhan's study".

Real-world psychology

The cultural context of diagnosis: Validity

Diagnosis is influenced by cultural contexts. Parker et al. (2001) investigated the cross-cultural reporting of symptoms of depression by comparing how depression was reported by two distinct groups in Malaysia: white Australians and Malaysian Chinese.

The researchers gathered data using questionnaires about the major symptoms that prompted group members to seek help. Results showed that despite all patients being diagnosed with depression, 60 per cent of Malaysian Chinese participants identified physical symptoms as their major symptom, compared to 13 per cent of white Australian participants.

This investigation revealed that culture can affect how symptoms are reported, which can affect diagnosis. To explain the differences in the reporting of symptoms, it is possible that the symptoms experienced were different between patients.

Kleinman (1982) investigated physical symptoms in 100 Chinese patients diagnosed with neurasthenia, which is a condition marked by weakness, fatigue, insomnia, aches, pains and low mood. It was found that 87 per cent of patients met the criteria for major depression (MDD) using the DSM-III. The initial diagnosis of neurasthenia could be explained by the differences in how Chinese patients reported the symptoms of depression. After being correctly diagnosed with MDD, patients were treated with anti-depressant medication and 70 per cent of patients reported improvement in symptoms.

Both of these investigations support the idea that culture can influence how patients report their symptoms. The way symptoms are reported can affect the accuracy of diagnosis and therefore determine if an individual will receive the correct treatment.

Apply your understanding

1 **Describe** the major findings of Parker et al.'s study regarding the differences in reporting symptoms of depression between white Australians and Malaysian Chinese participants. (1 mark)

2 **Explain** how Kleinman's study of Chinese patients diagnosed with neurasthenia contributes to the understanding of cultural influences on symptom reporting. (1 mark)

3 **Describe** the connection between cultural influences on symptom reporting and the validity of diagnosis. (1 mark)

FIGURE 1
People from different cultures report symptoms of depression differently.

Real-world psychology

Rosenhan's study

Rosenhan (1973) investigated the negative consequences of psychiatric institutions and the validity of diagnosis. He did this by conducting a field study, where eight healthy participants (pseudo patients) gained admission to 12 different psychiatric hospitals by complaining that they were hearing voices. At admission, participants told workers that the voices were the same gender, unfamiliar and said words like "thud" and "empty", which were the only symptoms they reported. Once participants were admitted into the hospital, they stopped reporting any symptoms and behaved in their usual manner. Seven of the participants were diagnosed with schizophrenia.

During their stay at the hospital, the pseudo patients reported little contact with doctors or staff. When describing their interactions with nurses, they said there was a lack of personal connection and eye contact. Despite participants telling hospital staff that they were no longer experiencing any symptoms and were feeling fine, it took an average of 19 days before they were discharged.

Rosenhan concluded that "we cannot distinguish the sane from the insane in psychiatric hospitals" and that the conditions were not conducive to successful therapy. For example, patients were powerless, humiliated, depersonalised and labelled.

This investigation was significant because it raised awareness around the validity of diagnosis and the treatments received in psychiatric hospitals. It highlighted the problems associated with the diagnostic system used at the time, and advocated for change in hospital practice. This investigation led to fundamental reforms in mental health and resulted in the de-institutionalisation of psychiatric patients and the increased use of outpatient care.

FIGURE 2 Psychiatric institutions were problematic and ineffective.

Apply your understanding

1 **Identify** the methods used in the investigation. (1 mark)
2 **Identify** any potential breaches of ethical principles in Rosenhan's study. (2 marks)
3 **Describe** the symptoms reported by the pseudo patients when gaining admission to psychiatric hospitals. (1 mark)
4 **Explain** how the investigation contributed to significant changes in mental health practices. (1 mark)

Reliability of diagnosis

reliability of diagnosis
the consistency of diagnoses made using a particular classification system

Reliability of diagnosis refers to the consistency of diagnoses made using a particular classification system. That is, different clinicians should give the same diagnosis for the same individual using the same system. The standardised nature of diagnostic manuals has increased the reliability of diagnosis over time. However, diagnostic manuals do have limitations, and the following factors can affect the reliability of diagnosis:

- Disorders are diagnosed using clusters of symptoms with the assumption that one symptom relates to another, but this is not always the case.
- Disorders are often comorbid, which means that an individual can have more than one disorder at the same time. This can make correct diagnosis difficult. For example, individuals diagnosed with depression can also present with alcohol use disorder.
- Physiological testing, such as blood and urine testing, cannot be used to test for psychological disorders (although research into this possibility is underway).

- Symptoms can be difficult to measure; for example, hearing voices and feelings of helplessness, so self-reported data is used. Self-reported data can be exaggerated, information can be withheld, and it can be biased. For example, a person might not report a symptom because the behaviour or experience does not conform to social norms.•

Real-world psychology

The cultural context of diagnosis: Reliability

Cooper et al. (1972) investigated the reliability of diagnosing depression and schizophrenia. Researchers asked psychiatrists from New York and London to diagnose a patient by watching videotaped clinical interviews. It was found that American psychiatrists were twice as likely as British psychiatrists to diagnose patients with schizophrenia, and British psychiatrists were twice as likely as American psychiatrists to diagnose patients with mania and depression when shown the same clinical interviews.

Results demonstrated that diagnosis was not reliable across cultures, which indicates that there are cultural differences in the interpretation of symptoms and therefore treatment of psychological disorders.

FIGURE 3 Diagnosis is often not a straightforward exercise.

Apply your understanding

1 **Identify** the main findings of this investigation. (1 mark)
2 **Describe** the differences between British and American psychiatrists when it came to diagnosing mania and depression. (1 mark)
3 **Explain** what the investigation demonstrated about the reliability of diagnosis. (1 mark)

Check your learning 12.6

Check your learning 12.6: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** the importance of validity in diagnosis. (1 mark)
2 **Describe** the importance of reliability in diagnosis. (1 mark)
3 **Explain** how culture can influence diagnosis using an example. (2 marks)

Analytical processes

4 Amy believes she might be struggling with social anxiety and decides to seek help from a psychologist. The psychologist conducts a thorough evaluation, including administering a comprehensive questionnaire, and diagnoses Amy with generalised anxiety disorder. Amy, feeling uncertain about this diagnosis, decides to seek a second opinion and schedules an appointment with another psychologist. The second psychologist, after engaging in a detailed conversation with Amy and administering the same standardised questionnaire, arrives at a diagnosis of panic disorder.

Apply your understanding of the reliability and validity of diagnosis to explain what this situation suggests about the reliability of the assessment tool and consistency in the diagnostic process. (2 marks)

Knowledge utilisation

5 **Examine** the challenges associated with determining the validity of diagnosis, considering the reliance on self-reported information. (2 marks)
6 Consider the factors that can affect the reliability of diagnosis, such as the presence of comorbid disorders and the unavailability of physiological testing. **Discuss** how these factors contribute to the complexity of maintaining consistency in diagnosing psychological disorders. (3 marks)

MODULE 12

Lesson 12.7
Review: Diagnosis of psychological disorders

Summary

12.1
- Normal behaviours help a person live well in their society. These behaviours are adaptive.
- Abnormal behaviours go against the expectations of a person's society. These behaviours are maladaptive.
- There are several approaches to assessing normality, including situational, sociocultural, historical, statistical, functional and medical approaches.

12.2
- Adaptive behaviours are age-appropriate, everyday living skills that allow us to function in society.
- Maladaptive behaviours develop as a way of avoiding anxiety and impair our ability to function in society.
- Early childhood experiences and environments can influence whether we develop adaptive or maladaptive behaviours.

12.3
- Practical: Cultural differences in diagnoses of abnormal behaviours

12.4
- Psychological disorders are characterised by cognitive and emotional disturbances, and abnormal behaviours.
- Psychological disorders can be diagnosed using the *Diagnostic and Statistical Manual of Mental Disorders* (5th edition-TR, 2022), and the *International Classification of Diseases* (11th revision, 2022).

12.5
- Major classes of psychological disorders categorised by the DSM-5-TR include the schizophrenia spectrum and other psychotic disorders, bipolar and depressive disorders, anxiety disorders and personality disorders.
- A significant symptom of the schizophrenia spectrum and other psychotic disorders is loss of contact with reality.
- Significant symptoms of bipolar and depressive disorders include prolonged depression and/or mania.
- Significant symptoms of anxiety disorders include avoidance behaviours.
- Significant symptoms of personality disorders include maladaptive behaviours that cause problems in social and work settings.

12.6
- Validity of diagnosis refers to the accuracy of classification systems for diagnosis.
- Reliability of diagnosis refers to the consistency of diagnosis given a set of symptoms.

Review questions 12.7A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 There are various approaches to the concept of normality. **Identify** which of the following reflects a historical approach to normality.
- **A** A person who wears a wig to a fancy dress party
- **B** A student who is forced to use his right hand for writing in class
- **C** A teenager who scores 120 on an IQ test
- **D** A person who is unable to look after their personal day-to-day needs

2 **Recall** the focus of the medical approach to normality.
- **A** Behaviour that deviates from cultural norms
- **B** Behaviour that causes distress or dysfunction
- **C** Behaviour that varies from statistical averages
- **D** Behaviour that is influenced by historical context

3 Which criticism is often directed at the sociocultural approach to normality?
- **A** It fails to account for cultural diversity.
- **B** It disregards statistical data.

C It doesn't consider an individual's ability to adapt to their environment.

D It overlooks the importance of historical norms.

4 A psychiatrist whose primary treatment for people with psychological disorders is medication is likely to take which approach to normality?

A Medical **B** Genetic

C Situational **D** Functional

5 Mood disorders include

A borderline personality disorder.

B bipolar disorders.

C antisocial personality disorder.

D generalised anxiety disorder.

6 A psychological disorder is best described as

A a medically diagnosed illness that interferes with a person's thoughts, feelings and emotions.

B a medically diagnosed illness that makes people hear voices, behave differently and feel depressed and helpless for long periods of time.

C a medically diagnosed illness that affects a person's thinking, emotions and behaviours, due to heredity or developing from psychosocial factors.

D A and C.

7 By the time people grow up, some of them develop adaptive or maladaptive behaviours that can affect their overall mental functioning and interactions with others. Which of the following is considered a maladaptive behaviour?

A Engaging in self-harm

B Interacting with family and friends in a positive manner

C Adapting to changing situations

D Developing independence

8 Lizzy, a clinical psychologist, is assessing a patient who exhibits symptoms of both depression and anxiety. She must determine the most appropriate diagnosis for the patient to ensure they receive the right treatment. In this context, which aspect of diagnosis is Lizzy primarily concerned with?

A Accuracy of classification systems in diagnosing disorders

B Consistency of diagnoses made using a particular system

C Interpretation of symptoms across cultures

D Reliability of treatment outcomes

9 Mark has a tattoo and has dyed his hair bright purple. He likes to walk around without shoes on. Mark also goes to work five days a week and earns a salary that allows him to provide for his young family. Which approach to normality would suggest Mark was abnormal, and which would suggest he was normal?

A Sociocultural, functional

B Historical, sociocultural

C Sociocultural, medical

D Medical, functional

10 Tyree is 29 and was recently fired from her job as a nurse. Tyree was fired because whenever she was given a shift she didn't want she would scream and throw a tantrum, pouting at her manager. Tyree is showing what type of behaviour?

A Functional behaviour

B Adaptive behaviour

C Maladaptive behaviour

D Historical behaviour

11 Personality disorders are characterised by

A emotional instability and mood swings.

B thoughts, feelings and behaviours deviating from societal and cultural expectations.

C disorganised thinking and hallucinations.

D intense, irrational fear of specific situations.

12 **Identify** which of the following can be used to diagnose psychological illness.

A DSM-5-TR, ICD-11

B Diagnostic and statistical manual for international disease

C International classification of mental health

D DSM-11, ICD-5

13 Which of the following is a common symptom of schizophrenia?

A Disorganised speech and behaviour

B Feelings of worthlessness

C Intense, irrational fear of social situations

D Split personality

14 How many subcategories of specific phobia exist?

A Four

B Two

C Three

D Five

Review questions 12.7B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

15 **Explain** the difference between normal (typical) and abnormal (atypical) behaviours. (1 mark)

16 **Explain** the difference between the statistical and medical approaches to normality. Use examples of each approach to support your response. (4 marks)

17 **Define** the following approaches to normality.

a Historical (1 mark) **b** Medical (1 mark)

c Functional (1 mark) **d** Statistical (1 mark)

18 There are several factors that can influence whether a person develops adaptive behaviours. **Identify** two of these and **explain** how they impact behaviours. (2 marks)

19 **Explain** how the DSM-5-TR is used by professionals. (1 mark)

20 **Describe** the main symptoms of generalised anxiety disorder. (2 marks)

Analytical processes

21 **Differentiate** between bipolar I and II. (1 mark)

22 **Distinguish** between the content and language used in the DSM-5-TR and the ICD-11. (2 marks)

Knowledge utilisation

23 **Discuss** how personality can influence whether or not an individual develops maladaptive behaviours. (2 marks)

24 **Discuss** the importance of using a proper diagnostic system when determining someone's mental health, with reference to Rosenhan's 1973 study. (2 marks)

25 **Discuss** the validity and reliability of diagnosis. (3 marks)

Data drill

Strength of relationship

One hundred people between the ages of 18 and 22 from a local university were given a questionnaire that looked at their current stress levels and their depression score. The data was plotted and is shown in Figure 1. A Pearson *r* correlation coefficient was used to determine if the relationship between stress score and depression rate was significant.

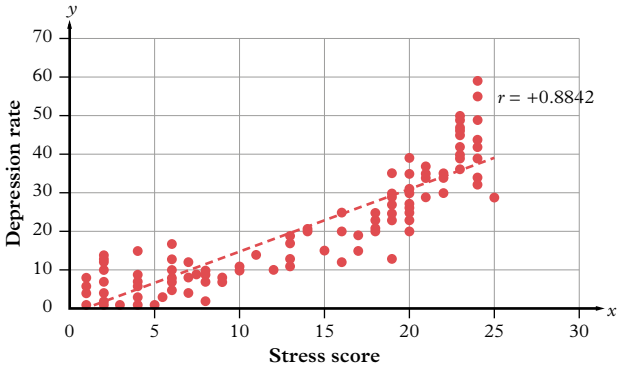


FIGURE 1 Scatterplot of correlation between stress score and depression rate

Apply understanding

1 **Identify** the highest depression rate experienced by participants. (1 mark)

2 **Determine** the co-variables of this study. (2 marks)

Analyse data

3 **Identify** the direction and strength of this relationship. (2 marks)

4 **Identify** one characteristic that makes it appropriate to use a Pearson *r* correlation coefficient to analyse the data. (1 mark)

Interpret evidence

5 **Draw a conclusion** about depression rates and stress scores. (1 mark)

6 **Predict** the depression rate of a participant who scored 30 on the stress score. (1 mark)

Module 12 checklist: Diagnosis of psychological disorders

Quizlet: Revise key terms online to test your understanding

UNIT 2

Topic 2 review

Multiple choice

(1 mark each)

1 How does the statistical approach define normality?
- **A** In terms of frequency within a population
- **B** Based on individual experiences
- **C** Through sociocultural factors
- **D** By evaluating mental health

2 What is a characteristic of maladaptive behaviours?
- **A** They assist in relating to others.
- **B** They are genetically predetermined.
- **C** They are learnt from parental modelling.
- **D** They interfere with day-to-day functioning.

3 According to the American Psychiatric Association (APA), a psychological disorder is characterised by
- **A** social skills deficits.
- **B** interpersonal challenges.
- **C** disturbance in neural pathways.
- **D** cognitive and emotional disturbances.

4 What does validity of diagnosis refer to?
- **A** The reliability of self-reported data from individuals
- **B** The influence of cultural factors on symptom reporting
- **C** The consistency of diagnoses made using a particular classification system
- **D** The accuracy of a classification system in correctly diagnosing psychological disorders

5 What is the main symptom of specific phobia?
- **A** Intense and irrational fear
- **B** Extreme sadness
- **C** Chronic worrying
- **D** Hallucinations

6 What factors are considered in the situational approach to normality?
- **A** Societal rules, mental health and physical health
- **B** Context or situation, and cultural expectations
- **C** Individual differences and internal factors
- **D** Gender, cultural background and age

7 How do early childhood experiences influence the development of maladaptive behaviours?
- **A** They shape early socialisation abilities.
- **B** They affect brain development and learning.
- **C** They determine adult interpersonal relationships.
- **D** They have no impact on maladaptive behaviours.

8 The ICD-11 and DSM-5-TR both
- **A** are only used for research purposes.
- **B** specify the causes of mental disorders.
- **C** provide a structured framework for classifying mental disorders.
- **D** are recognised as the standard framework by mental health professionals worldwide.

9 Why can self-reported data be unreliable?
- **A** Because it is always biased
- **B** Because it relies solely on anecdotal evidence
- **C** Because it is influenced by external factors such as environment
- **D** Because individuals may not report symptoms that don't conform to social norms

10 How does hypomania differ from mania in bipolar II disorder?
- **A** Hypomania leads to hallucinations.
- **B** Hypomania is more severe than mania.
- **C** Hypomania does not disrupt everyday functioning.
- **D** Hypomania is not a symptom of bipolar II disorder.

11 What limitation is associated with the medical approach to normality regarding its focus on diagnosis and treatment?
- **A** Neglecting cultural diversity
- **B** Disregarding environmental factors in mental health
- **C** Lack of attention to prevention and mental health promotion
- **D** Underestimating the importance of interpersonal relationships

12 What environmental stressor could increase an individual's susceptibility to developing maladaptive behaviours?
- **A** Pursuing a challenging goal
- **B** Happy home environment
- **C** Starting a new project
- **D** Natural disasters

13 What is one limitation of the DSM-5-TR compared to the ICD-11?
- **A** It does not provide a structured framework for diagnosis.
- **B** It does not include codes for all diseases and disorders.
- **C** It lacks detailed descriptions of diagnostic categories.
- **D** It does not specify the causes of mental disorders.

14 What distinguishes generalised anxiety disorder (GAD) from other anxiety disorders?
- **A** GAD involves excessive worrying about a variety of events or activities.
- **B** GAD is typically diagnosed based on the presence of panic attacks.
- **C** GAD is less common than other anxiety disorders.
- **D** GAD is characterised by extreme mood swings.

15 How does comorbidity impact the reliability of diagnosis?
- **A** It makes diagnosis easier due to clear symptom patterns.
- **B** It increases the risk of adverse medical interventions.
- **C** It can lead to overdiagnosis of disorders.
- **D** It increases subjective assessments.

Short response

16 **Describe** adaptive behaviours using an example from everyday life. (2 marks)

17 **Explain** the sociocultural approach in understanding the concept of normality, using an example. (2 marks)

18 **Identify** the classification system created by the World Health Organization used to diagnose psychological disorders. (1 mark)

19 **Identify** a strength and a limitation of using diagnostic manuals to diagnose psychological disorders. (2 marks)

20 **Identify** three symptoms of major depressive disorder (MDD). (3 marks)

21 **Describe** one factor that can affect the reliability of diagnosis. (1 mark)

22 **Explain** the role of genetics in predisposing individuals to maladaptive behaviours. (1 mark)

23 **Explain** how culture can influence the reporting of symptoms and its implications for validity of diagnosis. (2 marks)

24 **Discriminate** between a statistical and functional approach to the concept of normality. (1 mark)

25 **Contrast** the application and scope of the DSM-5-TR and ICD-11. (2 marks)

26 **Discriminate** between positive and negative symptoms of schizophrenia. (1 mark)

27 Provide an argument for and an argument against the historical approach to the concept of normality. (2 marks)

28 **Contrast** adaptive and maladaptive behaviours using an example. (2 marks)

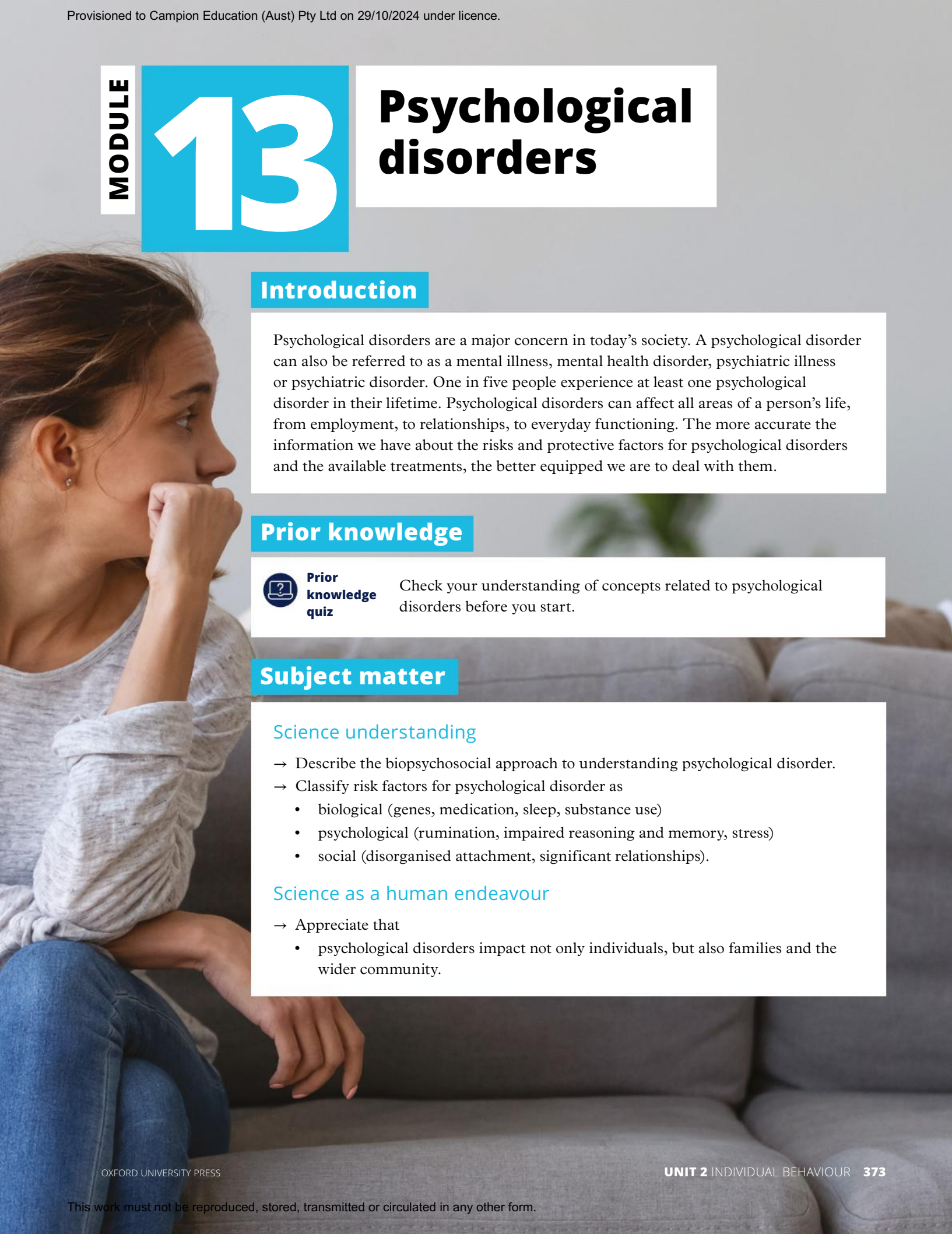
29 **Explain** the role of genetics and environmental factors in the development of personality disorders. (2 marks)

30 **Discuss** limitations of relying solely on treatment success to confirm the accuracy of diagnosis. (2 marks)

TOTAL MARKS
/41 marks

MODULE 13

Psychological disorders



Introduction

Psychological disorders are a major concern in today's society. A psychological disorder can also be referred to as a mental illness, mental health disorder, psychiatric illness or psychiatric disorder. One in five people experience at least one psychological disorder in their lifetime. Psychological disorders can affect all areas of a person's life, from employment, to relationships, to everyday functioning. The more accurate the information we have about the risks and protective factors for psychological disorders and the available treatments, the better equipped we are to deal with them.

Prior knowledge

Prior knowledge quiz

Check your understanding of concepts related to psychological disorders before you start.

Subject matter

Science understanding

→ Describe the biopsychosocial approach to understanding psychological disorder.
→ Classify risk factors for psychological disorder as
- biological (genes, medication, sleep, substance use)
- psychological (rumination, impaired reasoning and memory, stress)
- social (disorganised attachment, significant relationships).

Science as a human endeavour

→ Appreciate that
- psychological disorders impact not only individuals, but also families and the wider community.

Science inquiry skills

→ use appropriate equipment, techniques, procedures and sources to systematically and safely collect primary and secondary data

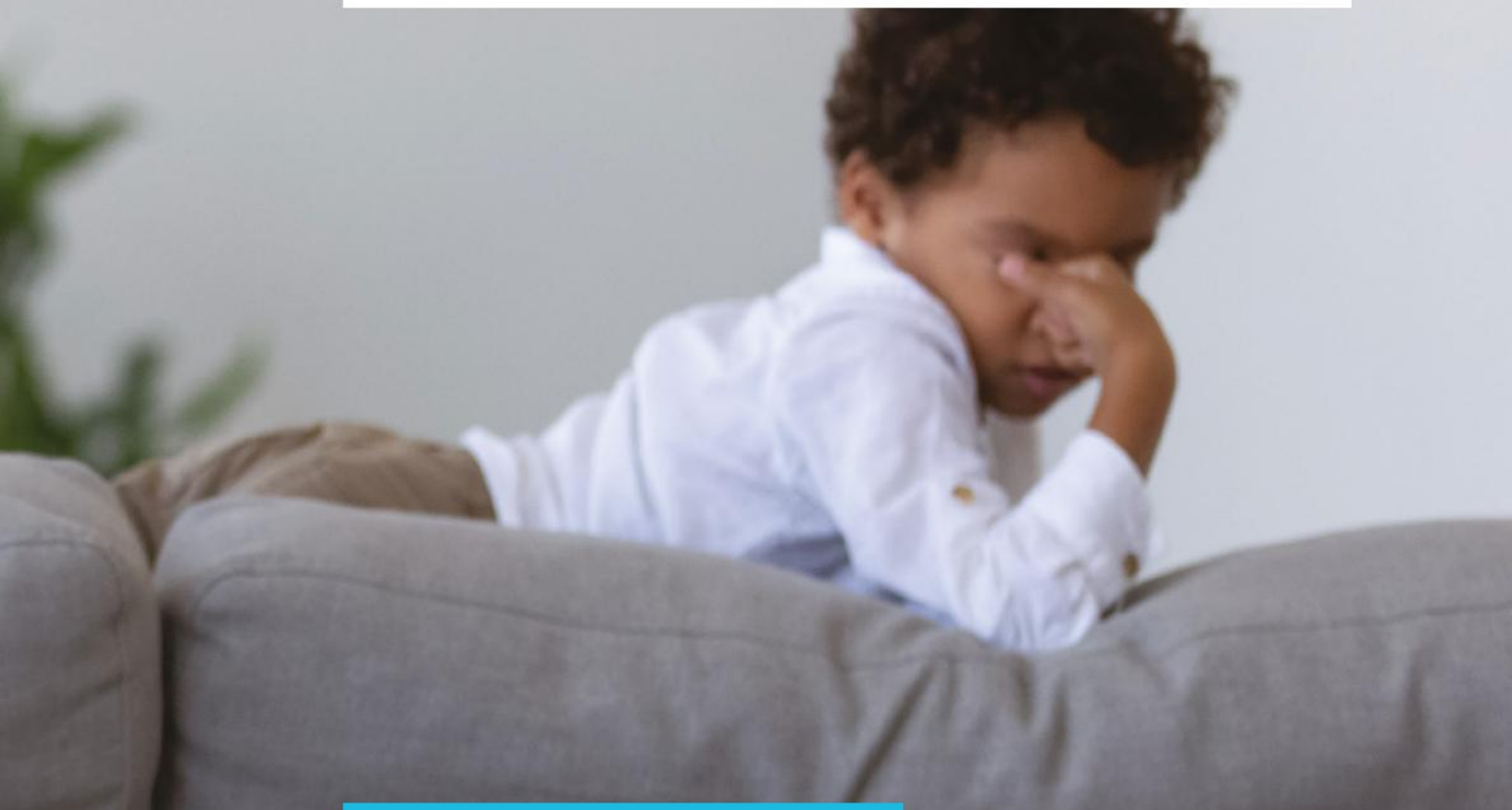
→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
- descriptive statistics

→ analyse data to identify trends, patterns and relationships; recognising error, uncertainty and limitations of evidence

→ select, synthesise and use evidence to
- draw conclusions, using *p*-values to infer significance, allowing for the possibility of type I and II errors

→ extrapolate findings to determine unknown values, predict outcomes and evaluate claims

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024



Support for your wellbeing

This module will provide information about mental health and psychological disorders. This information is intended for information only and should not be used for diagnosis or treatment. You can seek support for anything discussed in this module by speaking with a family member, friend, teacher or trusted adult. Alternatively, the following organisations can offer support: Beyond Blue, SANE, Lifeline, Kids Help Line, the Black Dog Institute and Headspace. Links are available via Oxford Digital.

Lesson 13.1
The biopsychosocial approach

Key ideas

→ The biopsychosocial model is a holistic, three-pronged approach to understanding, assessing and treating psychological disorders.

Learning intentions and success criteria

Introducing the biopsychosocial model

The **biopsychosocial model** was first developed by George L. Engel in 1977. Engel believed that to truly understand and treat a person's mental and/or physical illness, it was important to consider their condition in terms of biological, psychological and social influences (Engel, 1977; Borrell-Carrio et al., 2004). His model was a "holistic" option compared to the traditional biomedical model that had separated the body and the mind for centuries.

biopsychosocial model
a holistic approach to treating psychological disorders by looking at biological, psychological and sociocultural factors

The biomedical approach tended to treat the individual from a purely physiological perspective, in a distant and impersonal manner that ignored human distress. Engel believed that the clinician/doctor/psychologist had an important role in influencing the course of both treatment and the person's recovery. If the clinician was perceived to be uncaring and uninterested in the patient, the recovery could be hampered and delayed. Engel's aim was to bring greater "empathy and compassion" into the patient–practitioner relationship, with the objective of attaining a better recovery outcome.

According to Engel, biological factors include physiological/anatomical, neurological and genetic factors, and gender, age and ethnicity. Psychological factors are the individual's subjective perceptions, personality predisposition and their unique thoughts, feelings and behaviours. Social influences include family, friends, societal expectations and available services, cultural background and environment. The biopsychosocial model became a "collaborative pathway to health".

Development of the model

The biopsychosocial model has developed since its first inception and has been applied successfully in both medical and organisational settings. It considers questions such as the following:

- Is there a family history of physical or mental illness?
- Is this person experiencing psychological distress (sadness, anxiety) because of an underlying physiological condition?
- Does personality determine how well or how poorly someone copes with stress?
- Are there any difficulties at home, school or work?
- Does cultural background exert any extraordinary pressures or expectations that may be affecting someone?
- What social support structures does someone have in place?

This path of inquiry underpins the biopsychosocial framework and reflects an all-encompassing approach by the practitioner.

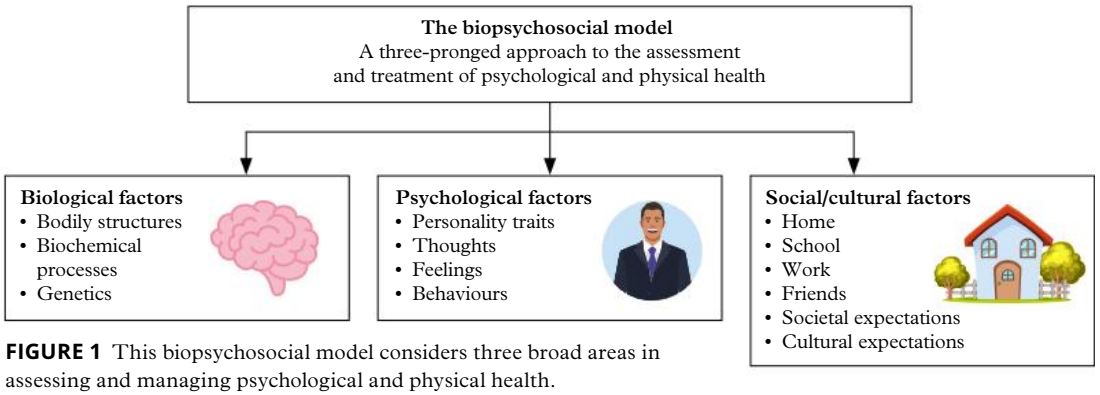


FIGURE 1 This biopsychosocial model considers three broad areas in assessing and managing psychological and physical health.

Challenge

While the biopsychosocial approach is widely used in understanding the development of psychological disorders, there are some criticisms when it comes to assessing risk factors, including an overly complicated understanding of risk factors, difficulty in identifying a cause and effect relationship between risk factors, and limited predictive power in identifying specific risk factors that lead to the development of psychological disorders. **Discuss** the arguments for and against the biopsychosocial approach to identifying risk factors in the development of psychological disorders.

Biological factors

This aspect of the biopsychosocial model considers a person's functioning in terms of bodily structures such as the brain and nervous system, biochemical processes (e.g. the role of particular neurotransmitters) and genetic predisposition (what has been inherited). It explains behaviour in terms of physiology.

Types of assessment include:

- neuroimaging: electroencephalogram (EEG), positron emission tomography (PET), magnetic resonance imaging (MRI) and functional magnetic resonance imaging (fMRI)
- neuropsychological testing: questionnaires and intelligence quotient (IQ) tests.

Types of treatment include:

- medication: antidepressants (for depression), psychotropic drugs (to manage delusions and hallucinations), mood stabilising drugs (to assist with anxiety)
- medical procedures.

Psychological factors

Psychological factors such as the following are taken into account:

- personality: an individual's personality predisposition (e.g. Are they outgoing (extroverted) or reserved (introverted)? Are they confident or fearful? What coping strategies do they use?
- behaviour: is the individual's behaviour conscious or unconscious? Are they aware of what they are doing or what consequences their actions might have for themselves or others?)
- perception: the individual's awareness of themselves and the universe around them
- cognition: the way someone processes information, and their intelligence and decision-making skills
- attention: what incoming information does someone focus on and what do they ignore?
- motivation: what drives someone to behave or think in a particular way?

Social factors

A range of social and cultural influences can either increase a person's resilience or contribute to their ill health. These influences can include:

- school environment or pressures
- work environment or pressures
- level of education
- availability of and access to appropriate medical and support facilities
- socioeconomic factors such as poverty and homelessness.

These factors can be crucial to a person's recovery if they have been ill. Research has found that social support networks are just as important to an individual's recovery as the actual medical attention or diagnosis they receive. There is great emphasis on developing a professional but also caring relationship between clinician/doctor/psychologist and patient/client.

Applying the model

Table 1 gives an insight into how this framework can be adapted to treat someone with a likely psychological disorder.

TABLE 1 Application of the biopsychosocial model to treat psychological disorders

	Onset of illness	Management of illness	Long-term strategies
Biological support	• Sedating medication for initial episode • Appropriate testing to determine diagnosis • Appropriate psychotropic medication to control delusions and hallucinations • Antidepressant medication • Nutrition and safety	• Psychotropic medication • Appropriate antidepressant medication • Mood stabiliser • Ongoing monitoring of symptoms and adjustment of treatment	• Psychotropic medication • Appropriate antidepressant medication • Mood stabiliser • Ongoing monitoring of symptoms on a less frequent basis and adjustment of treatment
Psychological support	• Reduce stimulation and calm down of patient/client • Sit beside patient/client rather than facing them • Acknowledge patient/client's delusions and hallucinations without challenging them • Support the taking of appropriate medication • Refer family members to appropriate support program(s) • Provide information regarding mental illness and the availability of support organisations • Provide emotional support • Work towards strategies of self-care and relationships with family	• Increase levels of external stimulation • Enable greater independence and responsibility for self • Provide information about the illness • Develop a wellness recovery plan and implement with patient/client • Refer family members to ongoing support programs • Ensure that links with support networks are made • Discuss in detail patient/client's experiences and allow them to develop a greater awareness of their mental and physical state	• Continue counselling support for the patient/client that allows them to debrief about their experiences • Consider how patient/client's experience can enable a wellness recovery plan • Continue to provide information about the illness • Ensure that important relationships are maintained • Integrate a wellness recovery plan in daily life • Possibly reduce frequency of appointments • Continue to refer family to appropriate supports

	Onset of illness	Management of illness	Long-term strategies
Social support	• Organise hospitalisation or intensive clinical support at home • Provide support and information for family and friends • Establish whether there are any cultural issues that may either impede or support recovery/ effective management	• Organise psychosocial rehabilitation services and respite programs to support patient/client and family • Provide access to education to assist in facilitating and reinforcing relationships with family and friends • Monitor whether cultural beliefs may interfere with taking medication and working towards independence	• Encourage increased independence • Possibly reduce psychosocial rehabilitation to allow patient/ client to return to school/work • Continue to monitor whether cultural beliefs have interfered with taking medication and working towards independence

Check your learning 13.1

Check your learning 13.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Explain** the biopsychosocial model. (1 mark)
2 **Describe** two psychological factors that may affect an individual. (2 marks)
3 **Describe** how the biopsychosocial model differs from the biomedical approach. (1 mark)
4 **Explain**, using an example, why the social aspect of the biopsychosocial model is important in dealing with a person with either a physical or psychological illness. (2 marks)

Knowledge utilisation

5 Think of someone suffering from major depressive disorder (Module 12). **Discuss** how the biopsychosocial approach could help them. (2 marks)
6 **Create** your own biopsychosocial model. Set up a table similar to Table 1 and show how your model could be applied to major depressive disorder. (4 marks)

Lesson 13.2
Risk factors and protective factors

Key ideas

→ Risk factors and protective factors for psychological disorders include individual attributes, social circumstances and environmental factors.

→ The number of risk factors affecting a person increases their risk of developing a psychological disorder; risk is cumulative.

Learning intentions and success criteria

Introducing risk factors

Psychological disorders can develop for a number of reasons, and nobody is immune. There are many different risk factors associated with developing a psychological disorder, including biological, psychological, sociocultural and environmental factors. These risk factors make it more likely for an individual to develop a psychological disorder. It is important to identify the cause of a psychological disorder so the practising psychologist is better able to assist the individual to manage their condition, and also reduce the chance of it recurring.

Risk factors and protective factors

Risk factors are factors that contribute to the likelihood of a person either suffering from a psychological disorder or experiencing a relapse. In contrast, **protective factors** guard against onset or relapse by supporting a person's general wellbeing. Protective factors give people resilience in the face of adversity and soften the effects of stress.

risk factor factor that contributes to the likelihood of a person developing (or relapsing into) a psychological disorder

protective factor factor that guards against the onset or relapse of a psychological disorder

It is important to acknowledge the limitations of our current understanding of the risk factors for psychological disorders and the significance of any single risk factor. Not everyone who is exposed to a risk factor will necessarily develop a psychological disorder. The multidimensional model, followed by many practitioners, recognises that risk factors interact, and that multiple and persistent risk factors are more likely to cause a psychological disorder than any single risk factor. Table 1 sets out risk factors and protective factors that may affect mental health according to the World Health Organization.

TABLE 1 Factors affecting mental health

Level	Risk factors	Protective factors
Individual attributes	• Low self-esteem • Cognitive/emotional immaturity • Difficulties in communicating • Medical illness, substance use	• Self-esteem, confidence • Ability to solve problems and manage stress or adversity • Communication skills • Physical health, fitness
Environmental factors	• Poor access to basic services • Injustice and discrimination • Social and gender inequalities • Exposure to war or disaster	• Equality of access to basic services • Social justice, tolerance, integration • Social and gender equality • Physical security and safety

Level	Risk factors	Protective factors
Social circumstances	• Loneliness, bereavement • Neglect, family conflict • Exposure to violence/abuse • Low income and poverty • Difficulties or failure at school • Work stress, unemployment	• Social support of family and friends • Good parenting/family interaction • Physical security and safety • Economic security • Scholastic achievement • Satisfaction and success at work

The four Ps

When treating patients with a psychological disorder, psychologists often try to identify factors that influence the psychological disorder: what factors increase the risk, and what factors protect against the onset and recurrence of the disorder? Together, these factors are referred to as the "four Ps":

- Predisposing risk factors
- Precipitating risk factors
- Perpetuating risk factors
- Protective factors.

Predisposing risk factors

FIGURE 1
Predisposing risk factors include things we might inherit, or encounter in the early stages of development.

Predisposing risk factors refer to factors that increase vulnerability to psychological disorders and take into account certain traits or attributes that we might be born with.

These factors may include:

- inherited traits, such as certain genes that may increase the chances of a psychological disorder developing; having a biological member of your family such as a parent or a sibling with a psychological disorder
- environmental exposures before birth, such as to toxins, alcohol or drugs
- chronic social stressors, such as difficult circumstances during childhood, bullying and parental neglect
- brain structure and function; for example, some neural networks may be impaired and the malfunctioning leads to nervous system changes and possibly psychological disorders
- ongoing chronic medical condition, such as diabetes, cystic fibrosis, cancer.

Precipitating risk factors

These factors help the practitioner to understand the patient's current symptoms and might include:

- stressful life situations (e.g. legal and/or financial problems, death of a loved one, divorce, witnessing parental violence)
- being the victim of parental emotional, physical or sexual abuse, or neglect
- belonging to an ethnic minority
- traumatic experiences (e.g. being assaulted, being affected by war or terrorism, military combat)
- long-term use of some medications.

Perpetuating risk factors

These factors inhibit recovery; they make the psychological disorder last longer than it otherwise would, and include:

- problems with alcohol, tobacco and drugs
- social isolation (e.g. having few friends or extended family, or few healthy relationships in general)
- relationship difficulties
- family conflicts
- poverty and/or homelessness
- medical conditions such as heart disease
- weakened immune system
- poor parental attachment
- previous mental illness
- missing school or work
- harm to self and/or others.

FIGURE 2 Homelessness is considered a perpetuating risk factor.

Protective factors

The following protective factors can help prevent the occurrence or recurrence of a psychological disorder and include a person's strengths, resilience and supports:

- good diet
- maintaining fitness and good physical health
- maintaining good sleep patterns
- ability to recognise early warning signs of relapse of the disorder
- awareness of potential risks for developing or experiencing the relapse of a disorder
- maintaining appropriate medication when relevant
- staying connected with family and friends
- awareness, acceptance and recognition of the psychological disorder
- joining a support group
- learning about psychological disorders
- anticipating and planning appropriately for potential scenarios and relapses
- avoiding harmful use of alcohol and drugs
- being involved in education, art or other activity
- economic wellbeing and having a reliable job or means of income
- having a home.

Skill drill

Semi-structured interviews

Science inquiry skill: Collecting data (Lesson 1.6)

One hundred adolescents from Brisbane, who had previously been diagnosed with a mental health disorder, attended a walk-in clinic for mental health. A semi-structured interview was used to determine what risk factors they had prior to their diagnosis. Figure 3 displays their results.

A semi-structured interview is a research method commonly used in psychology to assess risk factors for developing psychological disorders. This type of interview combines elements of both structured and unstructured interviews, providing a flexible framework for gathering information while maintaining some standardised components.

The flexibility of a semi-structured interview allows the interviewer to adapt to the participant's responses, delving deeper into particular areas of interest or seeking clarification on specific points. This approach is particularly useful in assessing risk factors for developing psychological disorders because it allows for a comprehensive exploration of the individual's background, experiences and potential stressors.

Practise your skills

1 **Identify** which three risk factors were reported the most by adolescents diagnosed with a mental health disorder. (3 marks)

2 **Identify** a strength of using a semi-structured interview to assess risk factors for developing a psychological disorder. (1 mark)

3 **Identify** a limitation of using a semi-structured interview to assess risk factors for developing a psychological disorder. (1 mark)

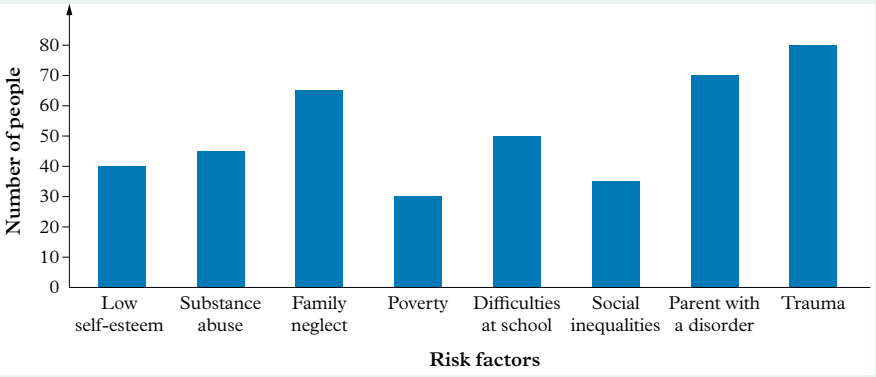


FIGURE 3 Risk factors of adolescents with a diagnosed mental health disorder

Cumulative risk

cumulative risk the combined risks or factors that may interact with each other to influence a psychological disorder

The combined and interactive impact of multiple risk factors that contribute to the development of a psychological disorder is referred to as **cumulative risk**.

Individuals often encounter risk factors across their lifespan. Unfortunately, events such as loss or bereavement are a part of life. People with psychological disorders, however, have often encountered multiple risk factors throughout their lives. Researchers have found that the accumulation of risk factors increases the chances of a person developing a psychological disorder.

In Lessons 13.3, 13.4 and 13.5 we will look at the risk factors for psychological disorders from the perspective of the biopsychosocial approach.

Check your learning 13.2

Check your learning 13.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the "four Ps" of risk and protective factors. (4 marks)

2 **Describe** one protective factor that could help guard against an individual developing a psychological disorder. (1 mark)

3 **Explain** what a risk factor associated with developing a psychological disorder is. (1 mark)

4 **Define** cumulative risk in relation to developing a psychological disorder. (1 mark)

Analytical processes

5 **Compare** risk and protective factors. (2 marks)

6 **Consider** an individual with a history of parental neglect and current symptoms of anxiety. **Identify** the predisposing, precipitating and perpetuating risk factors influencing the individual's current state. (3 marks)

Knowledge utilisation

7 **Predict** the potential psychological outcomes for an individual with low income, work stress and a supportive family. Consider in your response how these mixed risk and protective factors influence psychological health. (2 marks)

Lesson 13.3
Biological risk factors

Key ideas

Biological risk factors for psychological disorders include:

- → genetic vulnerability to specific disorders
- → poor response to medication due to genetic factors
- → poor sleep
- → long-term substance abuse.

Learning intentions and success criteria

Introducing biological risk factors for psychological disorders

Biological risk factors include genetic predisposition, physiological structures of the body and the biochemical processes of the brain and nervous system. These factors will be examined in more detail in the context of genetic vulnerability to specific disorders, poor response to medication due to genetic factors, poor sleep and long-term or sporadic substance abuse.

Genetic vulnerability to specific disorders

Twin studies, family studies and adoption studies have suggested that people can be more at risk of developing a psychological disorder if it runs in the family. Our genes, passed on to us by our parents, instruct our body on how it will make the proteins that make up our cells, including those in our brain. A genetic mutation can cause proteins to be created that will function differently from the way they do typically. Some people are genetically predisposed to producing low or high levels of particular neurotransmitters that render them at greater risk of a psychological disorder.

It is important to note that being vulnerable to a specific disorder does not mean a person will definitely develop one. It simply means they are more susceptible to its onset.

FIGURE 1 People can inherit genetic vulnerability for a psychological disorder from their parents.

Schizophrenia

Schizophrenia has a strong genetic link. Twin studies and adoption studies support the genetic component. Heston (1966) conducted a study on 47 infants who were raised by adoptive parents, but whose biological mothers had schizophrenia. He also obtained 50 control participants who were raised with their biological mothers who did not have schizophrenia. The findings showed that 16 per cent of the children whose biological mother had schizophrenia were diagnosed with this disorder compared to no participants from the control group (Kring et al., 2007).

Further research was conducted in Finland with a larger sample of adopted children. It was found that of the 164 adoptees who had a parent with schizophrenia, the risk of

FIGURE 2 The Genain quadruplets all developed schizophrenia later in life. The chances of four unrelated individuals all having schizophrenia is 1 in 100 million.

developing the illness was 8.1 per cent, compared to the 197 control group adoptees who did not have a parent with schizophrenia, whose risk was 2.3 per cent (Tiernari et al. cited in Kring et al., 2007).

The Genain quadruplets offer some insight into research on genetics and schizophrenia. These genetically identical quadruplets had psychological problems and all developed schizophrenia in their 20s. There were several causes for the onset of schizophrenia, and one of them was genetic. The quadruplets had a family history of psychological disorders on their father's side, and it is very likely that their genetic make-up, among other things, contributed to each quadruplet developing schizophrenia later in life (Nietzel et al., 1998).

Poor response to medication due to genetic factors

Some individuals respond better than others to medication, depending, in part, on their genetic make-up and metabolism. Abnormal levels of neurotransmitters are thought to be involved in psychological disorders. For example, extremely low levels of a neurotransmitter called serotonin has been linked with depression. Antidepressant medications such as Zoloft and Prozac work to increase the levels of serotonin. These types of medication are known as selective serotonin re-uptake inhibitors (SSRIs). Depending on their serotonin level, an individual may need higher or lower treatment dosages, and the SSRI may be ineffective if underlying factors other than serotonin levels are causing a person's depression (Burton et al., 2015).

Our bodies respond to medication via a five-stage process, and every individual can react to each stage differently according to their genetic make-up:

1. The first stage is how we absorb the drug into our body. This is known as the absorption stage.
2. The second stage is the distribution stage. It describes how our body distributes the drug to where it is needed. In the case of antidepressants, the site is the neural pathways in the brain.
3. The third stage is the target interaction stage. This involves where and how the drug interacts with the cells it was designed to treat. For antidepressants, the target for the drug is to bind with receptors in the brain and prevent the re-uptake of neurotransmitters such as serotonin.
4. The fourth stage is metabolic processing: how our bodies change the chemical compound of the drug to use it or prepare for it to leave our system. This usually happens in the liver, but can also happen in the stomach or blood plasma.
5. The fifth stage is the excretion stage: how our body gets rid of the chemicals left over from the drug.

FIGURE 3 Antidepressant medication can be more or less effective, depending on someone's genetic make-up.

Pharmacogenetics is a field of study that looks at how an individual's genetic make-up affects their response to drugs (Fabbri et al., 2013; Li et al., 2016). It is hoped that this growing field of study will build our knowledge of how and why people respond differently to drugs, allowing us to better plan and treat psychological disorders.

Poor sleep

Chronic sleep problems are associated with mental health issues and each can perpetuate the other. Sleep problems are particularly common in patients with anxiety, depression, bipolar disorder and attention deficit hyperactivity disorder. It is thought that sleep deprivation, or disorders such as insomnia, affect the way individuals regulate their emotions. For example, people who have been deprived of sleep seem to react more intensely to negative experiences or emotions than those who are not sleep deprived (Franzen et al., 2009). Patients who struggle to deal with negative emotions may be more susceptible to depression and other forms of psychological disorders. Likewise, if sleep deprivation is a symptom of a mental health condition, then a patient's condition may be exacerbated by a loss in their ability to deal with emotions effectively.

FIGURE 4 Poor sleep can be both a contributing factor to and symptom of psychological disorders.

Benzodiazepine medications can be used to treat poor sleep patterns by enhancing the effects of gamma-amino butyric acid (GABA), a neurotransmitter that affects our emotional reactions and ability to relax. However, one of the issues with using benzodiazepine medication is that it may intensify existing symptoms (i.e. depression), and prolonged use can lead to dependency (Barlow & Durand, 2011).

Therefore, when treating chronic sleep problems, it is important to consider whether a mental health issue has caused the sleep problem – or if the sleep problem has contributed to a patient's poor mental health.

Long-term substance abuse

Long-term substance abuse has been linked with a number of psychological disorders. There is an association between alcoholism and depression, cannabis and depression, and amphetamines and symptoms of paranoia and anxiety. Addictive substances, such as nicotine or alcohol, change the way the brain works by interfering with chemical neurotransmission. Some substances also affect the level of neurotransmitters released.

Nicotine, for example, affects the acetylcholine receptors in the brain (the "pleasure pathway") and increases dopamine levels – a neurotransmitter involved in the production of feelings of reward and pleasure.

Other substances affect how neuronal messages are transmitted. For example, repeated use of the drug ecstasy disrupts serotonin pathways in the brain, resulting in memory problems for long-time users. Similarly, cocaine attaches itself to dopamine transporters in the brain, preventing the re-uptake of dopamine into the neurons and causing dopamine to build up in the synapse. This causes the euphoria experienced by users after taking the drug. Prolonged use of these substances can have devastating long-term effects on the way our brain functions. It can lead to poor memory functioning, changes in sleep patterns and appetite, as well as problems in how information is processed in the brain.

Long-term substance abuse can enhance the symptoms of an existing psychological disorder. Some drugs can trigger the onset of early symptoms of a psychological disorder such as schizophrenia in individuals genetically predisposed to it. In addition, drugs such as cannabis, cocaine, amphetamines and LSD can increase the risk of schizophrenia and the risk of a relapse in those who are recovering (Nielsen et al., 2017).

Real-world psychology

Heavy cannabis use linked to schizophrenia

A recent Danish study, possibly the largest epidemiological investigation on the cannabis-psychosis link, reveals that heavy cannabis use, especially among young men, may lead to schizophrenia. The study analysed health records of 6.9 million people from 1972 to 2021, revealing that up to 30% of schizophrenia diagnoses in young men (21–30 years old) could have been prevented if cannabis use disorder hadn't developed.

The research does not provide definitive proof of the cannabis–schizophrenia connection but suggests a correlation, supported by the rise in marijuana potency and schizophrenia diagnoses. The study delves into gender and age risks, indicating a higher proportion of cases in males, especially younger males, and aligns this with the increasing potency of cannabis. The size of the study is highlighted, emphasising its impact as the first large-scale investigation across an entire population addressing the relationship between cannabis and schizophrenia across different age and sex groups.

The study raises questions for future research, including whether adolescent male brains are more vulnerable and the implications for prevention and treatment strategies. Researchers suggest a need for caution in interpreting the results and to consider potential misdiagnoses and confounding factors. The study's findings are considered intriguing but also raise further questions, prompting discussions about misdiagnosis, potential protective effects for women, and factors that may confound results.

Apply your understanding

1 **Describe** what the recent Danish study revealed about the potential link between heavy cannabis use and schizophrenia. (1 mark)
2 **Identify** the factors in the study that support the suggested correlation between cannabis use and schizophrenia. (2 marks)
3 **Discuss** the strengths and limitations of the study. (2 marks)

FIGURE 5 Smoking marijuana is linked to an increased risk of developing schizophrenia.

Check your learning 13.3

Check your learning 13.3: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Explain** biological risk factors for psychological disorders. (2 marks)
2 **Describe** how medication can be affected by genetics. (1 mark)

Analytical processes

3 Poor sleep can influence the development of psychological disorders, and can be caused by psychological disorders. **Consider** how a psychologist might assess which came first. (1 mark)

Knowledge utilisation

4 Consider the Genain quadruplets. **Determine** whether you think they provide support for the theory of biological risk factors. **Justify** your response. (2 marks)

Lesson 13.4
Psychological risk factors

Key ideas

Psychological risk factors for psychological disorders include:

→ rumination

→ impaired reasoning and memory

→ stress.

Learning intentions and success criteria

Introducing psychological risk factors for psychological disorders

Psychological risk factors for psychological disorders include an individual's personality, thoughts, feelings and behaviours. Such factors are explored next with particular reference to rumination, impaired reasoning and memory, stress and poor self-efficacy.

Rumination

Rumination refers to obsessive thinking and worrying about the negative aspects of a past, present or future situation. It has the potential to adversely affect mental health if a person is unable to break the cycle of ruminating about the negative aspects of life, preventing them from developing strategies to address their perceived problems. Rumination is associated with anxiety and, if untreated, can lead to depression.

rumination excessive thinking or worrying

A possible explanation for why rumination occurs is the way our brains function in relation to memories. People tend to remember things that are related to each other. When we constantly remember negative things, the brain automatically recalls similar negative experiences; this causes the areas in the brain associated with negative thinking to "light up". This process is known as neural networking. Over time, such thinking can become a "cognitive" habit (Belzung et al., 2015). And habits, as we know, are hard to break.

Rumination is made worse if patients also experience symptoms of depression and anxiety. It is likely that the brain of a depressed patient lacks the necessary chemical (or synaptic connections) that allows them to switch to a more positive set of memories, making it difficult to generate new solutions to problems. Therefore, as rumination intensifies, so does the likelihood of experiencing depression and anxiety.

Cognitive behavioural therapy has been shown to be effective in treating rumination by teaching patients to reappraise the way they think about and interpret their thoughts. It enables the individual to assign a new set of emotions and thinking patterns to their cognitive experiences (Watkins, 2015). You will learn more about cognitive behavioural therapy in Lesson 15.2.

FIGURE 1 Obsessive thinking and worrying can affect a person's mental health.

Impaired reasoning and memory

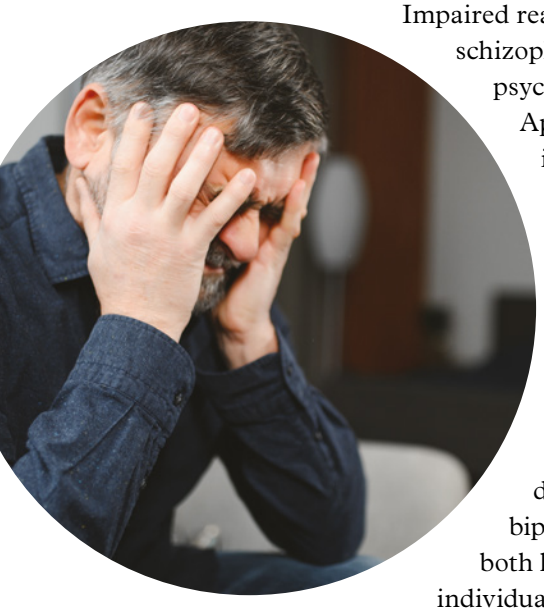


FIGURE 2 Memory impairment is associated with several psychological disorders and can have a significant impact on an individual's capacity to engage in everyday activities.

Impaired reasoning and memory are often associated with dementia, depression, schizophrenia and bipolar disorder. Causes vary and depend on the type of psychological disorder and the particular part of the brain that has been impaired. Approximately 70–80 per cent of people who suffer from schizophrenia show impaired reasoning and memory (Medalia & Choi, 2009).

Impaired reasoning can be described as the inability to engage in goal-directed thinking, where conclusions are drawn logically from what we know (the information we have stored in memory). Patients with thinking impairments tend to "jump to conclusions" without accessing all the information available. For people with schizophrenia, impaired reasoning is thought to lead to delusions (fixed, firm but false beliefs) that are held rigidly, even when evidence to the contrary is provided (Burton et al., 2015).

Impaired memory is associated with schizophrenia, autism spectrum disorder, depression, dementia, post-traumatic stress disorder (PTSD) and bipolar disorder (Burton et al., 2015). Depending on the type of disorder, both long-term memory and short-term memory can be affected. For example, individuals with schizophrenia show impairment to all forms of memory, in particular episodic memory (memory for past events and personal experiences), while those suffering PTSD show impairment to episodic and verbal memories (memory related to verbally presented information) (Millan et al., 2012).

Memory impairment can be disabling for patients, causing confusion and disruption to their everyday lives. Individuals with impaired memory typically find it difficult to work, engage in everyday activities and maintain personal relationships (Burton et al., 2015).

Stress

Stress can negatively affect mental health if it is not checked or managed. Stress causes our bodies to release hormones such as adrenalin and cortisol as part of the fight-flight-freeze response. If too much cortisol is released over long periods, the risk of developing a psychological disorder such as depression is increased.

Elevated cortisol (known as the "stress hormone") levels can also lead to memory and learning impairments. Cortisol has also been associated with the onset of psychological disorders, such as schizophrenia, depression and substance abuse.

Stress can be caused by traumatic life events, such as the death of a loved one, a health scare or a break-up with a partner. Most of us encounter some sort of stress during our lives, most of which we can deal with effectively. However, when stress has a substantial impact and is ignored, it can affect both our psychological and physical wellbeing (Burton et al., 2015).

Effects of stress include depression, memory loss, impaired immune functioning and risk of developing a psychological disorder (Burton et al., 2015). The possibility that stress will lead to a psychological disorder depends on a person's level of vulnerability (influenced by genetics, biology and social factors), their ability to cope with the stress, and the level of stress they experience (Burton et al., 2015).

FIGURE 3 Stress can have a negative impact on mental health.

Challenge

Quantifying psychological risk factors can be challenging due to the lack of objective and standardised measurement tools. Variables such as stress, coping mechanisms and personality traits are often assessed subjectively, introducing potential biases and reducing the reliability of measurements. **Discuss** the challenges of using self-reporting methods for assessing psychological risk factors in the development of psychological disorders.

Check your learning 13.4

Check your learning 13.4: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** three psychological risk factors. (3 marks)

2 **Explain** what is meant by rumination. (1 mark)

Analytical processes

3 **Compare** the effects of stress and the effects of impaired reasoning and memory on mental health. (2 marks)

Knowledge utilisation

4 A year ago, Marten's girlfriend broke up with him without warning. Marten now has a new girlfriend. Marten can't stop thinking about everything that went wrong with his ex-girlfriend and is convinced that the same thing will happen with his new girlfriend. **Identify** which risk or risks for psychological disorder apply to Marten. **Justify** your answer using your knowledge of psychological risk factors. (2 marks)

Lesson 13.5
Social risk factors

Key ideas

Social risk factors for psychological disorders include:

→ disorganised attachment

→ significant relationships.

Learning intentions and success criteria

Introducing social risk factors for psychological disorders

The culture of a particular community or sector of society can place expectations on people that are associated with the onset of psychological disorders. For example, pressure on women to be thin can lead to depression and other disorders, such as anorexia and bulimia. Social and economic factors, such as divorce or unemployment, can place some people at risk. Social isolation is another significant contributor to developing a psychological disorder. Some particular social factors are explored in this lesson.

Disorganised attachment

disorganised attachment experienced by individuals who find it difficult to share their feelings or empathise with others

As discussed in Module 6, attachment is a strong, close and emotional bond that develops between an infant and their caregiver. A contributing factor to social isolation is the phenomenon of **disorganised attachment**, which affects individuals in society who find it difficult to share their feelings or to relate to others.

Children who exhibit disorganised attachment behave in contradictory ways. For example, they will approach their primary attachment figure while simultaneously gazing away, or appear disoriented, engage in rocking behaviour and have dazed facial expressions. The disorganised child's behaviour is difficult to understand.

Disorganised attachment in children at 12 months of age is linked to disruptive and aggressive behaviour in later childhood (Lyons-Ruth et al., 1997). These behavioural patterns tend to persist across the lifespan, with disorganised attachment in adulthood leading to problems in managing and maintaining relationships, poor social and emotional regulation skills, and a low tolerance for stress. Adults with disorganised attachment may also exhibit aggressive and hostile behaviours and engage in problematic parenting styles, putting them at risk of developing psychological disorders (Firestone, 2016).

FIGURE 1 Disorganised attachment in childhood is a risk factor for psychological disorders in adulthood.

Real-world psychology

Who is affected by psychological disorders?

It is not uncommon for children to develop anxiety disorders during their youth. Obsessive compulsive disorder (OCD) can also have sudden onset during childhood. These disorders can have significant impacts on the whole family.

OCD is characterised by unwanted repetitive thoughts and behaviours to alleviate distress caused by the thoughts. For example, fear about the safety of a family member might lead to a child repetitively checking on the family member during the day and night to assure themselves that their loved one is safe. When a child engages in this behaviour in relation to, for example, a parent, the child's anxiety might be temporarily relieved, but the parent loses sleep. Inadequate sleep puts the parent at risk of anxiety and depression.

The parents of children with OCD and other anxiety disorders also often adapt their own behaviours in an attempt to relieve the symptoms of the disorder for their child. For example, imagine a child who needs to arrange their pencils a certain way before they will start colouring. A parent might try to avoid a stressful situation by arranging the pencils in the "right" way. This might help the child, but doing this each time the child wishes to colour could place an excessive burden on the parent's time and energy, and prevent them from attending to other children, and engaging in everyday activities and employment.

FIGURE 2 Many people will find this arrangement visually pleasing to look at, but if the stationery were not presented this way it would not impact their daily lives. Someone with OCD would struggle to do anything until everything was arranged in the way they needed to alleviate their anxiety.

Not working leads to financial stress, as does the cost of treatment.

By acknowledging that psychological disorders affect the family as much as the individual experiencing the disorder, better treatment and support can be provided to treat the individual, and assist the family.

Apply your understanding

1 **Describe** the characteristics of obsessive compulsive disorder. (1 mark)

2 **Discuss** the ways that psychological disorders can impact families. (3 marks)

Significant relationships

People have many and varied relationships throughout their lives. A significant relationship is a relationship that a person considers to be of high importance to them. This can include with family, friends, romantic partners and those we live with. Relationships like these usually involve feelings of love and affection. Loss of a significant relationship might be due to separation from a partner, the breakdown of a relationship with another family member or the death of someone close to you. All these circumstances can contribute to an individual experiencing anxiety and/or depression.

Grief

Grief is also commonly associated with loss and can be described as the physical, emotional, cognitive, behavioural and spiritual response to loss (Hall, 2014). For 10 to 15 per cent of people who experience loss, grief can become a chronic condition, lasting for years, especially in cases where bereavement has been violent, unexpected or untimely (Hall, 2014). Common reactions to loss of a significant relationship may include stress, anxiety, confusion, exhaustion, anger, guilt, shame and blame. Sleep loss and insomnia are also commonly associated with grief, as are physical reactions such as headaches, nausea and loss of appetite (Burton et al., 2015).

Psychological disorders such as anxiety or depression may arise from prolonged or intense feelings of grief. Loss of significant relationships can also result in risky behaviours, such as increased alcohol consumption and drug use. For some people, the death of a loved one can cause acute grief that worsens over time rather than improving. This debilitating mental health condition is known as "complicated bereavement disorder". People who suffer from this condition often have a history of clinical depression or anxiety, are emotionally dependent on the one they have lost, and can have alcohol and drug problems.

There is also a neurological basis involving the pleasure and reward system in the brain. When people experience grief, the limbic system, which is responsible for pleasure, reward and addiction, appears to be activated (Khoshaba, 2013).

FIGURE 3 People often experience grief and sadness after the loss of a loved one. This can manifest as anxiety or depression.

Check your learning 13.5

Check your learning 13.5: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** what is meant by "social risk factors" for psychological disorders. (1 mark)

2 **Describe** what is meant by "disorganised attachment". (1 mark)

3 **Explain** how early childhood experiences with disorganised attachment can have long-term effects on an individual's ability to manage relationships and stress in adulthood. (2 marks)

4 **Explain** how the loss of a significant relationship can contribute to an individual experiencing anxiety or depression. (1 mark)

Analytical processes

5 **Consider** the neurological basis of grief involving the limbic system. **Explain** how the activation of this system could contribute to complicated bereavement disorder. (2 marks)

Knowledge utilisation

6 Rosanna and David's grandmother has just passed away. Rosanna was extremely close to their grandmother. David didn't really like their grandmother. **Predict** the ways the loss of this relationship will affect Rosanna's and David's mental health. (2 marks)

MODULE 13

Lesson 13.6
Review: Psychological disorders

Summary

13.1
- The biopsychosocial model is a holistic, three-pronged approach to understanding, assessing and treating psychological disorders.

13.2
- Risk factors and protective factors for psychological disorders include individual attributes, social circumstances and environmental factors.
- The number of risk factors affecting a person increases their risk of developing a psychological disorder; risk is cumulative.

13.3
- Biological risk factors for psychological disorders include:
  - genetic vulnerability to specific disorders
  - poor response to medication due to genetic factors
  - poor sleep
  - long-term substance abuse.

13.4
- Psychological risk factors for psychological disorders include:
  - rumination
  - impaired reasoning and memory
  - stress.

13.5
- Social risk factors for psychological disorders include:
  - disorganised attachment
  - significant relationships.

Review questions 13.6A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 The cause of a psychological disorder is attributable to
- **A** a single factor.
- **B** poor diet.
- **C** several factors.
- **D** the interaction of several factors.

2 The biopsychosocial approach to psychological disorders
- **A** considers that psychological factors and social factors influence the development of a psychological disorder.
- **B** states that the influence of social factors on biological factors will cause a psychological disorder.
- **C** considers that the interaction between biological, social and psychological factors influences mental health.
- **D** involves choosing to treat a patient based on one of biological, social or psychological factors.

3 Risk factors for psychological disorder include
- **A** predisposing, precipitating and perpetuating factors.
- **B** precipitating, perpetuating and protective factors.
- **C** predisposing, precipitating and protective factors.
- **D** predisposing, perpetuating and protective factors.

4 Perpetuating risk factors
- **A** prevent the occurrence or recurrence of a psychological disorder.
- **B** inhibit recovery from a psychological disorder.
- **C** trigger a psychological disorder.
- **D** are triggered by trauma.

5 Protective factors against psychological disorder include
- **A** exercise and diet, good sleep patterns, staying connected with family and friends.
- **B** staying connected with family and friends, good sleep patterns, weakened immune system.
- **C** good fitness, poor parental attachment, having a home.
- **D** having a home, missing school or work, economic wellbeing.

6 Biological risk factors for psychological disorder include
- **A** genetic predisposition.
- **B** stress.
- **C** disorganised attachment.
- **D** rumination.

7 Psychological risk factors for psychological disorder include
- **A** rumination and poor sleep.
- **B** poor sleep and substance abuse.
- **C** impaired reason and memory, and poor self-efficacy.
- **D** rumination, poor sleep and substance abuse.

8 Social risk factors for psychological disorder include
- **A** substance use.
- **B** disorganised attachment.
- **C** impaired reasoning.
- **D** stress.

9 Which hormones are associated with stress?
- **A** Cortisol
- **B** Oxytocin
- **C** Adrenalin
- **D** Cortisol and adrenalin

10 Which of the following is classified as a biological risk factor for psychological disorder?
- **A** Stress
- **B** Poor sleep
- **C** Disorganised attachment
- **D** Rumination

11 Disorganised attachment is
- **A** caused by separation anxiety as a child.
- **B** when an individual finds it difficult to share their feelings or empathise.
- **C** when a person is panicked that their caregiver will leave them.
- **D** caused by poor sleep.

Review questions 13.6B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

12 **Identify** a predisposing risk factor for psychological disorder and **explain** how it is a risk factor. (2 marks)

13 **Identify** a precipitating risk factor for psychological disorder and **explain** how it is a risk factor. (2 marks)

14 **Recall** three protective factors against psychological disorders and **explain** how they assist in preventing the onset or recurrence of psychological disorders. (6 marks)

15 **Describe** two individual attributes that can be risk factors for developing psychological disorders. (2 marks)

16 **Describe** two social circumstances that can be protective factors from developing a psychological disorder. (2 marks)

17 **Explain** genetic vulnerability to psychological disorders. (1 mark)

18 **Describe** rumination and how it can affect mental health. Use an example to support your response. (2 marks)

19 **Describe** how stress can affect psychological health. (1 mark)

Analytical processes

20 **Differentiate** between biological, psychological and social risk factors for developing psychological disorders. (1 mark)

21 **Apply** your knowledge of the risk factors that contribute to psychological disorders by copying and completing the table. (9 marks)

	Predisposing	Precipitating	Perpetuating
Biological			
Psychological			
Social			

22 **Compare** the effects of disorganised attachment and the loss of significant relationships on mental health. (2 marks)

23 Assess the following scenario.

Jarrah lives with his father and two younger siblings. His mother has gone to work in a different town as a nurse and can only get home once a month. Jarrah's father works long hours, which means that Jarrah is responsible for picking up his siblings from school and caring for them until his father gets home. His little brother needs a lot of help at home because he gets really worried about his mum and asks Jarrah repeatedly to call her on the phone. This doesn't leave much time for Jarrah to complete his homework and he's often up late finishing assignments. He's been very tired and he really misses his mum.

a **Identify** any risk factors for Jarrah developing a psychological disorder. (3 marks)

b **Classify** each risk you identified as biological, psychological or social. (3 marks)

Knowledge utilisation

24 The Genain quadruplets are a key example of genetic influence in the development of psychological disorders.

a **Design** a methodology for testing the claim that schizophrenia is always caused by genetic factors. (1 mark)

b **Justify** your chosen method of participation selection and sampling method. (2 marks)

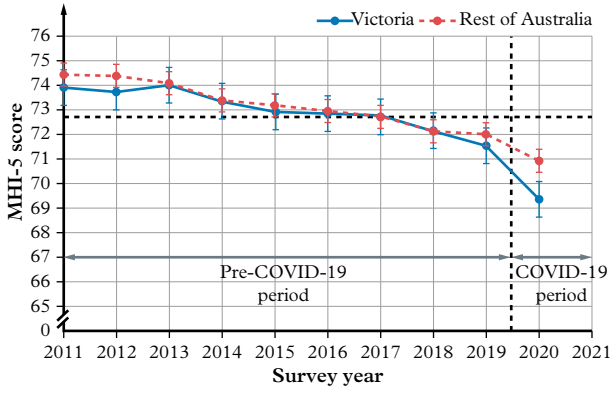
c **Discuss** the ethical responsibilities you will have in relation to your participants. (2 marks)

25 Siobhan is a 24-year-old female. Siobhan is relatively healthy, has a caring family and a positive social life. Recently Siobhan has been diagnosed with major depressive disorder. Siobhan's psychologist has been reviewing Siobhan's mental health using the biopsychosocial approach. **Discuss** what Siobhan's psychologist needs to consider in their approach, and the factors that might affect Siobhan's mental health. (3 marks)

Data drill

Impact of COVID-19 lockdowns on mental health

A study by Butterworth et al. (2022) aimed to assess the impact of COVID-19 lockdowns on the mental health of Australians aged 15 and older, using a quasi-experimental design. Data from the Household, Income, and Labour Dynamics in Australia (HILDA) Survey spanning 2011 to 2020 were analysed. The analysis included 151,583 observations from 20,839 individuals. The study compared mental health changes in individuals in the state of Victoria (experiencing lockdown) to those in the rest of Australia. The Mental Health Inventory (MHI-5) scores were used for assessment. The overall conclusion is that lockdowns were associated with a modest negative change in population mental health, with varying impacts across different subgroups. The results of the findings are shown in the graph.



Apply understanding

1 **Identify** the trend for mental health between 2011 and 2021 for people in Victoria and the rest of Australia. (1 mark)

2 **Determine** the mean score of the Mental Health Inventory (MHI-5) scores for Victoria and the rest of Australia in 2017. (1 mark)

Analyse data

3 **Compare** the MHI-5 scores for Victoria and the rest of Australia in 2019 and 2020. (2 marks)

Interpret evidence

4 **Draw a conclusion** about the MHI-5 scores for Victoria before and after lockdowns. (1 mark)

5 **Predict** the MHI-5 scores for Victoria and the rest of Australia in 2021. (2 marks)

Module 13 checklist: Psychological disorders

Quizlet: Revise key terms online to test your understanding

MODULE 14

Anxiety disorders

Introduction

Maintaining both physical and mental health is a common goal for everyone. While there are steps we can take to achieve and enhance our wellbeing, there are times when things go awry. No one is immune to the possibility of experiencing an anxiety disorder. Certain periods in life render us more susceptible to anxiety disorders, and some are common across the lifespan.

We were introduced to anxiety disorders in Module 12. In this module, we will look more closely at the prevalence, common symptoms, and perceived causes of specific anxiety disorders, including generalised anxiety disorder (GAD) and specific phobia. Note that throughout this module, the terms "psychological disorder" and "mental illness" will be used interchangeably.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to anxiety disorders before you start.

Subject matter

Science understanding

→ Describe the prevalence, symptoms and perceived causes of anxiety disorders, including generalised anxiety disorder (GAD) and specific phobias.

Science inquiry skills

→ identify and use appropriate sampling procedures for selection and allocation of participants

→ identify and apply ethical principles

→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  - descriptive statistics
  - parametric inferential statistics

→ analyse data to identify trends, patterns and relationships; recognising error, uncertainty and limitations of evidence

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Support for your wellbeing

This module will provide information about mental health and psychological disorders. This information is intended for information only and should not be used for diagnosis or treatment. You can seek support for anything discussed in this module by speaking with a family member, friend, teacher or trusted adult. Alternatively, the following organisations can offer support: Beyond Blue, SANE, Lifeline, Kids Help Line, the Black Dog Institute and Headspace. Links are available via Oxford Digital.

Lesson 14.1
Prevalence and symptoms

Key ideas

- → Specific phobia and generalised anxiety disorder (GAD) are types of anxiety disorders.
- → Specific phobia are characterised by an intense and irrational fear of a situation, injury, animal or particular environment, and affect approximately 11 per cent of the Australian population.
- → GAD is characterised by ongoing feelings of worry, commonly about minor, everyday life events, and affects approximately 3.8 per cent of the Australian population.

Learning intentions and success criteria

Introducing anxiety disorders

We all know what it's like to experience anxiety. While a little anxiety can be considered part of normal life, too much or too little can have negative consequences. To feel tense and apprehensive is a natural response to a perceived threat. It is when the frequency and intensity of this feeling is out of proportion to the situation and interferes with someone's everyday life that they may be diagnosed with an **anxiety disorder**.

anxiety disorder a psychological disorder in which the frequency and intensity of feeling anxious is out of proportion to the situation and interferes with everyday life

FIGURE 1 The symptoms of anxiety. "Somatic" symptoms are physical symptoms.

According to the Australian Bureau of Statistics, anxiety was the most common type of psychological disorder present in 2020–22, with more than one in six Australians (17.2 per cent) experiencing anxiety in the previous 12 months (ABS, 2023). Australian females are almost twice as likely as males to suffer from an anxiety disorder. In addition, it is common for an anxiety disorder to be associated or comorbid with depression, and can occur at any age.

Anxiety disorders classified by the *Diagnostic and Statistical Manual of Mental Disorders* (5th edition-TR) (DSM-5-TR) include selective mutism, various phobias and generalised anxiety disorder (GAD). The prevalence, symptoms and perceived causes of anxiety disorders, including specific phobia and GAD, are explained in detail in this lesson.

Real-world psychology

Selective mutism

FIGURE 2 In selective mutism, anxiety prevents a child from speaking.

Selective mutism is an anxiety disorder where children experience difficulty speaking in specific situations, earning it the alternative name "situational mutism". Selective mutism is not a choice: anxiety inhibits a child's ability to speak.

First signs of the disorder, such as inability to speak outside the immediate family, avoiding attention and difficulty participating in activities with peers, are typically observed in preschool or school settings in children between the ages of 3 and 6 years. Affected children can comfortably communicate at home but struggle elsewhere, which impacts learning and social development.

Behavioural signs include avoiding eye contact, lowered voice or whispering when speaking to others. Physical signs may include freezing, restlessness, tension, trembling, blushing, or unseen symptoms like reports of a racing heart. Some children might express anxiety when not knowing what to say or fearing judgment.

Diagnosis involves assessing the child's behaviour, communication patterns and anxiety symptoms. Hearing or speech assessments may be conducted to check for language delay. Professional help, especially in preschool and early school years, is crucial for recovery. Without intervention, speaking difficulties might continue into adulthood.

Treatment focuses on gradually increasing communication difficulty. Involving preschool or school staff is essential for practice sessions. Cognitive-behavioural therapy (CBT) helps children identify worries and develop positive self-talk and social skills. Speech therapy is provided if language delay is present. Medication may be prescribed if improvement with CBT is slow. Early intervention significantly improves the likelihood of a child overcoming selective mutism.

Apply your understanding

1 **Describe** selective mutism and how it manifests in children. (2 marks)
2 **Identify** the age at which signs of selective mutism commonly appear, and where it is most noticeable. (2 marks)
3 **Describe** the behavioural and physical signs that might indicate a child is experiencing selective mutism. (2 marks)
4 Imagine that you are a psychologist. **Apply** the biopsychosocial approach to treating a child with selective mutism. (3 marks)

phobia
an irrational fear of a specific object or situation

agoraphobia
fear of crowds, assemblies of people and open spaces

social phobia (social anxiety disorder)
fear of being humiliated in front of people

specific phobia
an intense and irrational fear of a specific situation or object

Phobias

A **phobia** is an irrational fear of a specific object or situation. According to the DSM-5-TR, the anxiety must be out of proportion to the actual danger or threat, and be experienced for at least 6 months. Most phobias belong to one of the following categories:

- **agoraphobia**: fear of crowds, assemblies of people and open spaces; the most common phobia and is most likely to occur in females in young adulthood
- **social phobia (social anxiety disorder)**: fear of doing something humiliating in front of others, perhaps while public speaking or interacting with people in some other situation; onset is often during adolescence
- **specific phobia:** fear of specific objects or situations, such as spiders or snakes, height, enclosed spaces, flying, darkness, illness, injury or death.

What is the difference between fear and phobia? Most of us express some fear in relation to certain objects or situations. We may have a fear of snakes or spiders or thunderstorms. Such fears can actually be healthy, since the source of our fear may be a threat to our safety.

A fear can turn into a phobia, however, when the person experiences intense anxiety in the presence of the item or situation, or even when only thinking about it. This fear is so strong that it interferes with everyday activities.

FIGURE 3 The fear of being trapped in an enclosed space is called claustrophobia.

Phobias and cognitive development

Fears are often related to cognitive development; for instance, when children believe in magical thinking, they are likely to fear imaginary creatures. Such children may fear that a monster lives in their wardrobe and insist on the wardrobe door being closed at night. Once they pass this cognitive stage, their fear of monsters is resolved. As a child reaches Piaget's formal operational stage of thinking (Lesson 6.3), they are able to anticipate more negative consequences and think more deeply about situations. This in turn is reflected in common fears, such as social anxiety, that may be carried into adolescence and beyond.

Introducing specific phobias

Before discussing specific phobias in detail, it is important to understand their links to stress and anxiety generally, and to independently define these terms.

Stress is defined as the psychological and physical response to internal or external sources of tension (stressors). Symptoms of anxiety include heart palpitations, muscle tension, feeling shaky/hand tremors, choking sensation, dry mouth and an upset stomach. Does this sound like the fight-flight-freeze response? It is!

stress
a psychological and physical response to internal or external sources of tension (stressors) that challenge a person's ability to cope; the stressors can be real or perceived

Stress and anxiety are a normal part of human existence. For some, however, they can become a major problem and an indicator that an anxiety disorder is present.

The connections between stress, anxiety and specific phobias are intricate. The physiological activation that occurs when we feel stressed is also accompanied by feelings of anxiety. Not only are stress and anxiety symptoms of specific phobias, they can also act as triggers for the condition.

Defining specific phobia

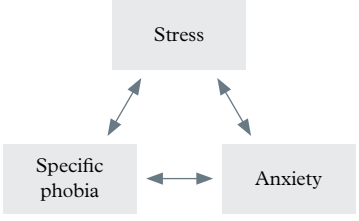


FIGURE 4 Stress, anxiety and specific phobias are related, with each one having the capacity to influence the other.

A specific phobia is a persistent, irrational and intense fear of a particular object or event. As with anxiety, exhibiting the fear response is normal, as long as it is a rational response to an actual situation that is happening.

Many people are frightened of spiders or snakes, and experience a fear response if one crosses their path. This fear response makes sense from an evolutionary perspective because humans are genetically wired to fear things that pose a threat to their survival. However, if that fear starts to interfere with a person's social functioning – where they deliberately avoid the distress-causing object, activity or situation to the point where it affects their day-to-day life – it becomes a specific phobia. If the individual is faced with the feared object or event, they may experience acute physiological arousal – the fight-flight-freeze response – as in the case of anxiety disorders. In extreme cases, just thinking about the phobic object can cause intense fear and anxiety.

FIGURE 5 Fear of toads is known as bufonophobia.

As we learnt in Lesson 12.4, there are five main types of specific phobia:

- situational phobias (e.g. fear of enclosed spaces, elevators, flying, dentists, driving, tunnels or bridges)
- injury phobias (e.g. fear of medical procedures or of the sight of blood)
- animal phobias (e.g. fear of snakes, spiders, rats or dogs)
- natural/environmental phobias (e.g. fear of heights, storms, water or darkness)
- other phobias (e.g. fear of clowns, loud sounds, vomiting or balloons popping).

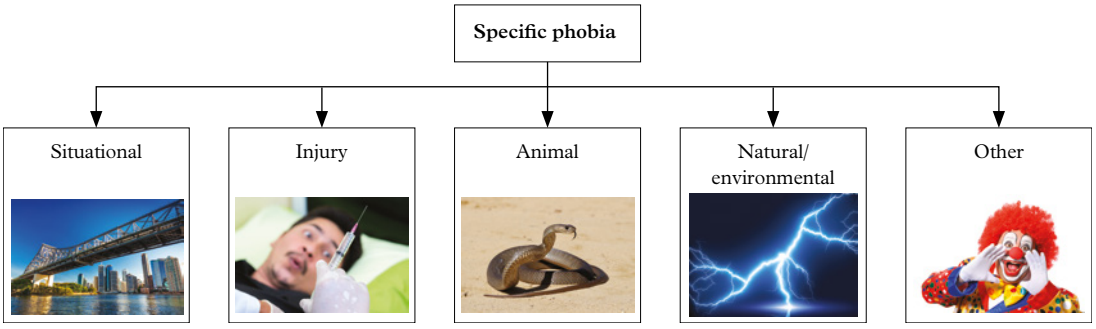


FIGURE 6 Categories of specific phobia

Symptoms of specific phobia

Like all physical and mental health conditions, we can think about the relative severity of stress, anxiety and specific phobias in terms of their position along a continuum. One model breaks this continuum up into four broad categories: healthy, reacting, injured and disorder, as shown in Table 1.

TABLE 1 Mental health continuum for specific phobia

Healthy	Reacting	Injured	Disorder
Normal healthy functioning	Common and reversible distress	Significant functional impairment	Significant psychological disorder; severe and functional impairment
← →			
• Normal fluctuations in mood, fear and anxiety • Normal levels of stress • Normal sleeping patterns • Physically well, full of energy • Socially active • Attends school and/or work	• Nervous, irritable, anxious • Moderate levels of stress • Trouble sleeping • Tired, low energy, muscle tension, headaches • Procrastination • Decreased social activity • Attends school/work	• Anxiety, pervasive and irrational fear • High levels of stress • Hypervigilance to threat information • Memory bias • Avoidance behaviours • Decreased performance • Social avoidance or withdrawal • High levels of absenteeism from school/work	• Excessive anxiety and fear, easily frightened, agitated • Extremely high levels of stress • Unable to fall or stay asleep • Exhaustion, physical illness • Unable to perform duties, absenteeism from school/work • Isolation, avoiding social events • Significant avoidance behaviours
No treatment required	Some professional psychotherapy	Professional psychotherapy	Professional psychotherapy and possible medication

Source: Adapted from http://staffmentalhealth.providencehealthcare.org/staff/self-assessment

We can use fear of spiders as an example to understand this model. A "healthy" person may be frightened of spiders, but their fear is considered to be within a normal range. If they see a spider, they might squash it or ask a friend to catch it and release it into the garden.

A "reacting" individual will physically and psychologically "react" to the spider by screaming, or running away each time they see one. They might also experience difficulty sleeping if they think that there might be a spider in their bedroom, and misinterpret bits of black thread or fluff in their environment as spiders.

If an individual is at the "injured" level along the continuum, their phobic symptoms significantly affect their functioning. Once they reach the "disorder" end of the spectrum, their fear has turned into a psychological disorder of specific phobia that requires significant intervention.

If we consider mental health as a continuum, however, we can see that a specific phobia can improve with treatment so that, over time, an individual could go from being "disordered" to "healthy".

Prevalence of specific phobias

Specific phobias are thought to affect around 11 per cent of the Australian population (Leahy & Holland, 2000), most commonly in children. Having specific fears at different times of childhood is normal, though most children will grow out of these; for some, these phobias can develop and create panic attacks.

For specific phobias, the age of onset depends on the phobia (Table 2). Most specific phobias develop during childhood and eventually disappear. Those that persist into adulthood rarely go away without treatment.

TABLE 2 Mean age of onset for selected phobias

Phobia	Years of age
Animal (animal-specific phobia)	7
Blood (injury-specific phobia)	9
Dental (situational-specific phobia)	12
Claustrophobia (situational-specific phobia)	20

FIGURE 7 Dental phobia often occurs at around 12 years of age.

FIGURE 8 Twin studies have shown that there are strong genetic links to the development of specific phobia.

Children are unlikely to be aware that their fear is irrational, and they are also more likely to develop a specific phobia than any other anxiety disorder.

Twin studies have revealed that anxiety disorders such as panic disorder and specific phobias are particularly heritable, occurring in 85 per cent of identical twins with a family history of these disorders (Nestadt et al., 2000).

Challenge

Mix and match!

Using the internet and other sources, match the specific phobia to its correct definition and classify each phobia as situational, animal, injury, natural/environmental or other.

Agoraphobia	Fear of drafts, air swallowing or airborne substances
Acarophobia	Fear of being alone or of oneself
Anemophobia	Fear of neglecting duty or responsibility
Acrophobia	Fear of open spaces or of being in public places
Claustrophobia	Fear of work or functioning; surgeon's fear of operating
Agliophobia	Fear of crowds or mobs
Aichmophobia	Fear of the sea
Autophobia	Fear of heights
Brontophobi	Fear of being seen or stared at
Ergasiophobia	Fear of insects
Gephyrophobia	Fear of pain
Ochlophobia	Fear of needles or pointed objects
Paralipophobia	Fear of crossing bridges
Scopophobia	Fear of confined spaces, such as lifts
Thalassophobia	Fear of thunder and lightning

Skill drill

Participants and sampling

Science inquiry skills: Planning investigations (Lesson 1.4); Considering ethics and safety (Lesson 1.5)

The participants and sample group of an experiment can affect the results of the study itself, and its generalisability to the wider population.

Siobhan has just finished reading about the "Little Albert" experiment (Watson & Rayner, 1920), where classical conditioning techniques were used to instil a fear of fur (doraphobia) in an infant named "Albert". Siobhan wants to conduct her own experiment to test how many people have the specific phobia of trypophobia (fear of clusters of small holes). Her preliminary research has found that many tests purport to determine if a person has this phobia. From this reading, she has concluded that roughly 15 per cent of the general population may have trypophobia and she wants to know if that number would be higher or lower in a secondary-school setting.

Practise your skills

1 **Identify** the population Siobhan is interested in. (1 mark)
2 **Determine** the most appropriate sampling technique that should be used. (1 mark)
3 **Describe** the strengths and limitations of the sampling technique chosen in question 2. (2 marks)
4 **Discuss** an ethical consideration that could be violated if Siobhan decides to conduct her research. (1 mark)

Generalised anxiety disorder

Most people know what it is like to feel anxious from time to time. However, sometimes this shifts to feelings of extreme anxiousness all the time. Like specific phobia, **generalised anxiety disorder (GAD)** is a specific kind of anxiety.

generalised anxiety disorder (GAD) a psychological disorder characterised by constant and excessive worrying about events, activities or topics that interferes with daily activities

People with GAD feel anxious and worry most of the time, with little respite. These feelings are not dependent on a particular situation and can invade day-to-day activities. This can include anxious feelings about work, school, health, family, friends and financial issues. People with GAD may be anxious about several of these areas or a combination of a few. People with GAD may feel anxious about being late for school, which can trigger feelings of apprehension for the whole day. For example, they may become fretful about what they will have for dinner that night. This can also become a focus of their worry, and they may feel that something terrible is bound to happen. Worry is transferred from one theme to the next.

Symptoms of GAD

People with GAD may experience any of the following symptoms over a 6-month period:

- feeling very worried about events or activities
- being unable to stop worrying
- difficulty participating in everyday activities due to worry (e.g. going to school).

They may also experience three or more of the following symptoms:

- restlessness
- difficulty sleeping or becoming easily tired
- difficulty concentrating
- irritability
- muscle tension.

The physical symptoms of GAD are muscle tension, mental agitation and susceptibility to fatigue (Barlow & Durand, 2012). For children to be diagnosed, only one of the physical symptoms needs to be present.

People with GAD find it hard to focus their attention, because their minds are preoccupied with worrying. They tend to worry about minor, everyday life events. For adults, this might include worrying about household chores, being on time for appointments, or other health and finance concerns. Although these types of worries can be serious, and most of us experience them from time to time, people with GAD worry persistently to the point where they struggle to function on a daily basis for months on end.

Prevalence of GAD

Anxiety disorders in Australia are common: according to the Australian Bureau of Statistics, between 2020 and 2022, 17.2 per cent of Australians aged between 16 and 85 years experienced anxiety disorders. Women (21.1 per cent) experienced higher rates of anxiety disorders compared to men (13.3 per cent). Of this sample, 3.8 per cent of Australians reported having generalised anxiety disorder, made up of 4.8 per cent women and 2.8 per cent men (Figure 9).

It is also common for individuals with GAD to be diagnosed comorbidly with another psychological disorder. For example, 39 per cent of Australians diagnosed with GAD also meet the diagnostic criteria for depression (Tiller, 2013). This makes GAD more difficult to accurately diagnose and treat.

It is not uncommon for people with GAD to be unable to identify an exact onset of symptoms; however, they typically report worrying as a common theme throughout their lives.

Children who are diagnosed with GAD usually worry about school, sport, natural disasters or war. It often presents with children being overly conforming, perfectionistic in nature, having to redo tasks, asking questions that state, "Okay, but what if …", and seeking frequent approval and reassurance from family, teachers and friends. About 6.9 per cent of Australian young people aged between 4 and 17 years have been diagnosed with an anxiety disorder, with about 2.2 per cent of them diagnosed with GAD (Australian Institute of Health & Welfare, 2022).

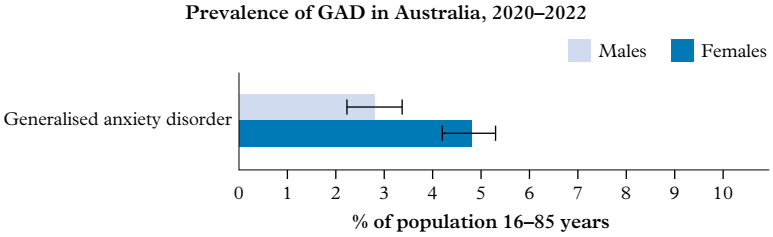


FIGURE 9 Prevalence of GAD in Australia, 2020–2022

Check your learning 14.1

Check your learning 14.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Explain** what is meant by "anxiety disorder". (1 mark)
2 **Describe** specific phobia, using an example. (2 marks)
3 **Recall** four symptoms of anxiety. (4 marks)
4 **Explain** what is meant by "generalised anxiety disorder (GAD)". (1 mark)
5 **Identify** who is most likely to be diagnosed with GAD. (1 mark)

Analytical processes

6 **Differentiate** between fear and a phobia. (1 mark)
7 When Marek was a child, he watched the movie *Jaws* with his parents. Marek is now a teenager, and a state-level swimmer for Queensland. Despite this, Marek refuses to swim in the ocean or even go to the beach. Marek visualises sharks being in the ocean, and can feel chills up his leg at the thought of one. **Apply** your understanding of specific phobia to **explain** why Marek reacts this way. (2 marks)

Knowledge utilisation

8 **Propose** a specific public health campaign or community program that could be used to address the high prevalence of anxiety disorders (17.2 per cent) in Australia. (1 mark)
9 Anxiety disorders are often comorbid with (occur at the same time as) depression. **Discuss** how this information could influence the approach to diagnosing and treating people with these conditions. (2 marks)

Lesson 14.2
Perceived causes of anxiety disorders

Key ideas

- → Perceived biological causes of anxiety disorders include the fight-flight-freeze response, the neurotransmitters GABA and glutamate, and genetic predisposition and inherited vulnerabilities.
- → Perceived psychological causes of anxiety disorders include behavioural factors, how behaviour is influenced by the environment; and cognitive factors, how thought processes influence feelings and behaviours.
- → Perceived social causes of anxiety disorders include environmental triggers, parental modelling and the transmission of threat information.

Learning intentions and success criteria

Introducing causes of anxiety disorders

There are several potential explanations for anxiety disorders. Biological components have been identified, as well as perceived psychological causes. Social and cultural factors can also contribute to the incidence of anxiety disorders.

We will discuss each of these causes with reference to specific phobia and generalised anxiety disorder (GAD).

Perceived biological causes

Psychological disorders and mental health can be strongly influenced by biology, including genetic predisposition and reaction patterns.

People who have specific phobia or GAD often have a history of mental health issues in their family. Of course, this doesn't mean that someone will have anxiety just because their parents or close relatives do, but it increases the likelihood. This can be seen in twin and adoption studies that look at the inheritability of disorders.

Study tip

Go to Lesson 4.1 to revise branches of the autonomic nervous system.

Specific phobia and GAD can both be affected by three biological factors that contribute to the development and maintenance of an anxiety disorder:

- the fight-flight-freeze response
- GABA and glutamate (neurotransmitters)
- genetic predisposition and inherited vulnerabilities.

The fight-flight-freeze response

The **fight-flight-freeze response** is important to human survival. It provides us with an instant burst of energy to deal with danger in our environment and is controlled by the sympathetic branch of the autonomic nervous system. Once activated, stress hormones such as adrenalin and noradrenalin are released into the bloodstream to increase our heart rate and respiration rate, circulate more glucose through our body for energy, improve focus and temporarily boost our stamina to either fight the impending danger or flee to a safe place.

fight-flight-freeze response a physiological response to stress that causes an organism to react in a combative manner (fight), remove themselves from the situation (flight) or not react at all (freeze)

It is important to recall that anxiety and fear are different: fear is a reaction to a danger presented, whereas anxiety is the anticipation of a threat that may or may not happen. A person with a specific phobia of spiders will experience an intense fight-flight-freeze response when they see a spider, or a milder response to simply looking at a picture of one!

Symptoms of the fight-flight-freeze response can include:

- elevated blood pressure
- tremor (shaking in the hands)
- palpitations (abnormally fast heartbeat that the person is aware of)
- diarrhoea
- sweating
- shortness of breath
- skin sensation of prickling, burning or itching without identifiable physical cause
- dizziness.

GABA and glutamate

The neurotransmitters GABA (gamma-amino butyric acid) and glutamate play an important role in maintaining the right balance in our nervous system so that our levels of anxiety (physiological arousal) remain at an optimal level. GABA has an inhibitory role on the fight-flight-freeze response and glutamate has an excitatory role; the two transmitters work together. When a person has low levels of GABA, the increased presence of glutamate increases agitation and anxiety, and can contribute to the person developing a specific phobia.

Genetic predisposition and inherited vulnerabilities

Can specific phobia and GAD be inherited? In a way, they can. It is not the phobia or GAD itself that is inherited, but the person's biological make-up that can lead to a genetic vulnerability – such as being born with low levels of GABA. This vulnerability is also expressed in personality: individuals who are apprehensive about environmental objects and events are more likely to develop anxiety disorders and specific phobia. Although a person may have the genetic predisposition to develop GAD or specific phobia, they will not necessarily develop one. Certain psychological, social and environmental influences can increase this likelihood.

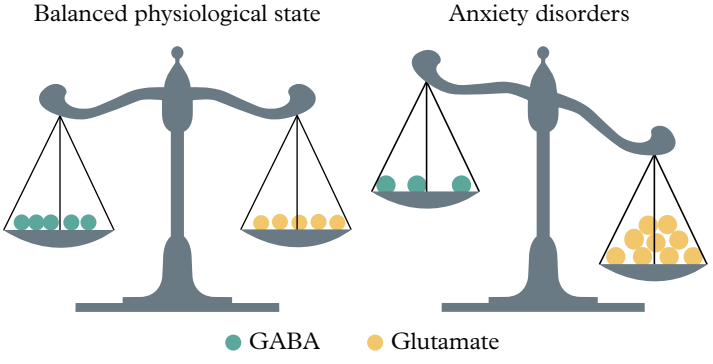


FIGURE 1 We need just the right amount of GABA and glutamate to maintain appropriate levels of anxiety.

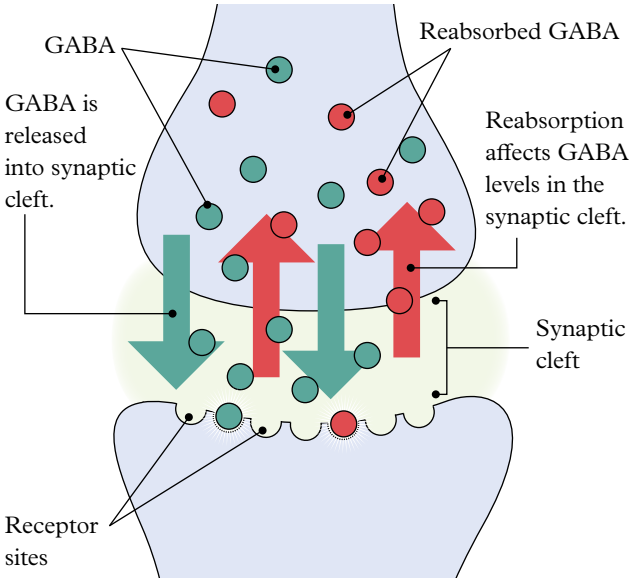


FIGURE 2 GABA at a synapse

Perceived psychological causes

The psychological factors involved in developing an anxiety disorder refer to "our thoughts, beliefs and perception about ourselves, our experiences and our environment" (Jacofsky et al., 2010). Essentially, we are the sum of our experiences and, depending on genetics and personality, we will interpret environmental events in our own unique way. This allows people to develop mental short-cuts (heuristics) that enable them to function at work, with family and friends, and within the community at large. Those who are more sensitive and anxious and feel less in control are more likely to notice events in their environment and to view them as potentially threatening, even though they may not be. These thoughts and perceptions play a key role in developing specific phobia or GAD.

We will now briefly look at how different theoretical approaches explain specific phobia and GAD. In particular, we will examine the behavioural and cognitive approaches to see how they differ.

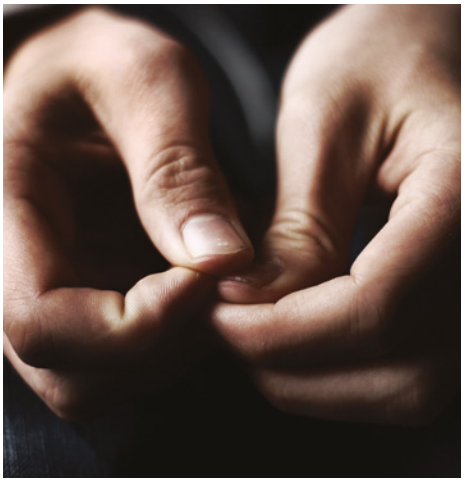


FIGURE 3 People who suffer from a specific phobia have shown a tendency to perceive events as more threatening than those who do not.

Theoretical approaches to anxiety disorders

The **behavioural approach** examines how an organism's behaviours are influenced by environmental factors and downplays the importance of thinking processes (cognition). According to the behavioural model, specific phobia and GAD are learnt through classical conditioning and maintained through operant conditioning.

Classical conditioning is a theory of learning whereby an individual forms an association between two stimuli to produce a learnt response. Operant conditioning is a theory of learning whereby an individual learns through associating a behaviour with a positive or negative consequence. You will learn more about classical and operant conditioning in Unit 3.

Unlike the behavioural approach, the **cognitive approach** emphasises the influence of thought processes on how we feel and behave. In treating specific phobia and GAD, psychologists use this model to examine and challenge the distorted thinking processes involved in the development and maintenance of the condition. The cognitive approach also reflects the notion that anxious individuals are likely to interpret situations, objects or activities as more dangerous than the average individual (Beck et al., 2005).

behavioural approach uses the principles of classical and operant conditioning to examine how factors or stimuli in the environment can influence behaviours

cognitive approach examines how thought processes influence feelings and behaviours, and the role distorted thinking plays in the development and maintenance of psychological conditions

Contributing social factors

Social and cultural factors can contribute to the type and incidence of specific phobia and GAD. People who experience an anxiety disorder will often avoid certain behaviours or activities to avoid experiencing their anxiety. Sometimes, a parent, partner or friend may help to maintain the avoidance behaviour by trying to be helpful. For example, consider the person with arachnophobia. Spiders can be found in the garden, in cupboards and under beds. In fact, they live both inside and outside the home. A well-meaning parent may think that they are assisting their child by using insect repellents and not asking their child to help in the garden or take the clothes off the line. They are in fact encouraging avoidant behaviours and unwittingly helping the child to maintain the phobia.

FIGURE 4 Exposure to a parent's specific phobia can teach a child to fear the same stimulus.

We will now look at three contributing social factors in more detail:

- environmental triggers
- parental modelling
- transmission of threat information.

Environmental triggers

In many instances, specific environmental triggers can lead to the development of specific phobia. There are three possible environmental paths:

1. direct exposure to a distressing or traumatic event, such as being attacked by a dog
2. witnessing other people experiencing a traumatic event, such as seeing another person being attacked by a dog
3. reading or hearing about dangerous situations or events; for example, developing a fear of dogs after hearing stories about children, adults or family pets being attacked by a dog.

FIGURE 5 Direct experience of a distressing environmental event can lead to specific phobia.

In the same way, early environmental experiences such as trauma, and physical and mental abuse can increase a person's risk of developing GAD, as can physical and mental abuse in adulthood. Significant events such as the birth of a child, the breakdown/loss of a close relationship, the death of a loved one or divorce can also all be contributing factors. Continual use of addictive substances such as caffeine heightens symptoms of anxiety and can lead to excessive worrying in vulnerable people (Meek, 2024).

Parental modelling

Albert Bandura combined behavioural and cognitive approaches to develop social learning theory. According to this theory, a great deal of our behaviour is learnt through imitating or modelling other people's behaviours, and specific phobia can be learnt by observing other people's phobic reactions.

Consider this scenario: a child is raised in a household where a parent is terrified of moths. Each time the parent sees one, they exhibit their fear by screaming and running out of the house. This increases the child's anxiety and leads them to believe that moths are dangerous and should be avoided at all costs. Thus, children whose parents show phobic responses are more likely to develop comparable fears of similar stimuli. Parental modelling can lead to the transmission of threat information, which is incorporated into the child's long-term memory. Research has also shown that children of anxious parents are more likely to develop anxiety disorders, such as GAD.

Transmission of threat information

The transmission of information that a person perceives as threatening is not limited to the parent–child relationship. Information can be received from a range of different sources including the media, internet, friends and school. A student who is interested in travelling might develop a fear of flying if each time they search the internet for "travel" or "flying" they are shown plane crash websites with graphic pictures or video clips. If their fear prevents them from being able to board a plane, then threat information delivered by the internet has led to a specific phobia.

Check your learning 14.2

Check your learning 14.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the perceived causes of specific phobia. (3 marks)
2 **Identify** the perceived causes of GAD. (3 marks)
3 **Describe** three biological influences on anxiety disorders. (3 marks)
4 **Describe** two social factors that could lead to the development of an anxiety disorder. (2 marks)

Analytical processes

5 **Discriminate** between perceived biological, psychological and social causes of anxiety disorders. (1 mark)
6 **Differentiate** between the behavioural and cognitive approaches to anxiety disorders. (1 mark)

Knowledge utilisation

7 Parents, friends, teachers, family and partners can affect the development of anxiety disorders. For specific phobia, this can be by helping the individual avoid the stimulus; for GAD, this can be by alleviating the stressor. **Assess** the impact this may have on the individual. (1 mark)

MODULE 14

Lesson 14.3

Review: Anxiety disorders

Summary

14.1
- Specific phobia and generalised anxiety disorder (GAD) are types of anxiety disorders.
- Specific phobia are characterised by an intense and irrational fear of a situation, injury, animal or particular environment, and affect approximately 11 per cent of the Australian population.
- GAD is characterised by ongoing feelings of worry, commonly about minor, everyday life events, and affects approximately 3.8 per cent of the Australian population.

14.2
- Perceived biological causes of anxiety disorders include the fight-flight-freeze response, the neurotransmitters GABA and glutamate, and genetic predisposition and inherited vulnerabilities.
- Perceived psychological causes of anxiety disorders include behavioural factors, how behaviour is influenced by the environment; and cognitive factors, how thought processes influence feelings and behaviours.
- Perceived social causes of anxiety disorders include environmental triggers, parental modelling and the transmission of threat information.

Review questions 14.3A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 Which of the following symptoms can lead to the diagnosis of an anxiety disorder?
- **A** Situational stress
- **B** High frequency and intensity of anxiety interfering with everyday life
- **C** Occasional mild anxiety
- **D** Physical symptoms of anxiety alone

2 According to the Australian Bureau of Statistics, what percentage of Australians experienced an anxiety disorder in 2020–22?
- **A** 2.8 per cent
- **B** 17.2 per cent
- **C** 1.72 per cent
- **D** 3.8 per cent

3 How many subcategories of specific phobia exist?
- **A** Four
- **B** Two
- **C** Three
- **D** Five

4 What is the most common phobia?
- **A** Social phobia
- **B** Agoraphobia
- **C** Specific phobia
- **D** Claustrophobia

5 **Identify** the term used to describe the systematic error in thinking that affects decisions and judgments commonly observed in individuals with specific phobia.
- **A** Cognitive dissonance
- **B** Memory bias
- **C** Cognitive bias
- **D** Confirmation bias

6 Children with GAD commonly
- **A** lack concern for school performance.
- **B** are overly conforming and have a perfectionistic nature.
- **C** show indifference towards their surroundings.
- **D** lack emotional sensitivity.

7 **Identify** the type of worry typically experienced by people with GAD.
   A Sporadic, during stressful events
   B Rare
   C Occasional, about major life events
   D Persistent, about various aspects of life

8 What is required for a diagnosis of GAD in children?
   A Presence of multiple physical symptoms
   B Presence of one physical symptom
   C No physical symptoms
   D Presence of all physical symptoms listed in the DSM-5-TR

9 Which neurotransmitter plays an inhibitory role in the fight-flight-freeze response?
   A Dopamine
   B Serotonin
   C GABA
   D Glutamate

10 **Identify** the type of conditioning that explains how specific phobia can develop.
   A Observational
   B Classical
   C Operant
   D Cognitive

11 Unlike the behavioural model, the cognitive model emphasises the importance of
   A thought processes.
   B personality predispositions.
   C psychodynamic factors.
   D cultural and environmental elements.

12 Which of the following is a physical symptom of the fight-flight-freeze response?
   A Elevated blood pressure
   B Increased appetite
   C Lethargy
   D Calmness

Review questions 14.3B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

13 **Describe** the main symptoms of people experiencing generalised anxiety disorder in terms of the four main components of anxiety disorders. (4 marks)

14 **Identify** three types of phobias and provide an example of each. (3 marks)

15 **Describe** the interaction between stress and anxiety and specific phobia. (1 mark)

16 **Identify** and **explain** one biological cause of anxiety disorders. (2 marks)

17 **Describe** one social factor that can contribute to the development of anxiety disorders. (1 mark)

18 **Explain** how the amygdala and prefrontal cortex interact in the regulation of anxiety. (1 mark)

19 **Explain** the concept of cognitive bias in relation to anxiety disorders. (2 marks)

Analytical processes

20 **Differentiate** between normal fears and phobias. (1 mark)

21 **Apply** a behavioural model to **explain** how anxiety disorders can develop. (2 marks)

22 **Compare** the symptoms of generalised anxiety disorder (GAD) with those of specific phobias. (2 marks)

23 Amanda has a fear of birds. When she is outside, she actively avoids walking near them and at school she sits away from the courtyard where flocks of pigeons tend to gather. Images or videos of birds make her uncomfortable and bird sounds make her nervous.
   a **Identify** the type of specific phobia Amanda is experiencing. (1 mark)
   b **Categorise** Amanda's specific phobia as healthy, reacting, injured or disorder. **Explain** why. (2 marks)
   c **Explain** the reactions that she would need to show to downgrade her phobia to the category below what she is currently experiencing. (1 mark)

Knowledge utilisation

24 **Develop** a coping strategy for someone dealing with chronic anxiety. (1 mark)

Data drill

Proportion of adults affected by anxiety disorders

The Substance Abuse and Mental Health Services Administration (SAMHSA) conducted the Mental Health Surveillance Study (MHSS) clinical study from 2008 to 2012 in which clinicians administered semi-structured diagnostic interviews to a sample of 8629 adult respondents to assess the presence of selected psychological disorders. The data from the MHSS clinical study was used to estimate the percentage and number of adults affected by specific psychological disorders.

Apply understanding

1 **Identify** the single anxiety disorder with more than 2 per cent prevalence in the 26–49 age group. (1 mark)

2 **Identify** the age group with the greatest prevalence of obsessive compulsive disorder. (1 mark)

Analyse data

3 **Identify** the age group with the most certainty around the mean for social phobia. Provide a reason for your response. (2 marks)

4 **Sequence** the anxiety disorders for 18–25 year olds from the highest prevalence to the lowest. (1 mark)

Interpret evidence

5 **Infer** if there is a statistical difference in percentage between 50+ year olds and 26–49 year olds with social phobia. **Justify** your response. (2 marks)

6 **Draw a conclusion** about adults with one or more anxiety disorders. (1 mark)

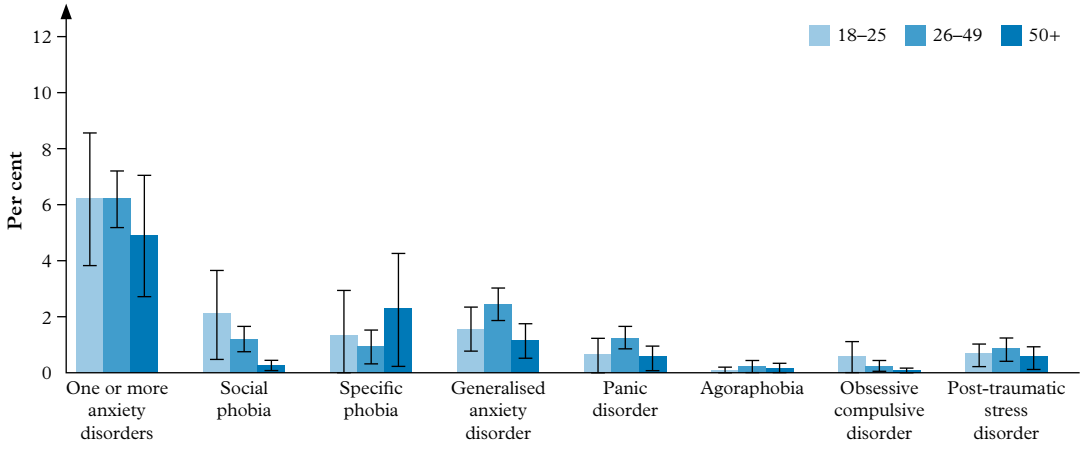


FIGURE 1 Past-year anxiety disorders among adults aged 18 or older, by age group: percentages and 95 per cent confidence intervals

Source: MHSS clinical study, 2008–12

Module 14 checklist: Anxiety disorders

Quizlet: Revise key terms online to test your understanding

MODULE 15

Treatment of psychological disorders

Introduction

Stigma related to psychological disorders is, unfortunately, common. This stigma is often why individuals experiencing symptoms of psychological disorders do not seek the help that they need. When individuals do seek help, a number of treatments are available to reduce and relieve symptoms. It is up to psychologists and mental health professionals to determine the best course of treatment for each individual. Effective treatment can involve the combination of psychological and biological treatments, and can result in improved lives for individuals and their families.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to treatment of psychological disorders before you start.

Subject matter

Science understanding

→ Describe the impact of stigma on help-seeking behaviours.
→ Compare the use of psychotherapies, pharmacotherapies, electroconvulsive therapy (ECT) and psychosurgery in the treatment of psychological disorders.
→ Explain the placebo effect.

Science inquiry skills

→ distinguish between types of investigations
→ identify and apply ethical principles
→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  • correlation, e.g. Pearson *r* correlation coefficient

→ analyse data to identify trends, patterns and relationships; recognising error, uncertainty and limitations of evidence
→ select, synthesise and use evidence to
  • draw conclusions, using *p*-values to infer significance, allowing for the possibility of type I and II errors

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Support for your wellbeing

This module will provide information about mental health and psychological disorders. This information is intended for information only and should not be used for diagnosis or treatment. You can seek support for anything discussed in this module by speaking with a family member, friend, teacher or trusted adult. Alternatively, the following organisations can offer support: Beyond Blue, SANE, Lifeline, Kids Help Line, the Black Dog Institute and Headspace. Links are available on Oxford Digital.

Lesson 15.1
Stigma and treatment

Key ideas

- → Stigma labels a person as "different" and separates them from others.
- → Self-, social and institutional stigma can prevent people from seeking treatment for psychological disorders.

Learning intentions and success criteria

Introducing stigma

Mental illness has long been stereotyped; you might have come across images of someone in a straitjacket, laughing maniacally, or heard someone with a psychological disorder referred to as "crazy". This stereotyping can lead to stigma, where people with mental illness are viewed in a negative way. **Stigma** refers to a "mark of disgrace" that labels a person as different and separates them from others. The stigma associated with mental illness can leave people feeling embarrassed or ashamed.

stigma
a negative mark that applies to an individual and separates them from others

Types of stigma

There are three types of stigma associated with psychological disorders: self-stigma, social stigma (Corrigan & Rao, 2012) and institutional stigma.

Self-stigma

Self-stigma occurs when a person with poor mental health internalises negative stereotypes and has subsequent negative emotional reactions to their mental illness, including low self-esteem and poor self-efficacy.

Study tip

Self-efficacy refers to a person's general coping strategies and their perception of their ability to control the events that happen in their lives.

Social stigma

Social stigma includes the various prejudices and discrimination directed at individuals with psychological disorders by the general public. Social stigma tends to include negative stereotypes about mental illness, such as beliefs that people experiencing a mental illness are dangerous or unpredictable.

Institutional stigma

A recent review of studies on stigma has identified institutional stigma as another type of stigma that affects people with psychological disorders. It refers to governmental and private organisational policies that deliberately or inadvertently restrict opportunities for individuals with mental illness. Examples include reduced funding for mental health research or fewer available mental health services compared to available services for other health concerns.

Effect of stigma on treatment

Embarrassment and shame (self-stigma) can mean that people with psychological disorders are less likely to seek, accept (social stigma) or find (institutional stigma) help, and will often go untreated for years Stigma can leave the patient feeling devalued, which acts as a barrier

FIGURE 1 Stigma that prevents a person seeking treatment for their disorder can have a significant impact on the people around them, such as the loss of financial stability.

to them seeking the treatment they need. This not only affects the person with the disorder, but also their family and friendship groups. Imagine, for example, a family member with untreated major depressive disorder. If the disorder prevents the family member from working, the family's financial position is likely to be negatively affected, which could lead to an inability to maintain housing for the family.

A person may also avoid seeking treatment because they do not want to seem weak to their family and friends when, in actual fact, experiencing a psychological disorder has nothing to do with personal strength at all.

Real-world psychology

Overcoming mental health stigma

Efforts to combat stigma, particularly through personal contact and long-term commitment to the cause, have shown promise in reducing negative perceptions.

Celebrities like Demi Lovato and Dwayne "The Rock" Johnson sharing their mental health struggles have significantly contributed to normalising conversations and reducing stigma associated with mental health issues. Lovato has been sharing their struggles in various print and digital media since 2011, and Johnson began sharing in 2021. Among young people, 90 per cent who are looking up mental health issues online seek personal stories, demonstrating the impact of such narratives on awareness and understanding.

Social marketing campaigns, such as the "Each mind matters" campaign, which ran between 2013 and 2015 in California, have proven effective in increasing mental health service use and awareness. Those exposed to the campaign showed a 10.7 per cent increase in treatment use and an 8.3 per cent increase in the perceived need for treatment (Collins et al., 2019). That campaign included a variety of social marketing initiatives, including informational resources, the production of a television documentary, efforts to improve media representation of mental illness and educational presentations, all designed to reduce stigma associated with mental illness.

Overcoming stigma requires a collective effort to promote understanding, share personal stories, and combat misinformation to ensure individuals with mental illness receive the support they need.

Apply your understanding

1 **Explain** the role celebrities can play in reducing stigma around mental health. (2 marks)
2 **Devise** part of a social marketing plan for your school to improve awareness of anxiety and stigma associated with seeking treatment. Your plan should include a slogan and a 100-word informational resource. (2 marks)

Check your learning 15.1

Check your learning 15.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Explain** what is meant by "stigma" and how this affects treatment of psychological disorders. (2 marks)

2 **Define** the concept of self-stigma and **explain** how it may impact individuals with mental health conditions. (2 marks)

Analytical processes

3 **Infer** the consequences of institutional stigma on individuals with mental health conditions. (1 mark)

Knowledge utilisation

4 **Discuss** the combined impact of self-stigma, social stigma and institutional stigma on help-seeking behaviours. (4 marks)

Lesson 15.2
Treatments

Key ideas

→ There are a variety of treatment options available for psychological disorders.

→ Some treatments are applied when there is perceived to be a psychological cause for a disorder, and others when there is perceived to be a biological cause.

→ The use of placebo treatments in mental health research raises a number of ethical issues.

Learning intentions and success criteria

Introducing treatments for psychological disorders

There are many approaches to treating people who live with a mental illness, and these can be delivered by a broad range of health-care professionals. In this lesson we focus on the treatment approaches used in clinical psychology settings, including cognitive behavioural therapy. We also examine other treatment approaches based on the biological model, such as pharmacotherapy. Here we examine the usefulness of placebo treatments in mental health research. Finally, we examine specific treatments such as electroconvulsive therapy and psychosurgery for relieving symptoms of specific mental disorders.

Introducing psychotherapies

Psychotherapy is the use of psychological methods, such as cognitive behavioural therapy, systematic desensitisation therapy and psychodynamic psychotherapy, to help a person overcome and change their mental health in a positive way.

psychotherapy a form of psychological support administered by a qualified practitioner, like a psychologist, who uses various communication methods and interactions to evaluate, diagnose and address maladaptive emotional responses, cognitive processes and behavioural patterns

Cognitive behavioural therapy

cognitive behavioural therapy (CBT)
a form of psychotherapy that focuses on breaking unhealthy patterns of thinking or behaving and replacing them with positive habits and coping skills

A common form of psychotherapy is **cognitive behavioural therapy (CBT)**. Cognitive behavioural therapy, often combined with relaxation, has been successfully used in treating a range of mental health issues such as depression, anxiety, panic disorders, post-traumatic stress disorder and obsessive compulsive disorder. CBT uses a combination of verbal and behavioural modification techniques to help change irrational patterns of thinking that create and maintain a mental health issue. CBT focuses on helping an individual change negative, dysfunctional thoughts and replace them with more positive, realistic ones.

In CBT, the individual is taught to recognise their thoughts about a situation and recognise that their behaviour influences these thoughts. They are also taught to recognise that their thoughts influence their behaviour. As a person recognises this, they can alter their maladaptive behaviour and thoughts, and improve their reaction to the situation. For example, if we assume that depression is caused by negative thoughts, CBT would help a person acknowledge and challenge these negative thoughts.

FIGURE 1 Cognitive behavioural therapy is carried out in one-on-one sessions with a psychologist.

Systematic desensitisation

systematic desensitisation
a therapy technique whereby an individual is gradually exposed to anxiety-inducing stimuli while also practising deep muscle relaxation, thereby eliminating the anxiety response

Systematic desensitisation can be useful in the treatment of specific phobia. It involves training an individual to respond without anxiety to the situation or thing that causes anxiety. The individual is first trained in deep muscle relaxation. They are then exposed to stimuli related to their phobia, starting with the least anxiety-causing and moving up to the most anxiety-causing. As the stimuli are presented, the individual practises deep muscle relaxation. Muscle relaxation is incompatible with anxiety, so the individual learns to respond to their phobia without anxiety.

Psychodynamic psychotherapy

psychodynamic psychotherapy
an approach used mainly for depressive symptoms, whereby an individual explores repressed problems to gain insight into present beliefs and problems

Psychodynamic psychotherapy is primarily used to treat depressive symptoms and improve the way individuals interact with others, including developing and maintaining relationships.

Psychodynamic psychotherapy was developed by Sigmund Freud. The technique requires individuals to focus on repressed problems that may have begun in childhood, and helps people to understand their feelings towards people they have lost or people from their past. The primary focus of psychodynamic psychotherapy is to uncover the unconscious mental and emotional processes of an individual, so that they can gain insight into their beliefs and problems. This understanding is believed to help relieve psychological symptoms and improve people's lives.

Systemic therapy

systemic therapy
an approach that focuses on solving problems caused by behaviours in groups, rather than on the causes of behaviours

Systemic therapy focuses on the relationships between members of groups, rather than on the thoughts and feelings of an individual. Rather than delving into the causes of behaviours, it looks at ways to solve problems caused by behaviours within groups. Systemic therapy is often applied in family and couples therapy and is increasingly used to resolve issues in non-familial settings, such as workplaces.

Pharmacotherapies

Pharmacotherapy is the use of drugs and medication to assist mental health. This treatment is typically used where the therapist believes that the mental disorder is caused by biological factors. For example, selective serotonin reuptake inhibitor (SSRI) drugs (e.g. Zoloft) may be prescribed for a patient experiencing depression or anxiety to increase the levels of the neurotransmitter serotonin in the brain, and thereby relieve depressive symptoms. Similarly, antipsychotic drugs (e.g. Clozapine) are designed to interact with dopamine neurotransmitters in the brain to control psychotic symptoms such as delusions and hallucinations in patients with schizophrenia (Barlow & Durand, 2011).

pharmacotherapy the use of drugs and medication to assist mental health

FIGURE 2 Zoloft is an SSRI medication prescribed to treat depression.

Substance abuse

Pharmacotherapy can be used effectively to treat substance abuse. Methadone and buprenorphine can be administered as part of a comprehensive and fully supervised pharmacological treatment plan for long-term users of opioid-based drugs such as heroin. These medications can assist recovering substance abusers to successfully manage their physical dependence, drug craving and compulsive drug use (Department of Health and Human Services, Victoria, 2016).

Interaction between psychotherapy and pharmacotherapy

Psychologists are not able to prescribe medication as part of a treatment program as they are not medical doctors. This does not mean that psychotherapy and pharmacotherapy cannot work together. The treating psychiatrist or physician should consider whether psychotherapy such as CBT should be offered in conjunction with pharmacotherapy. This is important, because individuals may sometimes become reliant on medication and not seek alternative psychological treatments (McGrath et al., 2004). Furthermore, some patients may find it difficult to remember to take their medication or they may fail to adhere to the dosage recommendations, which affects their recovery.

electroconvulsive therapy (ECT) psychological treatment where seizures are induced in individuals

Electroconvulsive therapy

Electroconvulsive therapy (ECT) is a psychological treatment in which short seizures (less than 60 seconds) are induced in patients. These seizures are intended to provide relief in patients living with mental health issues, in particular bipolar disorder and major depressive disorder.

Individuals undergoing ECT are anaesthetised and given a muscle relaxant. Electrodes are placed at one or both of their temples, through which an electric shock is administered. The anaesthetic and muscle relaxant mean that the individual is unaware of the seizure that follows.

Very little is known about how and why the procedure works, but it is thought that by administering electric shocks to the brain, an anticonvulsant effect in the frontal and temporal lobes gives patients temporary relief from symptoms. Studies have found remission rates of 50 to 80 per cent in patients with depression (Dierckx et al., 2012; Fink & Taylor, 2007; O'Sullivan & Gilbert, 2003).

FIGURE 3 This patient is being prepared for electroconvulsive therapy (ECT). They have been given a mouthguard to protect their teeth and tongue during the seizure.

Although ECT may sound invasive, it is considered a safe and effective treatment for major depressive disorder, particularly when symptoms are resistant to other forms of therapy (Burton et al., 2015). However, there are side effects, namely confusion, memory loss and amnesia, and patients can have difficulty recalling details of events happening around the time of treatment (Burton et al., 2015). Relapse rates can also be high, and patients can require the procedure to be re-administered after a few months (Royal Australian and New Zealand College of Psychiatrists, 2004). However, patients report immediate relief from symptoms, unlike with pharmacotherapy treatments, which can take weeks to show effect.

Psychosurgery

psychosurgery brain surgery including removing parts of the brain and deep brain stimulation to treat mental health disorders

As we learnt in Lesson 2.1, the Ancient Egyptians used trephination to allow evil spirits to escape, or good spirits in. Since then, **psychosurgery** has developed and now involves other brain surgeries.

Psychosurgery can be used to treat depression and anxiety disorders, such as obsessive compulsive disorder, as well as schizophrenia.

During psychosurgery, a small area or piece of the brain is removed or destroyed. Ideally, the surgery targets an area of the brain that is the cause of symptoms. It is not a guarantee, with less than half of all patients improving significantly after the surgery.

Alternatively, treatment may be through deep brain stimulation (DBS), where affected areas of the brain are stimulated with electric pulses delivered by electrodes placed under the scalp. The electric pulses are delivered by a transmitter placed in the chest. The transmitter is programmed to send continuous pulses to the brain. Recently, DBS has been used to treat Parkinson's disease, and is being trialled as a fall-back treatment for obsessive compulsive disorder, and more severe forms of depressive disorders (Fitzgerald, 2011). Recent studies also suggest that the risks for DBS (e.g. haemorrhaging) are relatively low, and that this procedure should be considered a viable treatment for patients whose disorders do not respond to medication or other psychological treatments (Fenoy & Simpson, 2014).

Risks of psychosurgery

Like all surgery, psychosurgery inherently carries risks that are not present in other treatments, and as such is typically used as a last resort, when patients have shown little or no improvement after trying alternative treatments. Risks and side effects of psychosurgical procedures include confusion, headaches, weight gain, memory loss, lethargy, personality changes, brain haemorrhaging and, in the worst case scenario, death (Lapidus et al., 2013). For these reasons, some countries or states (e.g. New South Wales) have banned the use of psychosurgery, or have very strict legislation governing how and when it can be used. This is also why clearly detailed and informed consent processes are important for patients undertaking these methods.

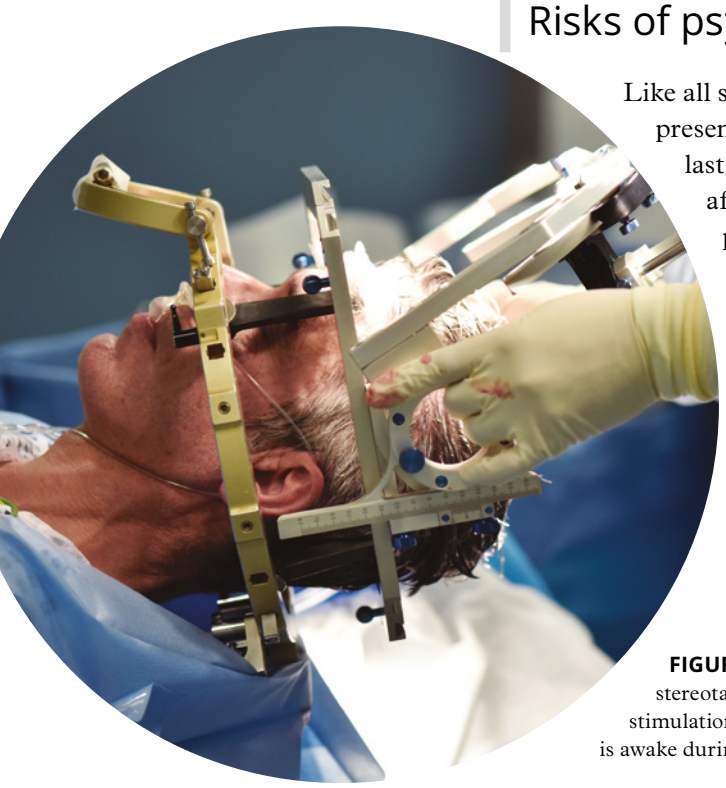


FIGURE 4 This patient's head is held still with a stereotactic frame while electrodes for deep brain stimulation are inserted under their scalp. The patient is awake during the procedure.

Placebo treatments

The use of placebo treatments in mental health research is cause for ethical debate, even though they are common in many research designs. A **placebo** is an inert or inactive substance (such as a sugar pill) that causes a reduction in symptoms simply because people believe that what they are taking will be effective (Burton et al., 2015). Sometimes a belief in an effect can have just as much of an impact as an actual treatment for the relief of symptoms. This is known as the **placebo effect**.

placebo
a substance or treatment with no active therapeutic effect, often administered to the control group

placebo effect
participants experience perceived or actual improvement due to their belief about the treatment rather than the treatment itself

While placebos can make people feel better, the effect can be small or temporary when compared with a legitimate treatment. An important part of research that involves participants is informed consent, and this cannot really be obtained when the deception involved in a placebo-controlled research design exists.

Another problem with placebo treatments in research is that they can sometimes require a participant to go without treatment. Imagine you have a psychological disorder such as an anxiety disorder. You volunteer for a trial to test a new medication that is supposed to reduce your symptoms. You later find out that the medication you have been taking is a placebo. How would you feel about this?

In cases where a sound treatment for a psychological disorder already exists, the use of a placebo treatment to trial a new medication can be seen as unethical. This is because medical health professionals are required to provide patients with the best proven treatment available (Rothman & Michels, 1994). However, there are arguments in favour of using placebo treatments in trials, such as that the placebo effect can still improve patient symptoms, and the outcome of the trials can often improve treatment methods overall.

FIGURE 5 The use of placebos is a contentious topic in mental health research.

Challenge

You can think of treating psychological disorders as like making a smoothie with different fruits to create something unique according to your tastes and needs.

In psychology, instead of sticking to just one way of helping people, an eclectic approach involves combining ideas and methods from different psychological approaches. The therapist picks and chooses the "fruits" that work best in the treatment smoothie for each individual. For example, when treating disorders like schizophrenia, a doctor might use a combination of psychotherapies and pharmacotherapies to treat the positive and negative symptoms.

Identify strengths and limitations of using an eclectic approach to treating psychological disorders.

Skill drill

Research and ethics

Science inquiry skills: Planning investigations (Lesson 1.4); Considering ethics and safety (Lesson 1.5)

In 1953, William Scoville conducted a surgical procedure on H. M. to alleviate severe epileptic seizures. The procedure involved removing 8 centimetres of brain tissue from the anterior (front) two-thirds of the hippocampus. Although initially a surgical intervention, H. M.'s case evolved into a study when cognitive testing after the surgery revealed memory damage.

Milner, a student of Scoville, conducted cognitive assessments on H. M. over 50 years, establishing a cognitive longitudinal case study on H. M.'s anterograde amnesia (inability to form new memories) and partial retrograde amnesia (inability to recall memories).

The research methods included regular cognitive testing to assess H. M.'s memory function. The results indicated that H. M. suffered total anterograde amnesia and partial retrograde amnesia for events following the surgery, while early childhood memories remained intact. This groundbreaking study, documented in a prominent neurosurgical journal, uncovered the correlation between damage to the hippocampus and memory loss – a link initially assumed in the 1950s and later confirmed through brain scans in the 1990s, and reported by Corkin in 1997. The surgical procedure's lasting impact on H. M.'s memory function highlights the critical role of the hippocampus in memory formation.

Practise your skills

1 **Identify** the research method used to investigate H. M. (1 mark)
2 **Describe** a strength and a limitation of the research method used to investigate H. M. (2 marks)
3 **Discuss** an ethical consideration related to the amnesia experienced by H. M. after his surgery. (1 mark)

Check your learning 15.2

Check your learning 15.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** how CBT works, with reference to one psychological disorder. (2 marks)
2 **Explain** what is meant by psychosurgery. (1 mark)
3 **Identify** a risk factor for psychosurgery and **explain** why informed consent is vital for patients undergoing such procedures. (2 marks)
4 **Define** the placebo effect. (1 mark)

Analytical processes

5 **Compare** CBT and psychodynamic psychotherapy. (2 marks)
6 **Discriminate** between systematic desensitisation and systemic therapy. (1 mark)
7 **Compare** the use of psychotherapies, pharmacotherapies, electroconvulsive therapy and psychosurgery by copying and completing the table. (8 marks)

Treatment	Description	Disorder(s) commonly used to treat
Psychotherapies		
Pharmacotherapies		
Electroconvulsive therapy		
Psychosurgery		

Knowledge utilisation

8 You are planning to use a placebo treatment in your trial of a new medication. **Justify** your use of the placebo treatment. (1 mark)

MODULE 15

Lesson 15.3
Review: Treatment of psychological disorders

Summary

15.1
- Stigma labels a person as "different" and separates them from others.
- Self-, social and institutional stigma can prevent people from seeking treatment for psychological disorders.

15.2
- There are a variety of treatment options available for psychological disorders.
- Some treatments are applied when there is perceived to be a psychological cause for a disorder, and others when there is perceived to be a biological cause.
- The use of placebo treatments in mental health research raises a number of ethical issues.

Review questions 15.3A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 Stigma can be a barrier to accessing treatment for a psychological disorder because
- **A** people with a psychological disorder are always dangerous.
- **B** people with a psychological disorder fear being stereotyped negatively.
- **C** family and friends fear becoming negatively stereotyped.
- **D** people with a psychological disorder have trouble interacting with others.

2 Which of the following could be used as treatment for an individual with severe bipolar disorder?
- **A** Electroconvulsive therapy
- **B** Psychotherapy
- **C** Pharmacotherapy
- **D** Placebo treatments

3 **Identify** the correct definition of social stigma.
- **A** Prejudices directed at individuals with psychological disorders by the general public
- **B** Policies that restrict opportunities for individuals with mental illness
- **C** Internalisation of prejudices directed at individuals with psychological disorders
- **D** Policies that perpetuate stigma against people with psychological disorders

4 How can long-standing stereotyping affect individuals with mental illness?
- **A** It enhances their self-esteem.
- **B** It helps them acknowledge their symptoms.
- **C** It may prevent them from recognising the need for help.
- **D** It reduces the stigma associated with psychological disorders.

5 **Identify** the primary focus of cognitive behavioural therapy.
- **A** Inducing seizures in patients
- **B** Administering drugs and medication
- **C** Modifying irrational patterns of thinking and behaviour
- **D** Destroying small areas of the brain

6 What is pharmacotherapy?
- **A** Inducing seizures in patients
- **B** Administering drugs and medication
- **C** Destroying small areas of the brain
- **D** Modifying irrational patterns of thinking and behaviour

7 Which type of psychotherapy focuses on an individual's unconscious mental and emotional processes?
- **A** Cognitive behavioural therapy
- **B** Systematic desensitisation therapy
- **C** Psychodynamic psychotherapy
- **D** Electroconvulsive therapy

8 **Recall** how electroconvulsive therapy (ECT) is conducted.
- **A** Administering drugs and medication
- **B** Destroying small areas of the brain
- **C** Inducing seizures in patients through electric shocks
- **D** Modifying irrational patterns of thinking and behaviour

9 **Identify** an effective treatment for specific phobia.
- **A** Psychosurgery
- **B** Systematic desensitisation
- **C** Electroconvulsive therapy
- **D** Placebo treatment

10 What does psychosurgery involve?
- **A** Inducing seizures in patients
- **B** Administering drugs and medication
- **C** Destroying small areas of the brain
- **D** Stimulating affected areas with electrodes

11 What is the placebo effect?
- **A** Administering drugs and medication
- **B** Destroying small areas of the brain
- **C** A reduction in symptoms due to the belief in the effectiveness of an inactive substance
- **D** Modifying irrational patterns of thinking and behaviour

12 The use of placebo treatments in mental health research is ethically debated because placebos
- **A** have no impact on symptoms.
- **B** often require participants to go without treatment.
- **C** induce severe side effects.
- **D** are the most effective form of treatment.

13 Informed consent is challenging when using placebo treatments in research because
- **A** participants are unaware of the placebo effect.
- **B** participants are deceived about the nature of the treatment.
- **C** placebo treatments have no impact on participants.
- **D** placebo treatments are always temporary.

14 What is an argument in favour of using placebo treatments in trials?
- **A** Placebos have no impact on patient symptoms.
- **B** They induce severe side effects.
- **C** The placebo effect can improve patient symptoms.
- **D** Placebos are unethical in all cases.

Review questions 15.3B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

15 **Define** the following.
- **a** Psychotherapy (1 mark)
- **b** Pharmacotherapy (1 mark)
- **c** Electroconvulsive therapy (1 mark)
- **d** Psychosurgery (1 mark)
- **e** Placebo treatment (1 mark)

16 **Describe** how pharmacotherapy is used, giving an example of a mental health disorder where this treatment approach is commonly used. (2 marks)

17 **Describe** the risks and side effects associated with psychosurgical procedures. (2 marks)

18 **Explain** the primary focus of cognitive behavioural therapy. (1 mark)

19 **Explain** the procedure of electroconvulsive therapy (ECT) and its intended effects on patients experiencing certain mental health issues. (2 marks)

20 **Explain** two ethical concerns related to the use of placebo treatments in mental health research, particularly in terms of informed consent. (2 marks)

21 **Explain** systemic therapy and provide an example of its application in the treatment of mental health issues. (2 marks)

Analytical processes

22 **Compare** cognitive behavioural therapy (CBT) and psychodynamic psychotherapy in terms of their underlying principles and approaches to treating mental health disorders. (2 marks)

23 **Contrast** pharmacotherapy and psychotherapy. Consider their methods, mechanisms of action and applications in the treatment of psychological disorders. (3 marks)

24 **Compare** electroconvulsive therapy and psychosurgery. Consider the procedures, intended effects and disorders they are commonly used to treat. (3 marks)

25 **Compare** the ethical considerations associated with the use of placebo treatments in mental health research with ethical concerns related to psychosurgery. (2 marks)

Knowledge utilisation

26 **Develop** a treatment plan for an individual presenting to you with the following symptoms and experiences:

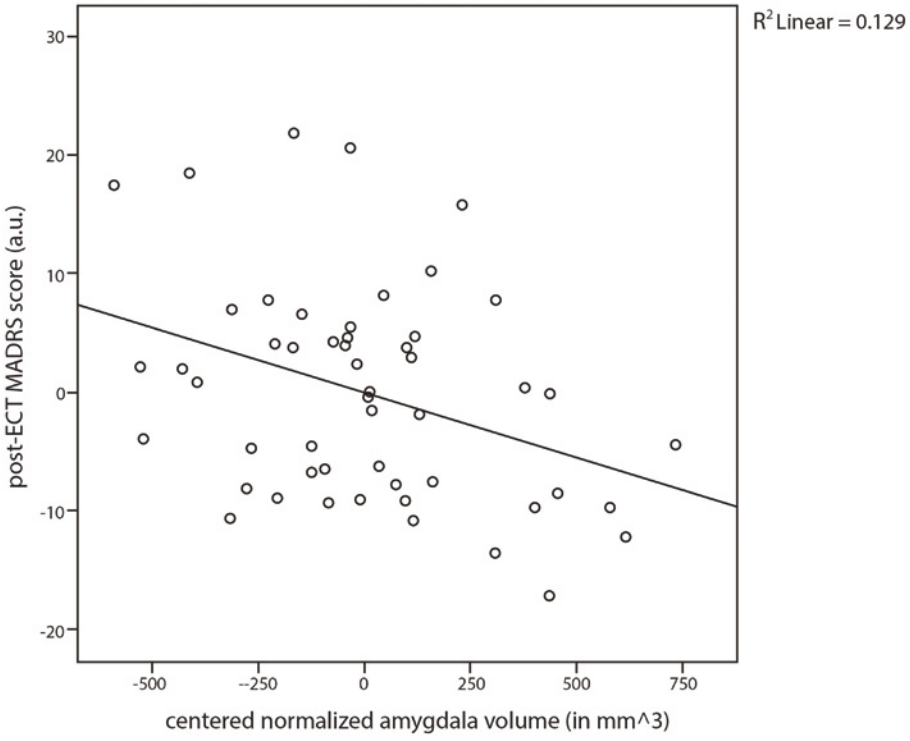
- feels intense worry about crossing the road, so much that they are unable to complete the weekly shopping or collect their child from school
- has tried an SSRI before, but it did not help
- has frequent arguments with their partner related to the activities that the individual is unable to participate in.

Justify each of your treatment decisions. (2 marks)

Data drill

Amygalda size and effectiveness of ECT

Electroconvulsive therapy (ECT) is an effective treatment for patients with severe depression. An investigation based on the work of Ten Doesschate et al. (2014) examined if the volume (size) of the amygdala was related to the effectiveness of ECT. The brains of 53 severely depressed patients were scanned using MRI before and after treatment. The effectiveness of the treatment was determined by comparing patient scores on the Montgomery-Åsberg Depression Rating Scale (MADRS) pre- and post-treatment. It was found that a larger amygdala volume was correlated with a lower post-ECT MADRS score ($p = 0.013$). The results of the correlation are shown in the graph.



Apply understanding

1 **Identify** the highest post-ECT score for participants with an amygdala volume between –250 and 0. (1 mark)

2 **Identify** the post-ECT score of the participant with an amygdala volume of 750. (1 mark)

Analyse evidence

3 **Identify** the strength and direction of the relationship of post-ECT score and amygdala volume with reference to the correlation coefficient. (2 marks)

Interpret evidence

4 **Draw a conclusion** about the relationship between the amygdala volume and post-ECT score, with reference to the *p*-value. (2 marks)

Module 15 checklist: Treatment of psychological disorders

Quizlet: Revise key terms online to test your understanding

UNIT 2

Topic 3 review

Multiple choice

(1 mark each)

1 What does the biopsychosocial model aim to bring into the patient–practitioner relationship?
- **A** Empathy and compassion
- **B** Increased social interaction
- **C** Appropriate medical intervention
- **D** Unbiased psychological evaluation

2 According to Engel's biopsychosocial model, biological factors include
- **A** family, friends and societal expectations.
- **B** school environment and level of education.
- **C** personality predisposition and coping strategies.
- **D** physiological/anatomical, neurological and genetic factors.

3 What are the main symptoms of anxiety disorders?
- **A** Increased irritability and racing thoughts
- **B** Persistent, irrational and intense fear
- **C** Temporary feeling of worry and fear
- **D** Feelings of worthlessness or guilt

4 What is the most common type of anxiety disorder?
- **A** Panic disorder
- **B** Specific phobia
- **C** Generalised anxiety disorder (GAD)
- **D** Obsessive-compulsive disorder (OCD)

5 How can stigma in relation to psychological disorders be defined?
- **A** A mark of disgrace
- **B** A mark of distinction
- **C** A symbol of acceptance
- **D** A symbol of mental health

6 Which type of testing is used to assess psychological risk factors for psychological disorders?
- **A** Neuropsychological assessments
- **B** Galvanic skin response
- **C** Blood tests
- **D** Urine tests

7 According to research, what is as important to an individual's recovery as medical attention or diagnosis?
- **A** Genetic testing
- **B** Biological factors
- **C** Social support networks
- **D** Neuropsychological testing

8 Which type of psychotherapy focuses on repressed problems and unconscious processes?
- **A** Psychodynamic psychotherapy
- **B** Cognitive behavioural therapy
- **C** Systematic desensitisation
- **D** Systemic therapy

9 Which gender is more likely to suffer from an anxiety disorder in Australia?
- **A** Males
- **B** Neither
- **C** Females
- **D** Both equally

10 What is the primary goal of electroconvulsive therapy (ECT)?
- **A** Reducing long-term memory loss
- **B** Reducing permanent brain damage
- **C** Administering electric shocks to the brain
- **D** Relieving symptoms of mental health issues

11 Which of the following is an example of a perpetuating risk factor in the development of psychological disorders?
- **A** Traumatic life event
- **B** Genetic predisposition
- **C** Supportive social network
- **D** Maladaptive coping mechanisms

12 Which neurotransmitter is particularly implicated in depression and is targeted by antidepressant medications such as Zoloft and Prozac?
   A GABA
   B Serotonin
   C Dopamine
   D Acetylcholine

13 A possible explanation for why rumination occurs is
   A an overactive limbic system.
   B lack of social support networks.
   C lack of neurotransmitter activity.
   D neural networking and cognitive habits.

14 Which psychological disorder is strongly linked to disorganised attachment in adulthood, leading to problems in relationships and emotional regulation?
   A Schizophrenia
   B Bipolar disorder
   C Borderline personality disorder
   D Obsessive compulsive disorder

15 What are three biological factors that contribute to the development of anxiety disorders?
   A Heritability, parenting style and cognitive distortions
   B Neurotransmitters, cognitive bias and personality traits
   C Hormonal imbalance, environmental triggers and cognitive biases
   D Neurotransmitters, genetic predisposition and inherited vulnerabilities

Short response

16 **Describe** what the biopsychosocial model aims to consider in understanding and treating a psychological disorder. (3 marks)

17 **Identify** one perpetuating risk factor in the development of psychological disorders. Use an example to support your response. (2 marks)

18 **Describe** the role of cognitive behavioural therapy (CBT) in treating mental health issues. (1 mark)

19 **Describe** one specific phobia. (1 mark)

20 **Identify** two potential risks and two benefits associated with psychosurgery as a treatment for psychological disorders. (4 marks)

21 **Explain** one example of a psychological factor considered in the biopsychosocial model. (1 mark)

22 **Explain** how stress can impact mental health using an example from everyday life. (2 marks)

23 **Explain** the development of anxiety disorders with reference to the fight-flight-freeze response. (3 marks)

24 **Explain** how parental modelling can contribute to the development of specific phobias in children. (1 mark)

25 **Discriminate** between a fear reaction and a phobia. (1 mark)

26 Sarah has been feeling increasingly sad and anxious lately, but she can't pinpoint any specific reason for her mood changes. She has also been having trouble sleeping and has lost interest in activities she used to enjoy. Using the biopsychosocial model, **explain** how biological, psychological and social factors could be contributing to Sarah's symptoms. (3 marks)

27 **Use** the social learning theory to **explain** the transmission of specific phobia. (2 marks)

28 **Explain** the role of distorted thinking in anxiety disorders, with reference to a cognitive model. (2 marks)

29 **Explain** two ethical considerations relevant to the use of placebo treatments in mental health research. (2 marks)

30 **Explain** the role of pharmacogenetics in understanding an individual's response to psychiatric medication, with reference to the biopsychosocial model. (2 marks)

TOTAL MARKS
/45 marks

MODULE 16

Emotion and wellbeing

Introduction

Are your emotions the same as your feelings and your moods? What makes you happy? Is happiness the same as wellbeing? Think about times when you were experiencing happiness, or experiencing sadness: did your body do different things or did it react the same way? These questions and the ideas behind them will be explored through this chapter as we approach the way emotions are formed, the role of cognition in your emotions, and the factors that influence our happiness and wellbeing.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to emotion and wellbeing before you start.

Subject matter

Science understanding

- → Compare the two-factor (Schachter & Singer 1962) and appraisal (Lazarus 1982) theories of emotion.
- → Describe physiological processes associated with emotion, including autonomic arousal and activity in the limbic system, i.e. thalamus, hypothalamus, amygdala, hippocampus, basal ganglia and cingulate gyrus.
- → Describe factors that affect happiness.
- → Interpret data from an experiment comparing the effect of watching emotive (e.g. a scary movie) versus informative (e.g. an advertisement for toothpaste) stimuli on emotional responses (measured by changes in heart rate).
- → Explain subjective wellbeing (Diener 1984), psychological wellbeing (Ryff & Keyes 1995), and the broaden-and-build-theory (Frederickson 2004) of positive emotions.
- → Explain mindfulness, with reference to attention and acceptance.
- → Describe the positive consequences of the flow experience (Nakamura & Csikszentmihalyi 2002), with reference to enhancing positive affect, life satisfaction, performance and learning.

Science inquiry skills

→ distinguish between types of investigations
→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  - descriptive statistics
  - correlation, e.g. Pearson *r* correlation coefficient
  - parametric inferential statistics
→ judge the reliability and validity of the experimental process

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Key studies

Key study summaries

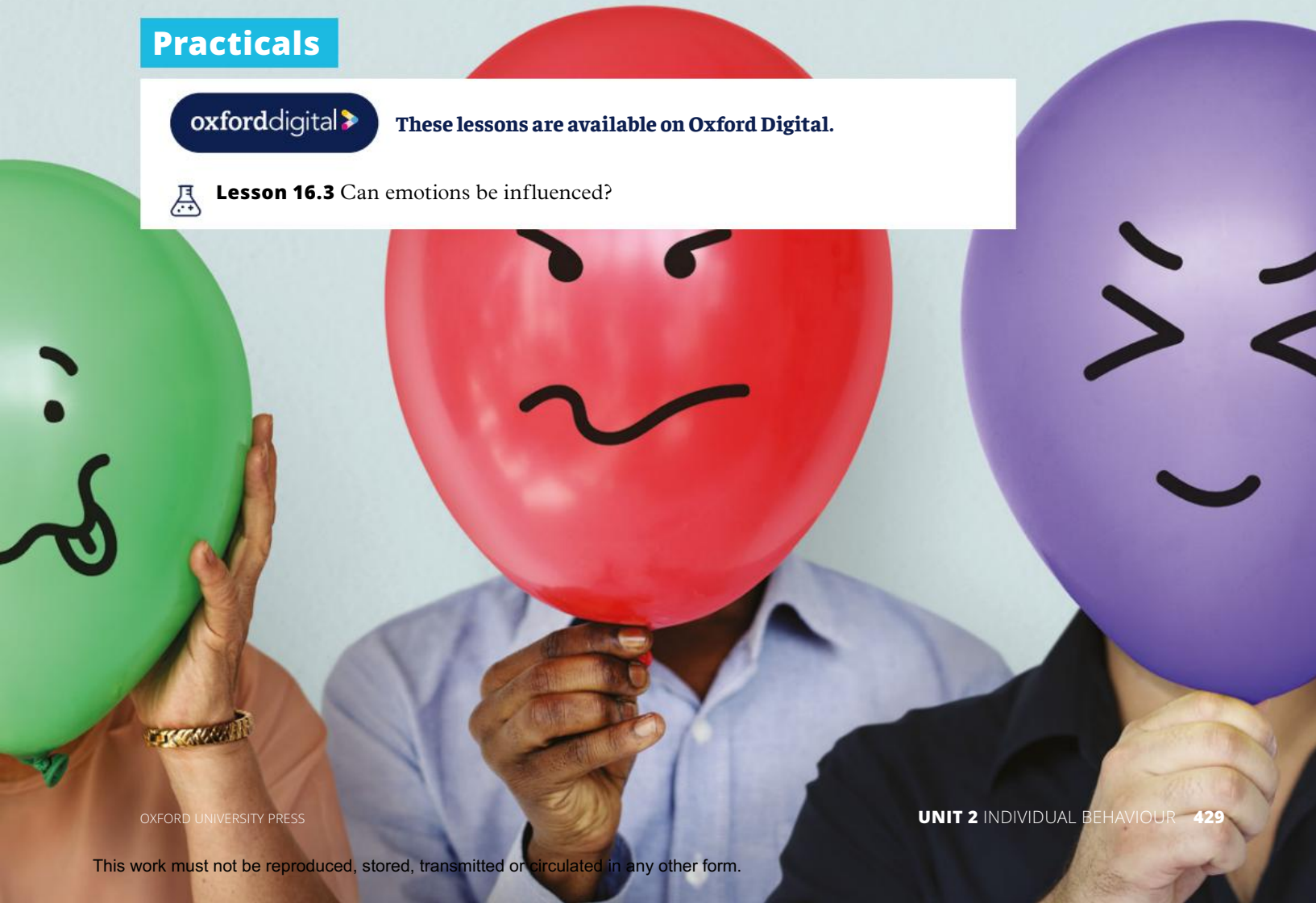
Read summaries of the key studies for this module.

→ Diener, 1984
→ Fredrickson, 2004
→ Lazarus, 1982
→ Nakamura & Csikszentmihalyi, 2002
→ Ryff & Keyes, 1995
→ Schacter & Singer, 1962

Practicals

oxforddigital **These lessons are available on Oxford Digital.**

Lesson 16.3 Can emotions be influenced?



Lesson 16.1
Theories of emotion

Learning intentions and success criteria

Key idea

- → There are three components to emotion: physiological changes, subjective feelings and behaviour associated with these.
- → Schachter and Singer's two-factor theory of emotion considers that we experience emotions based on our interpretation of physiological changes experienced in response to an event or situation.
- → Lazarus's appraisal theory of emotion considers that we experience emotions based on our evaluation of a situation or event.

FIGURE 1 Emotions are highly varied!

Introducing emotion

Every day when you are interacting with yourself or others, you are experiencing emotions. You may be noticing your own emotions after a long day, receiving a bad mark at school, falling in love, or having a fight with a friend. You might be angry after discussing something with your parents, or feeling worried about what you will do after you finish high school. In many of these situations there will be a common feeling; in some you will feel joy and excitement, and in others you may feel sad or afraid. But what causes these feelings?

Defining emotion

People usually think of emotions as their feelings and moods. Though feelings, moods and emotions are connected, emotion is more complicated than what you feel. Psychologists think of **emotion** (such as fear, anger, excitement) as a complex psychological state that encompasses three components:

- physiological changes
- subjective feelings
- an associated behavioural or expressive response.

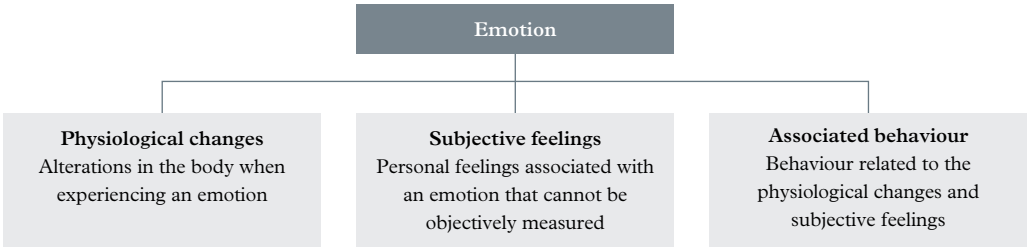


FIGURE 2 The components of emotion

Emotions are often intense, short-lived, and usually a direct response to a specific event or stimulus, including external stimuli (like a scary situation) or internal processes (like thoughts or memories). Emotions are **valenced**, meaning that they have an associated quality of "goodness" (positive valence) or "badness" (negative valence). Emotions such as love and joy are examples of positively valenced emotions.

emotion
a response to a specific event or stimulus involving experiential, behavioural and physiological elements

valence
the associated quality of how "good" or "bad" something is

Physiological changes

Physiological change refers to the way your body is altered when you are experiencing a certain emotion. For example, if you are experiencing love, you might feel butterflies in your stomach, and an increase in heart rate. You may also experience sweaty palms and flushing cheeks if you were nervous about this situation. When you experience an emotion your body can become more aroused, meaning it is more responsive to the environment.

FIGURE 3 Increased heart rate can be a physiological change related to emotion.

physiological change
a change to the normal functioning of the body, such as heart and breathing rates

Subjective feelings

Subjective feeling refers to an individual's experience of an emotion. The same event can elicit different feelings from different people: for some people, falling in love is happy and feelings of happiness will be associated with this situation. For others, falling in love may be fearful and they may feel scared or apprehensive.

subjective feeling
a feeling that is associated with an emotion; it is subjective as it is personal and cannot be objectively measured

associated behavioural or expressive response
the behavioural changes that result from subjective feelings and physiological changes

Associated behavioural or expressive response

An **associated behavioural or expressive response** is the way that you react to the physiological changes and subjective feelings of emotion outwardly. For example, someone who is falling in love may want to hold hands with the object of their affection, or kiss them.

Study tip

Feelings are the subjective experience of emotions. They are the personal interpretations and conscious awareness of emotional states. Moods are less intense than emotions, exist for longer periods of time and don't necessarily have a specific trigger.

Theories of emotion

Understanding how the three components of emotion interact is as important as understanding that they exist. This has led to the development of many different theories that typically differ in the order and timing of the emotional components. The QCAA Units 1 & 2 syllabus focuses on two theories: the two-factor theory and appraisal theory.

FIGURE 4 Kissing someone can be a behavioural response to the physiological changes and subjective feeling of falling in love.

The two-factor theory of emotion

two-factor theory of emotion
a theory that suggests emotion involves two factors: physiological arousal and cognitive assessment (labelling) of the event or situation

In 1962, Schachter and Singer conducted a seminal study to test their **two-factor theory of emotion**, which suggests that emotion arises from the interaction of two factors: physiological arousal and cognitive assessment of that arousal in response to an event or situation.

Method

The study involved 184 male participants, all college students who were told that they would be receiving an injection of a vitamin supplement called Suproxin. In reality, the injection contained epinephrine, a hormone that induces physiological arousal, including increased heart rate and hand tremors.

Participants were divided into four groups. The first two groups were accurately informed about the effects of the injection, while the third group was misinformed, and the fourth group was not informed at all about the possible side effects. After the injection, participants were placed in a room with a confederate (an actor working for the researcher) who was acting either euphorically or angrily. The purpose of the confederate was to provide a context for the participants' arousal. The participants' emotional states were then assessed in two ways: by their observed behaviours, and by a self-report questionnaire.

Results

The results indicated that participants who were not informed or were misinformed about the effects of the injection were more likely to experience emotions that matched with the confederate's behaviour. Participants who were correctly informed about the effects of the injection were less likely to be influenced by the confederate, as they attributed their arousal to the known side effects of the injection rather than the social context.

Conclusion

Schachter and Singer's study concluded that an individual's subjective experience of emotion is determined by both their physiological arousal and the cognitive interpretation of arousal within a given context. In other words, the emotion that someone experiences is based on their interpretation of their physiological changes. This study is a landmark in psychology, providing empirical support for the two-factor theory of emotion and contributing significantly to our understanding of the complex nature of human emotions.

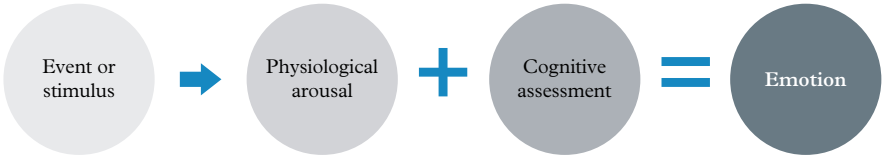


FIGURE 5 The process of emotion according to the two-factor theory

Applying the two-factor theory

Consider the following two scenarios:

1. You are walking alone in the dark and see a group of men ahead, wearing dark clothes. You notice that your heart rate is rapid and that you are sweating. Based on the situation, you could conclude that you are experiencing fear.
2. You are at a concert dancing to your favourite band. You notice that your heart rate is rapid and that you are sweating. Based on the situation, you determine that you are experiencing excitement.

To Schachter and Singer, physical arousal alone is not responsible for our emotional responses. This conclusion led them to focus on the interaction between physical arousal and how people cognitively label that arousal.

FIGURE 6 In the two-factor theory, the young woman and the people at the concert could be experiencing the same physiological changes, but assign different emotions to each situation.

Consider the two scenarios again. According to the two-factor theory of emotion, the way you process the experience is as follows:

In the "alone at night" scenario:

- I see a group of men walking towards me.
- My heart is racing and I am sweating.
- My rapid heart rate and sweat are caused by fear.
- I am afraid.

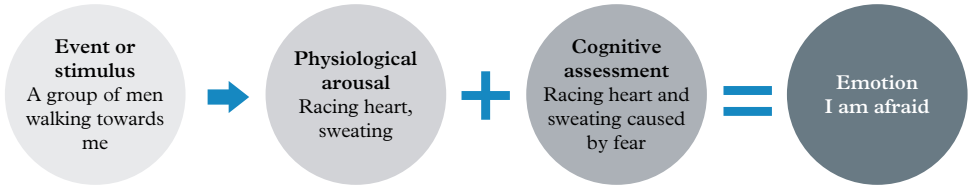


FIGURE 7 Cognitive assessment of physiological arousal leads to the emotion of fear.

In the concert scenario:

- I am having fun seeing my favourite band.
- My heart is racing and I am sweating.
- My rapid heart rate and sweat are caused by excitement.
- I am excited.

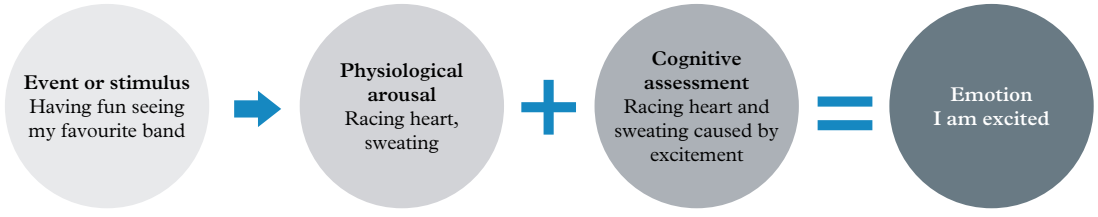


FIGURE 8 Cognitive assessment of physiological arousal leads to the emotion of excitement.

Criticisms of the two-factor theory

The two-factor theory of emotion has been criticised, as researchers who have repeated the study have found that the confederate had a small impact on emotions. The theory has also been criticised on the basis that it focuses on the autonomic nervous system and does not consider the emotional processes that are part of the central nervous system.

Challenge

Emotions and physiology

Choose one of love, joy, anger or sadness.

a **Investigate** the physiological changes that occur when these emotions are experienced.

b **Evaluate** why you think this happens.

Appraisal

appraisal
the mental evaluation of an event or situation that occurs before an emotion is displayed

The term **appraisal** was developed by American psychologist Magda Arnold. Appraisal refers to the cognitive processes that occur before an emotion is displayed. Arnold suggested that the first step in experiencing an emotion is appraising the situation. This appraisal will initiate the emotional process by arousing both the physiological systems and the emotional response itself. Arnold's theory expressed that while the physiological changes are important to the emotional process, they are not important in the initiation of reactions to experiences.

The appraisal theory of emotion

appraisal theory of emotion
a theory that suggests we experience emotions based on our evaluation of a situation or event

Building on Arnold's initial theory, Richard Lazarus developed a new **appraisal theory of emotion**. At the core of Lazarus's theory is appraisal, the initial evaluation of an event or situation (Lazarus, 1982) that leads to the simultaneous experience of a physiological response and the emotion (UWA, 2023). Lazarus, along with his colleague Susan Folkman, later expanded on the initial concept of the appraisal theory to include coping potential and reappraisal (Lazarus & Folkman, 1984).

There are two components to the appraisal theory of emotion:

- primary appraisal, which is the initial evaluation and categorisation of a situation or event as beneficial or harmful
- secondary appraisal, which involves evaluating one's resources and coping potential for dealing with the situation or event.

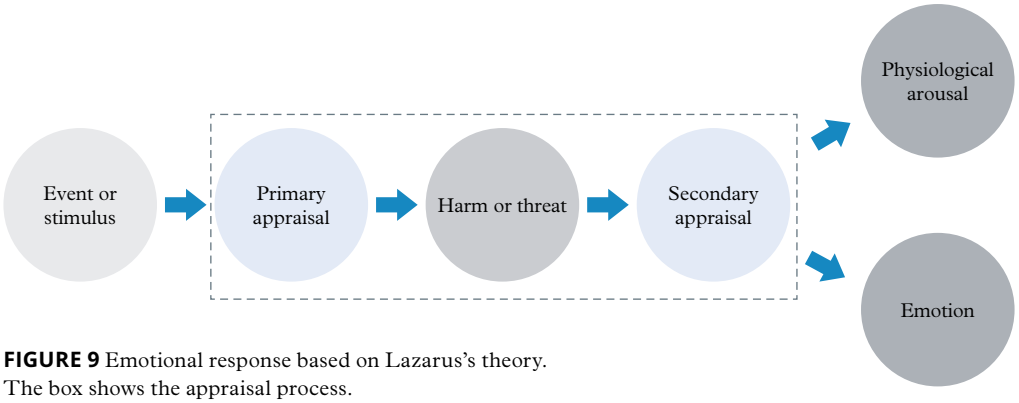


FIGURE 9 Emotional response based on Lazarus's theory. The box shows the appraisal process.

Primary appraisal

Primary appraisal is where a person determines whether an event or situation is dangerous. If the situation has no personal relevance for that individual, then it is viewed as neutral or irrelevant, and little or no further thought is needed. Conversely, should the situation be perceived as a stressor, the person will analyse their available resources during secondary appraisal.

primary appraisal
initial evaluation and categorisation of a situation as dangerous, positive or irrelevant

During primary appraisal, the situation is classified into one of three categories:

- **dangerous**, involving:
  - harm or loss: an assessment that some type of damage has been done such as an illness or poor test result (e.g. "I just failed a major test.")
  - threat: an assessment that there may be a future harm or loss (e.g. "I might fail the next major test.")
- **positive**: an assessment that there is opportunity for personal growth or that there may be a positive outcome (e.g. "I didn't do well on the practice test, but with a bit of hard work, I'll do better next time.")
- **neutral/irrelevant/benign:** an assessment that an event is of little or no personal importance to the person and, therefore, does not go beyond primary appraisal (e.g. "My neighbour did poorly on their test.").

Secondary appraisal

If a situation is judged as dangerous, primary appraisal is followed by secondary appraisal. **Secondary appraisal** is the stage where a person determines if they are capable of handling the situation based on their available resources and coping potential (Lazarus, 1982). How well a person can deal with the situation is also influenced by their beliefs, goals, personal circumstances, life experiences and personality.

secondary appraisal
the process of consciously evaluating one's resources and coping potential for dealing with the situation

Primary and secondary appraisal (mental evaluation) occur almost simultaneously.

Applying the appraisal theory

Let's consider the following example involving a student named Jamie who is about to give a speech in front of the class. As Jamie stands up to present, his immediate, automatic assessment of the situation involves primary appraisal. Jamie's heart races, and there's a sense of butterflies in his stomach. In this moment, Jamie interprets the situation as threatening because he is worried about negative judgment from his classmates, especially if he makes mistakes or forgets parts of his speech. This leads to an emotional response of anxiety.

During secondary appraisal, Jamie evaluates his ability to deal with the situation, such as the time he spent preparing and rehearsing his speech. He also evaluates the resources on hand such as his well-written and organised notes. His fear of negative evaluation remains, sustaining his experience of anxiety; however, the intensity of the emotion is less due to his secondary appraisal.

Another aspect of secondary appraisal is **coping potential**: a person's ability to use either problem-focused coping or emotion-focused coping.

coping potential
a person's ability to use either problem-focused coping or emotion-focused coping

Problem-focused coping

Problem-focused coping looks at the causes of the emotion from a practical perspective and works out ways to deal with the problem or stressful situation with the objective of reducing that stress. Some problem-focused strategies:

problem-focused coping
addressing a negative situation by using practical ways to deal with it

- **Take control:** For example, someone who has just lost their job may prepare a new resume and go online to look for a new position.
- **Seek information:** Look for additional information on how to deal with the situation. For example, someone who has just been diagnosed with an illness may seek a second opinion. Knowledge can sometimes reduce the level of stress.
- **Evaluate the pros and cons:** This involves taking a sheet of paper and dividing it so that the positives about the situation are listed on one side and the negatives on the other side. For example, a person wanting to leave their job or change a relationship may use this to help clarify their own thoughts and decide what they want.

FIGURE 10 Losing a job can be stressful for someone who needs their job, whereas someone who doesn't really need or care about their job may feel relieved.

Emotion-focused coping

emotion-focused coping
reducing the negative emotional responses associated with stress such as embarrassment, fear, anxiety, depression, excitement and frustration

Emotion-focused coping involves trying to reduce the negative emotional feelings associated with the stressor, such as embarrassment, fear, anxiety, depression, excitement or frustration. Emotion-focused strategies include:

- meditation
- relaxation
- talking to friends and family about your problem
- denial (pretending the event did not occur)
- ignoring the problem in the hope that it will disappear
- distraction (finding other methods to keep your mind busy and not on the problem; e.g. watching TV, reading, eating or playing video games)
- expecting a worst-case scenario so that you are ready for the worst
- physical exercise to reduce negative feelings (stress).

Reappraisal

reappraisal
the cognitive process of re-evaluating an event or situation and potentially altering the emotional response based on new information or perspective

Appraisal involves the initial interpretation of an event that leads to an emotional response. In contrast, **reappraisal** is a continual process where the situation and one's coping potential are re-evaluated, based on new information or changes in the environment, which can alter the individual's emotion. Reappraisal is a regulatory strategy that can transform the quality of the emotional response and is a key mechanism in adaptive emotional regulation.

Consider the earlier example of Jamie's appraisal of public speaking. After the initial wave of anxiety, Jamie takes a moment to engage in problem-focused coping and reappraisal. He evaluates the pros of the situation: sharing an interesting topic with classmates and an opportunity to practise his public-speaking skills. He also reflects on past presentations that went well and reminds himself that nervousness is a normal response that can be channelled into enthusiasm. After reappraising the situation, Jamie's emotional response changes from anxiety to a more composed and motivated state.

Summary of the appraisal theory of emotion

Figure 11 summarises the appraisal theory of emotion. Reappraisal can occur after primary appraisal and secondary appraisal, including after the assessment of stress and coping mechanisms.

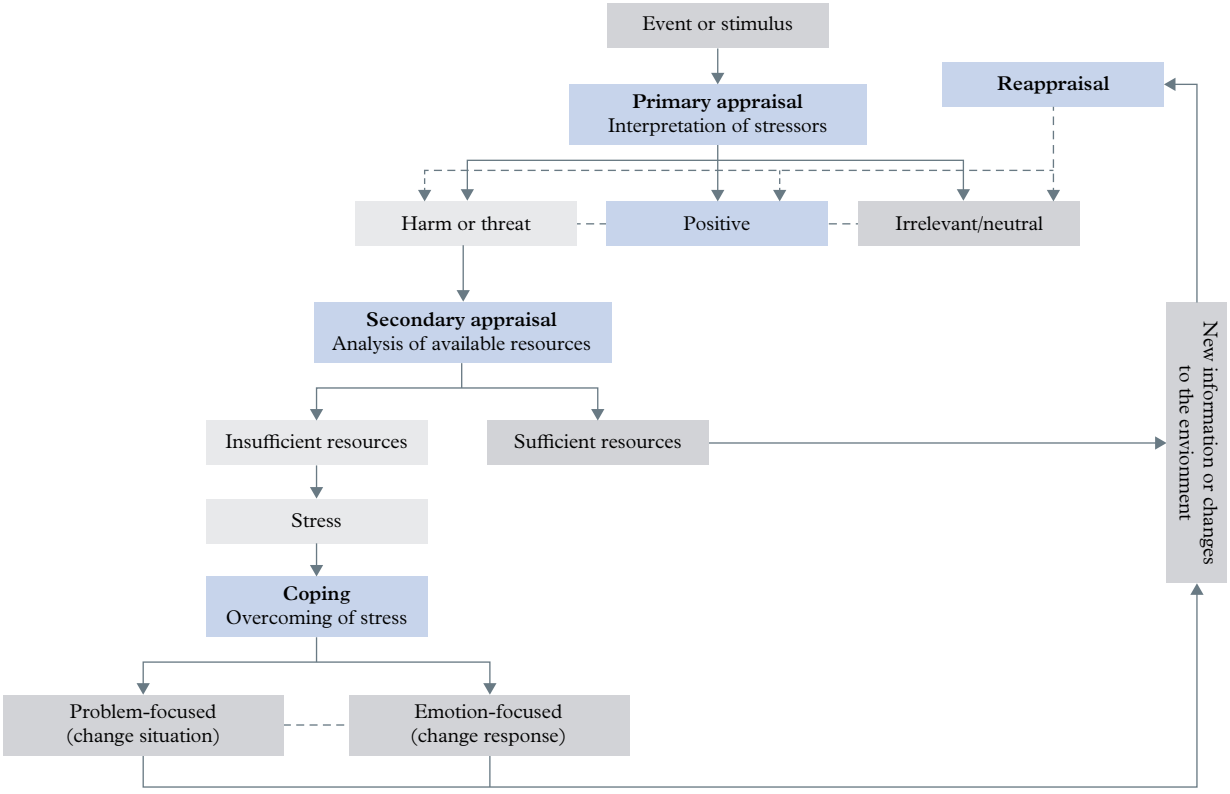


FIGURE 11 How the appraisal process works

Check your learning 16.1

Check your learning 16.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the three components of emotion. (3 marks)
2 **Explain** the two-factor theory of emotion. Provide an example in your response. (2 marks)
3 **Explain** the two components of the appraisal theory of emotion. (2 marks)

Analytical processes

4 **Distinguish** between physiological reaction and cognitive assessment according to Schachter and Singer. (1 mark)
5 **Compare** primary appraisal and secondary appraisal. (2 marks)
6 **Contrast** appraisal and reappraisal. Provide an example. (2 marks)
7 Imagine that you are walking through the bush one day and suddenly a snake is in front of you. Your heart starts racing and you tremble. **Apply** the two-factor theory to this situation. (3 marks)
8 A woman is walking to her car during the day and an elderly man approaches her. Using the appraisal theory of emotion, **contrast** this occurrence with the woman's possible reaction if a young man approached her as she walked to her car at night. (1 mark)
9 A man is sitting at home on the Gold Coast and sees a spider crawling up his leg. He knows that Queensland has poisonous spiders and he panics. He then realises that it is just a common house spider and calmly removes the spider from his leg. **Determine** what stages of the appraisal theory he experienced. (2 marks)
10 **Compare** the two-factor theory of emotion and the appraisal theory of emotion. (2 marks)

Knowledge utilisation

11 Crying is a physiological response that is typically associated with sadness or grief. **Discuss** what you think crying when you are very angry or very happy means in terms of
   a the two-factor theory of emotion (3 marks)
   b the appraisal theory of emotion. (3 marks)

Lesson 16.2
Physiological processes

Key ideas

- → The limbic system is a collection of interconnected brain areas involved in experience and expression of emotion.
- → Structures in the limbic system include the thalamus, hypothalamus, amygdala, hippocampus, cingulate gyrus and basal ganglia.
- → LeDoux's biological model of emotion identifies a short (unconscious) and long (conscious) neurological pathway for emotion.
- → The short pathway bypasses the sensory cortex and hippocampus to reach the amygdala. This results in a "thoughtless" response to a stimulus, which is useful for survival.
- → The long pathway receives sensory information from the thalamus and relays this to the cortex, the hippocampus and then to the amygdala, allowing more time for us to make a "thoughtful" appraisal and plan a more appropriate response.

Learning intentions and success criteria

Introducing physiological processes related to emotion

In the previous lesson, you learnt that emotion involves physiological changes, subjective feelings and an associated behaviour in response to a stimulus. Both the two-factor theory of emotion and the appraisal theory of emotion explain the influence of cognitive processes on a person's subjective experience of emotion and acknowledge the related physiological changes. However, what brain systems underlie emotions? How do differences in these systems relate to differences in how different people experience emotion? How does processing emotion in the brain relate to physiological changes in the body?

Study tip

Go to Module 3 to revise the structure and functions of various areas of the brain. Go to Module 4 to revise the structure and function of the nervous system including the autonomic nervous system. The autonomic nervous system consists of the sympathetic nervous system that is involved in arousal and the body's stress or fight-flight-freeze response.

From Unit 1, we know that different areas of the brain are responsible for different processes, and regulate different physiological responses. In this lesson, we will learn that emotions are associated with specific physiological processes, such as changes in heart rate, blood pressure and respiration, driven largely by the autonomic nervous system (ANS) and various interconnected brain structures of the limbic system (LeDoux, 2000).

The physiology of emotion

Our understanding of the brain systems that underlie emotions has been built through painstaking research involving behavioural experiments, animal and human lesions studies, and modern functional neuroimaging. Research into the physiology of emotion has notably been influenced by the work of neuroscientists such as Papez (1937), Yakovlv (1948), Maclean (1952) and, more recently, LeDoux (1996).

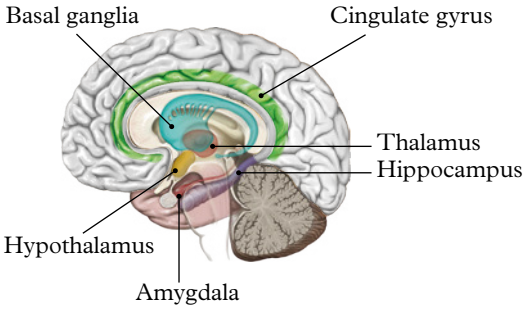


FIGURE 1 Structures of the brain associated with emotion

These researchers have identified the areas of the brain and the complex neural pathways involved in emotion, particularly fear.

The interconnected brain areas are collectively referred to as the **limbic system**, and it is one of the oldest structures in the brain. The limbic system has been associated with the recognition, regulation and expression of emotion, as well as other processes that, at times, rely on emotion, such as motivation, memory and learning. Figure 1 shows the location of the limbic system structures.

limbic system
a group of structures in the brain involved in the experience and expression of emotions; includes the amygdala, hippocampus, thalamus, hypothalamus, cingulate gyrus and the basal ganglia

The limbic system

Table 1 describes some of the major components of the limbic system and their role in emotion.

TABLE 1 Components of the limbic system

Structure of the limbic system	Implications for emotion
Thalamus	• The thalamus is located in the forebrain near the centre of the brain that receives all sensory information (except smell) and relays it to different parts of the brain.
Hypothalamus	• The hypothalamus is located in the forebrain, just below the thalamus. • It links the nervous system to the endocrine system. • It is responsible for maintaining homeostasis and controlling autonomic functions such as hunger, thirst, body temperature, heart rate, and the body's stress response, known as the fight-flight-freeze response, which prepares the body for action in response to threatening stimuli.
Amygdala	• This almond-shaped structure assesses the emotional relevance of stimuli, and triggers appropriate responses. • It is critical for processing emotions, particularly fear. In threatening situations, the amygdala signals the hypothalamus to trigger autonomic arousal (i.e. fight-flight-freeze reaction; LeDoux, 1998). • It is involved in conditioning, a type of learning that can influence how we respond to events or external stimuli. • The amygdala is also implicated in social processing and recognising emotions (Crtichley et al., 2000). For example, studies have shown that psychopaths who struggle with recognising fear have different activity in the amygdala than people who are not psychopaths (Birnaumer et al., 2005).
Hippocampus	• The hippocampus interacts with the amygdala in the formation and retrieval of memories (Phelps, 2004). - Formation of emotional memories: when an emotional event is experienced, the hippocampus is activated to process and store information about the surroundings or the specific situation in which the emotion is experienced. This context can include spatial details, time and other environmental cues. The hippocampus also integrates the emotional intensity conveyed by the amygdala with the contextual details of the event, thereby storing the emotional significance of the event. - Memory recall: When recalling an emotional event, the hippocampus helps retrieve the memory by providing the contextual information associated with that memory.
Cingulate gyrus	• The cingulate gyrus is part of the cingulate cortex, which is situated above the corpus callosum. It forms the outermost component of the limbic system. • It plays an important role in attention, and cognitive and emotional processing. Studies have shown that the anterior cingulate cortex (the front part) combines emotional, attentional and body information to bring about conscious emotional experience. It also participates in: - emotion formation and processing (Hadland et al., 2003; Vogt, 2005), learning (Bussey et al. 1996) and memory (Kozlovskiy et al., 2012; Stanislav, et al., 2013) - responding to emotional aspects of pain, including physical pain (such as touching a hot stove) and psychological pain (such as being socially cast out) (Gleitman et al., 2011).

Structure of the limbic system	Implications for emotion
Basal ganglia	• The basal ganglia, a group of subcortical structures located at the top of the midbrain, are known for their role in voluntary movement and cognitive functions. More recently, studies have shown that there is a limbic region of the basal ganglia involved in affective functions and these structures form part of a neural loop that plays a key role in how we process and **regulate emotions**. The basal ganglia is involved in: - recognising emotions in others (Cheung et al., 2006), such as understanding facial expressions and body language during a conversation, which is important for social interactions - the brain's reward system, primarily through the action of the neurotransmitter dopamine (Haber & Knutson, 2010), which can be linked with learning and habit formation (Graybiel, 1995) - decision-making: evaluating the emotional outcomes of our actions, like weighing the risks and rewards of a choice (Zald & Andreotti, 2010). • Dysfunction in the basal ganglia has been linked to the development of symptoms associated with neurological disorders, such as Parkinson's disease, and psychological disorders, such as major depressive disorder, generalised anxiety disorder and schizophrenia (Macpherson & Hikida, 2019).

emotional regulation
the ability to control and productively use one's emotions

Study tip

Subcortical refers to parts of the brain that are located below the cerebral cortex.

Study tip

"Affect" and "emotion" are related concepts, and for the purpose of your studies, you can consider these synonymous. However, the term "affect" is broader and more encompassing and can be used to describe and measure feelings or emotions.

Real-world psychology

Generalisability of animal models in psychological research

The human brain is widely recognised as being the most complex brain of all animals. It is capable of experiencing complex emotions and higher order thinking. Despite this, dolphins – in particular killer whales – have been shown to have a larger and more complicated limbic system than people.

FIGURE 2 The human brain and dolphin brain have a similar structure but different systems.

Killer whales are the largest species of dolphin. They are a herd species, spending their entire lives in close family pods, with a matriarch at the head of the pod. Killer whales are highly social creatures, with their own dialects, hunting styles and social structures that can be as complex, if not more, as those of humans. The social nature of killer whales is integral to their survival.

MRI studies of a killer whale's brain have shown that the limbic system, or lobe, is significantly larger than in humans. MRI imaging has also shown that the areas adjacent to the limbic system in killer whales are highly related to emotional and social connections. Spindle cells are cells that are associated with the way that primates and humans process social structures. These cells appear in greater numbers in killer whales compared to humans.

Killer whales that have been studied in the wild or, unfortunately, captivity are known to display a range of emotions including anger, fear and joy. They have also been shown to be self-aware. The size of a killer whale's limbic system, and their

complex social structures, can be used as a springboard for the importance of the limbic system in emotional regulation.

Apply your understanding

1 **Identify** two strengths of using animal models in psychological research. (2 marks)
2 **Explain** two factors that should be considered when evaluating the generalisability of findings related to animal research. (2 marks)
3 **Design** a modification to improve the generalisability of the findings. **Justify** your response. (2 marks)

LeDoux's biological model

The limbic system and specific brain structures are implicated in various stages in emotional regulation as shown in **LeDoux's biological model of emotion**. LeDoux (1994) discovered two neurological pathways for emotion: the "short" and "long" routes.

The first, "direct" pathway (the **short route**) involves the transmission of sensory information from the thalamus straight to the amygdala. In a threatening situation, the amygdala signals the hypothalamus to trigger the autonomic nervous system to prepare the body for action such as running from danger. LeDoux proposed that the short pathway offers an evolutionary advantage as it involves fast, unconscious processing; however, without conscious assessment of the situation, this can lead to an inaccurate response.

In the second, "indirect" pathway (the **long route**) sensory information from the thalamus is passed to the cortex and hippocampus, then the amygdala. The long pathway provides time for a more accurate appraisal of the situation and engaging in a more appropriate response.

Both pathways influence the autonomic nervous system (ANS). In response to danger, the sympathetic branch of the ANS prepares the body for action by ramping up physiological arousal. Once the threat has passed, the parasympathetic branch of the ANS is activated to prepare the body for rest by tamping down physiological arousal.

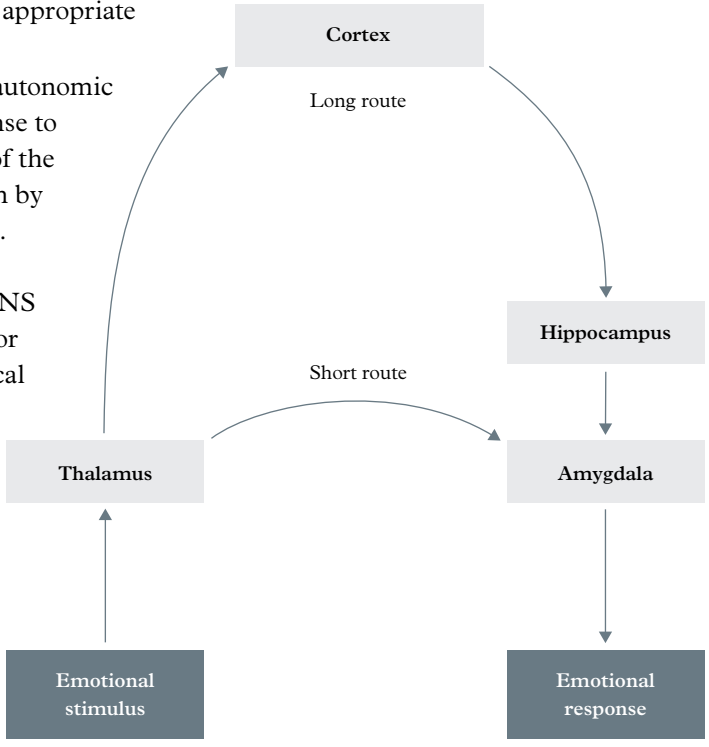


FIGURE 3 LeDoux's biological model of emotion with the long and short pathways

LeDoux's biological model of emotion
a model that proposes there are two neural pathways of emotion

short route
environmental stimuli are sent directly from the thalamus to the amygdala for fast but "thoughtless" response

long route
environmental stimuli are sent from the thalamus to the cortex and the hippocampus before the amygdala, allowing time to appraise the situation (i.e. a "thoughtful" response)

Study tip

Recall from Module 4, the autonomic nervous system controls involuntary body functions and is divided into two branches: the sympathetic nervous system and parasympathetic nervous system. They work on the same body systems but in opposite ways.

Real-world psychology

Biology of emotion

In 2008, researchers Kevin Ochsner and James Gross studied fMRI imaging to determine if emotional responses were more present in certain areas of the brain. Their study focused on the limbic system, in particular the amygdala and prefrontal cortex. Ochsner and Gross (2008) suggested that a SCAN (social cognitive and affective neuroscience) model should be used to assess cognitive emotion regulation. SCAN models are multi-level and suggest that there should be a link between the measures of behavioural, experiential and physiological responses to the descriptions of information processing systems and their neural substrates (Ochsner & Gross, 2008).

Ochsner and Gross found that the prefrontal cortex is involved in cognitive reappraisal, as is the amygdala, which has been implicated in emotional responding. They found that the amygdala's involvement changes depending on what the reappraisal is trying to achieve. If the reappraisal's aim is to increase emotion, this may increase activity in the amygdala. Alternatively, if the goal of reappraisal is to decrease emotion, this may decrease activity in the amygdala (Ochsner & Gross, 2008).

Ochsner and Gross also found that the systems involved in reappraisal may be different from those that are involved in other forms of emotional regulation, such as emotional suppression. They found that reappraisal was associated with a decrease in amygdala activity, and suppression was associated with an increase in amygdala activity.

Apply your understanding

1 **Identify** the area of the brain that plays a role in cognitive reappraisal. (1 mark)
2 **Describe** what emotion regulation is. (1 mark)
3 **Describe**, with reference to the findings by Ochsner and Gross (2008), the function of the amygdala in emotion. (1 mark)
4 **Justify** why functional imaging was most appropriate for this study. (1 mark)
5 In this study, the researchers identified activity within the amygdala and the prefrontal cortex. **Evaluate** the validity of LeDoux's biological model of emotion based on the findings of this research. (4 marks)

Check your learning 16.2

Check your learning 16.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the structures of the limbic system. (6 marks)
2 **Describe** how the thalamus is involved in emotion. (1 mark)
3 **Explain** the function of the hypothalamus in emotion with respect to autonomic arousal. (1 mark)

Analytical processes

4 **Distinguish** between the short and long route of LeDoux's biological model of emotion with respect to speed and level of awareness. (1 mark)
5 **Compare** the roles of the amygdala and the hypothalamus in emotion. (2 marks)
6 Jane touches a hot stove and immediately pulls back her hand. **Determine** which part of the limbic system primarily processed her physical pain response. (1 mark)

Knowledge utilisation

7 **Predict** the risks of only using the short pathway in LeDoux's biological model. (2 marks)
8 Rahul is deciding whether to invest in a risky stock. **Deduce** the part of the limbic system that helps Rahul evaluate the emotional outcomes of this financial decision. **Justify** your response. (2 marks)

Practical

Lesson 16.3
Practical: Can emotions be influenced?

Learning intentions and success criteria

oxforddigital **This practical lesson is available on Oxford Digital. It is also provided as part of a printable resource that can be used in class.**

Lesson 16.4
Factors that affect happiness

Key ideas

→ Happiness is a complex and multifaceted construct that relates to wellbeing and positive emotions.

→ Factors that have the potential to affect happiness include age, physical health, culture, religion, income and employment, and intentional activities.

Learning intentions and success criteria

Introducing happiness

happiness
a complex and multifaceted construct that relates to wellbeing and positive emotions

People have chased the idea of happiness for centuries. In 2019, Hills and colleagues estimated that 6 per cent (around eight million) of all books published are written about happiness, suggesting its significance in our lives.

In psychology, **happiness** is a complex and multifaceted construct that relates to wellbeing, such as life satisfaction, and positive emotions. Researchers are interested in studying happiness because positive emotions and wellbeing have been empirically associated with many positive life outcomes such as greater professional success, better mental and physical health, better relationships, and extended life expectancy (Cohn et al., 2009).

Everyone strives to achieve a state of happiness, but influences on happiness are often unclear. Research shows that happiness is not the result of bouncing from one joyful experience to the next; achieving happiness typically involves periods of considerable discomfort.

There is debate about what affects happiness, and whether happiness affects these factors. For example, people may assume that because someone has a higher income, they are happier than someone with a lower income. Alternatively, it may be the case that this person with the higher income earns a higher income because they are happier.

Study tip

Social desirability bias is a type of confounding variable. It can occur when people change their responses or behaviour because of their desire to be liked more. This is an extraneous variable that researchers need to consider, particularly when using face-to-face interviews.

FIGURE 1 Happiness is a complex and multifaceted construct.

Effects on happiness

Happiness is a difficult construct to measure. Often happiness is measured using a self-report, or the reports of close family or friends. As with all self-reports, people are able to respond in a way that reflects how they would "like" to be seen. Even when friends or family are reporting, the individual they are reporting on may be portraying themselves as being happy despite the reality of their feelings.

Rather than focusing on factors that *definitely* affect happiness, it is best to think of these as factors that have the *potential* to affect happiness and be affected by happiness.

FIGURE 2 Younger people experience periods of intense happiness, and older people may achieve greater overall happiness.

FIGURE 3 Less stress about physical health has been associated with greater happiness.

FIGURE 4 Bhutan values and measures gross national happiness as a more significant indicator of progress and development than gross domestic product.

Some of the factors with potential to affect happiness are:

- age
- physical health
- culture
- religion
- income and employment
- intentional activities.

The following paragraphs describe these factors in more detail. Of course, having one or any of these factors alone is not a guarantee of happiness.

Age

Research by Ed Diener (1984) suggests that age has limited effects on levels of happiness. Younger people may feel more intense happiness; however, people may achieve greater overall happiness and wellbeing as they grow older.

Physical health

General physical health typically peaks between adolescence and middle age. During this time, people are less susceptible to illness, and typically immune systems are strong. You are no longer at risk of many childhood illnesses and are not yet affected by age-related debilitation, including weakening bones and age-related memory loss. Being less stressed about physical health has been associated with increased happiness levels.

Culture

Different cultures have different expectations of what should make someone happy. A notable example of this is Bhutan, which instead of measuring the country using gross domestic product, measures the gross national happiness. By Western measures, Bhutan is one of the poorest countries in the world, and yet their population is increasingly happy.

The cultural expectations of the place where you live can influence how happy you are. This can be because of reduced stress as well as general happiness.

Religion

While religion may not be something that everyone participates in, research has shown that those who are actively religious have increased levels of happiness. This can be because they attend church regularly, and therefore have social engagements and a sense of community, which leads to increased happiness and wellbeing.

FIGURE 5 Being actively religious can increase levels of happiness.

Income and employment

Being employed, with a good income, typically reduces stress for most individuals. But determining what people regard as a "good" income is not as clear. People often assume that millionaires are much happier than the rest of the population, however, research by Diener and Seligman (2004) suggests that once someone is able to earn enough to support themselves, their families and any medical costs, there is little difference in happiness levels.

For example, someone earning $35,000 a year may not be able to cover their family's costs including medical, but someone earning $70,000 may be able to support these costs. In this instance, the happiness levels of someone earning $70,000 should be similar to someone earning $150,000, provided that both individuals are able to support their family.

FIGURE 6 Ability to support one's family is a better predictor of happiness than level of income.

Intentional activities

Intentional activities are deliberate actions individuals take to enhance their happiness. Examples include practising mindfulness, which fosters a present-focused awareness that can reduce stress; engaging in activities that produce flow, a state of absorption where time seems to stand still; and consciously increasing positive emotions through acts like expressing gratitude or performing kind deeds.

FIGURE 7 Intentionally engaging in activities to induce a state of absorption, such as yoga and meditation, can enhance happiness.

Challenge

The heritability of happiness

The factors that affect happiness described in this lesson are environmental factors. Conduct research online and **determine** the heritability of happiness; for example, to what extent do genes affect a person's level of happiness?

Skill drill

Analysing scientific investigations

Science inquiry skills: Planning investigations (Lesson 1.4); Evaluating evidence (Lesson 1.8)
Read the following excerpt from Kyoto University (2015, November 20).

Can happiness be measured? Sato (2015) and his team at Kyoto University think so. People feel emotions in different ways; some people feel happiness more intensely than others when they receive compliments. Emotional factors and satisfaction of life together may constitute the subjective experience of being "happy". Sato and his team wanted to see if there was a neural mechanism for happiness, so they scanned the brains of participants with an MRI. The participants then took a survey that asked how happy they were generally, how intensely they felt emotions and how satisfied they were with their lives. The findings were that those who scored higher on the happiness surveys had more grey matter in the precuneus, a region in the medial parietal lobe. Those with a larger precuneus were likely to experience happiness more intensely (Sato, 2015).

Practise your skills

1 **Identify** the type of design used in this investigation. (1 mark)
2 **Create** a research question for this investigation. (1 mark)
3 **Describe** a limitation that results from the type of investigation design used. (1 mark)
4 **Identify** a feature of the MRI scans that limits the generalisability of the findings. (1 mark)

Check your learning 16.4

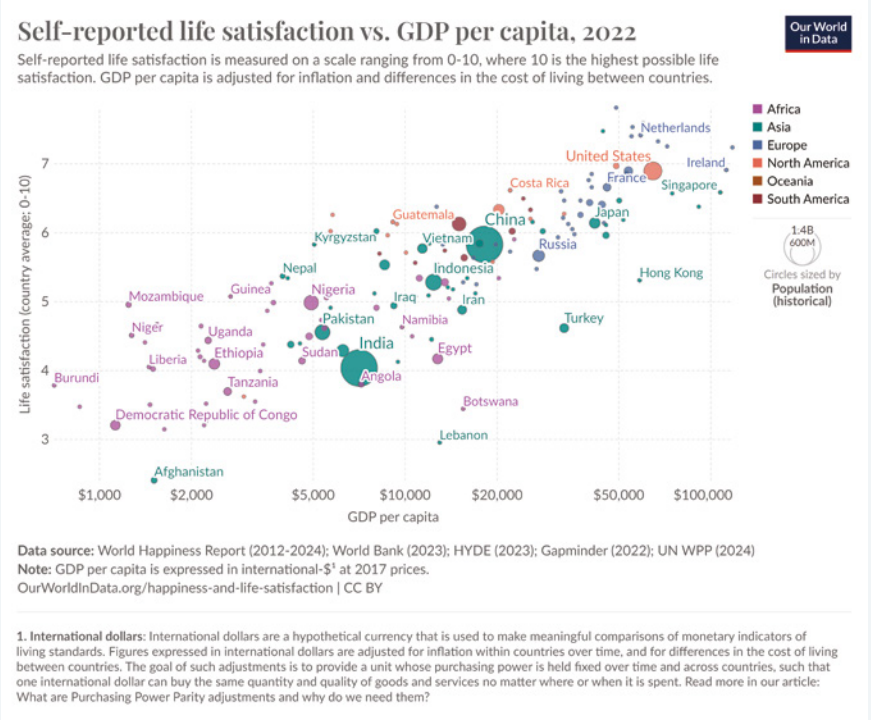
Check your learning 16.4: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Define** happiness. (1 mark)
2 **Describe** how physical health affects happiness. (1 mark)

Analytical processes

3 **Contrast** the influence of culture and religion on happiness. (1 mark)
4 **Deduce** the relationship between happiness and income using evidence from the graph. (2 marks)



Lesson 16.5
Wellbeing

Key ideas

- → Subjective wellbeing developed by Diener (1984) proposes that wellbeing is determined by one's global satisfaction with life and overall balance of positive and negative affect.
- → Psychological wellbeing as discussed by Ryff (1989) proposes that six dimensions contribute to our overall wellbeing: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life and self-acceptance.
- → The broaden-and-build theory of emotion developed by Fredrickson (2004) proposes that increasing frequency of positive emotions leads to improved wellbeing.

Learning intentions and success criteria

Introducing wellbeing

In the previous lesson, we described happiness as a complex and multifaceted construct that relates to wellbeing and positive emotions. Just like other constructs, such as intelligence, researchers have taken different approaches to operationalising happiness and consequently how they measure happiness.

Subjective wellbeing

Ed Diener, aka "Dr Happiness", is often recognised as the father of positive psychology, a field of psychology that focuses on improving or maintaining mental health rather than the traditional focus on mental illness. His pioneering work on **subjective wellbeing** laid the groundwork for assessing personal happiness and life satisfaction through self-reports and enabling the empirical study of happiness. The subjective nature of wellbeing is that it relies on a person's own experience (Diener, 1984).

subjective wellbeing
how people evaluate their lives to determine their level of wellbeing

Model of subjective wellbeing

Diener's research led to the development of his **model of subjective wellbeing**. There are two key areas to Diener's wellbeing model:

1 life satisfaction
2 affective balance.

model of subjective wellbeing
Diener's model that wellbeing is based on life satisfaction and affective balance

FIGURE 1 Diener's model of subjective wellbeing is based on life satisfaction and affective balance.

Life satisfaction

Life satisfaction involves a global judgment about satisfaction with one's life. Life satisfaction is influenced by the perception of fulfilment or meaning from the domains closest to you; for example, family, friends and marriage (Diener, 1984). To measure life satisfaction, Diener developed the Satisfaction with Life Scale (SWLS).

life satisfaction
a subjective and global judgment of satisfaction with one's life

Affective balance

affective balance
the moods, emotions and feelings that a person experiences

Affective balance encompasses all the positive and negative moods, emotions and feelings that an individual experiences over a period of time. An individual may experience a combination of positive feelings, such as happiness and excitement, and negative feelings, such as anger and sadness, or they may experience one more than the other (Diener, 1984). All people experience positive and negative affects; however, those who, on balance, experience more positive than negative affects report greater wellbeing which, in turn, is associated with higher levels of happiness.

The positive and negative affect schedule (PANAS) (Watson et al., 1988) is one of the most widely used measures of affective balance.

FIGURE 2 We all experience positive and negative affects.

Psychological wellbeing

psychological wellbeing
wellbeing conceived as a multi-dimensional model with six key domains: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life and self-acceptance

autonomy
independence and a feeling of being able to use one's own free will

environmental mastery
being able to direct our own lives

personal growth
feeling that one can continue to develop and try new things

positive relations with others
when one can develop and maintain close relationships with others

purpose in life
when one has goals in life and feels that these goals provide life with meaning

self-acceptance
when one views oneself as a whole in a positive way

Another model of wellbeing was developed by Carol Ryff. Ryff's (1989) model of **psychological wellbeing** was developed as a multi-dimensional framework to capture the complexity of human functioning beyond the scope of traditional measures of mental health. The model identifies six equally weighted dimensions related to psychological wellbeing:

1. **Autonomy** is the ability of an individual to make their own decisions using their own free will.
2. **Environmental mastery** is a feeling of being able to influence our own lives.
3. **Personal growth** is when a person feels that they are able to continue to develop and experience new things, which they can recognise.
4. **Positive relations with others** is where individuals have close bonds with others that include intimacy, empathy and affection.
5. **Purpose in life** is when individuals have goals in life that give their lives meaning.
6. **Self-acceptance** is where individuals are able to have a positive outlook on all parts of themselves.

Ryff (1995) later suggested that all six components are required to achieve a sense of wellbeing. She asserted that wellbeing means more than simply feeling happy and satisfied. She proposed that it is a combination of the six factors above that provide an overall sense of wellbeing.

FIGURE 3 In Ryff's model, having positive, intimate relationships with others and working towards goals can help people achieve a sense of wellbeing.

Challenge

Wellbeing and happiness

Use the components of Ryff's (1989) model of psychological wellbeing to think about your own happiness. Consider your autonomy, environmental mastery, personal growth, relationships with others, purpose in life and self-acceptance. **Create** a mnemonic (a memory device) to help you remember the six dimensions of psychological wellbeing using your own experience as concrete examples.

Study tip

Factor analysis is a statistical method used to identify underlying relationships between various items (like questions on a test) and group similar things. You have already come across this in Lesson 10.2.

Measuring psychological wellbeing

In self-report measures of wellbeing, participants respond to a series of questions relating to each component. For example, Ryff's psychological wellbeing scale (PWBS) is an 18- or 42-item self-report questionnaire that measures each of the six dimensions of psychological wellbeing. Scores are added up at the end to provide a total wellbeing score. Table 1 displays how people may feel with high or low scores for each component.

TABLE 1 Possible feelings associated with high and low scores for psychological wellbeing

Factor	High score	Low score
Autonomy	• Independent and self-determining • Able to regulate own behaviour • Resists social pressures or conformity • Evaluates satisfaction with life by own personal standards	• Concerned with expectations of others • Relies on the judgments of others to make important decisions • More likely to conform to social pressures and behave how society expects
Environmental mastery	• Able to manage own environment • Will choose or create environments that are suitable for personal needs	• Difficulty managing everyday life • Feel as though they are powerless to change their environment • Feel that they have little control over the external world
Personal growth	• Open to new experiences • Has sense of purpose and can see improvement in their self • Continued development	• Has limited sense of progression • Feels as though they lack improvement over time and may feel bored and uninterested in life

Factor	High score	Low score
Positive relations with others	• Trusting and satisfying relationships with others • Strong empathy and concern for others • Capable of affection and intimacy and understand human relationships	• Limited close and trusting relationships • Have limited concern for others' wellbeing • Isolated and will not understand the nature of human relationships
Purpose in life	• Feels that past, present and future lives have meaning • Has goals and aims for life	• Has a limited sense of meaning in past, present and future lives • Limited goals and aims for the future • No beliefs that give meaning to life
Self-acceptance	• Positive attitude towards oneself • Acknowledges all aspects, positive and negative, of themselves • Positive feelings about past and current life	• Dissatisfied with themselves • Want to be different from what they are

Study tip

In psychology, when we talk about something being "multidimensional", we are saying it has many different parts or "dimensions", like a jigsaw puzzle that forms a picture when the pieces are joined. Psychologists create different models of a construct using different numbers of "pieces" called "dimensions" or "facets".

Validation of Ryff's model

Ryff and her colleague Keyes (1995) aimed to test and revalidate the six distinct dimensions of wellbeing proposed in Ryff's model of psychological wellbeing. Using multiple methods, including factor analysis, they sought to establish the independence of each dimension, both conceptually and empirically. Their findings supported the multi-dimensional nature of wellbeing and demonstrated that each dimension contributes uniquely to an individual's overall psychological wellbeing.

The study also explored how these dimensions of wellbeing correlated with various mental health measures, such as symptoms of anxiety and depression, and positive indicators of functioning like self-esteem and optimism. The results showed that higher scores on the dimensions of wellbeing were associated with better mental health and positive functioning.

This research provides empirical support for Ryff's model and underscores the importance of considering multiple dimensions of wellbeing. The model provides a framework for future research with practical applications in mental health and psychological support services.

The broaden-and-build theory

Psychologists have often focused on negative emotions in their research about happiness and wellbeing. They are the obvious choice, as presumably removing the causes of someone's sadness can lead to happiness. Negative emotions also have obvious biological and survival advantages. For example, when someone is afraid, this will activate their autonomic nervous system, which prepares their body to fight the threat or run, enhancing their chances of survival. Positive emotions may not have such an obvious survival advantage, but recent research by Barbara Frederickson has shown that there are benefits to positive emotions that need to be considered in wellbeing.

broaden-and-build theory focuses on the effect of positive emotions on wellbeing

The **broaden-and-build theory** focuses on positive emotions including joy, interest, contentment and love. Barbara Fredrickson (2004) proposed that these positive emotions encourage discovery of "novel and creative actions, ideas and social bonds", which helps to build an individual's resources. In turn, having greater resources allows individuals to experience greater wellbeing.

Fredrickson recognised that not only do positive emotions contribute to positive wellbeing, they can produce optimal wellbeing. The broaden-and-build theory provides a different approach to understanding emotion from other theories that have focused on how much negative affect a person has towards their overall satisfaction with life. The broaden-and-

build theory proposes that positive emotions broaden our thoughts and actions, which builds lasting personal resources that lead to increased positive emotions and greater wellbeing.

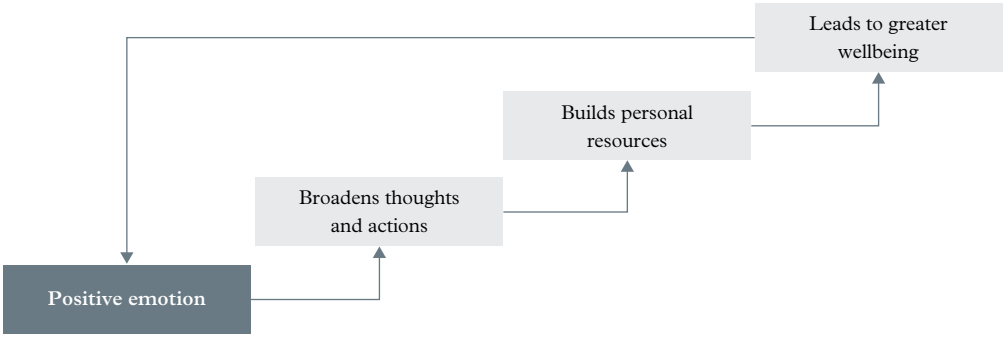


FIGURE 4 Fredrickson's broaden-and-build theory explains that experiencing positive emotions can create an upward spiral of wellbeing, which leads to more positive emotions.

The influence of negative and positive emotions on wellbeing

Negative emotions can narrow one's focus (Fredrickson, 2004). Recall the example of fear. If the situation is life-threatening, having a narrow focus on preservation of life can encourage quick action that will result in an immediate benefit – for example, running away from a bear. These negative emotions and subsequent actions were once entirely beneficial to human survival.

Positive emotions do the opposite; they are likely to broaden an individual's focus so that they experience a greater array of thoughts and actions that enter their mind. Fredrickson uses the example of joy. Joy makes people want to play, and this play encourages individuals to push their limits and use their creativity. Interest encourages the urge to explore, and contentment encourages the urge to sit back and take the world in, and integrate these circumstances into new views of the self and the world (Fredrickson, 2004). Fredrickson identified love as the merging of distinct positive emotions experienced within contexts of safe, close relationships, which creates recurring cycles of urges to play, explore and spend time with loved ones. Fredrickson's broaden-and-build theory suggests that the way these emotions encourage positive actions represents the way that positive emotions broaden habitual modes of thinking or acting.

FIGURE 5 The emotion of interest encourages the positive action of exploring.

Positive emotions

Earlier we viewed the benefits of negative emotions from an evolutionary and survival standpoint. Fear is beneficial as it causes activation of the fight-flight-freeze response, a key survival strategy that animals, including humans, possess.

The broaden-and-build theory has highlighted that positive emotions have benefits to "optimal wellbeing", but just how does this work? According to Fredrickson,

positive emotions positively influence wellbeing in a number of ways:

- A broadened mind has long-term adaptive benefits. It can lead to building enduring physical and emotional resources.
- Juvenile play prepares the young for adult survival, and without play in youth, adults may not be equipped for later life. Play builds social resources, which with age can develop into social support, and this, in turn, becomes intellectual support.
- Interest leads to exploration. Exploration creates knowledge and develops intellectual complexity.

FIGURE 6 Playing can help children build lifelong resources.

Perhaps what is key to "optimal wellbeing" are the personal resources that are developed and maintained during positive emotional states (Frederickson, 2004). These personal resources are durable and adaptive and are likely to last throughout the lifetime.

The broaden-and-build theory focuses on positive emotions. These positive emotions help people to broaden their knowledge, understanding and life experiences. Because of this broadening, individuals are able to build skills and relationships across the lifespan, which in turn increases the likelihood of optimal wellbeing.

Check your learning 16.5

Check your learning 16.5: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the six factors that Ryff determined were part of psychological wellbeing. (6 marks)

2 **Explain** subjective wellbeing with reference to Diener's two key areas. (2 marks)

3 **Explain** three benefits of positive emotions, with reference to the broaden-and-build theory. (3 marks)

Analytical processes

4 **Contrast** environmental mastery and purpose in life. (1 mark)

5 Tamika feels that she has a lot of control over her life, and thinks she can change things to improve her life. She has been dating her boyfriend for a year, has close friendships and gets along with her family. **Determine** which two aspects of psychological wellbeing you think she would score highly on. (2 marks)

6 Juan recently took a wellbeing test and received low scores for autonomy and personal growth. **Infer** what Juan is likely to feel about his life. (2 marks)

Knowledge utilisation

7 The broaden-and-build theory focuses on positive emotions instead of negative emotions. Think about your own life, and the positive experiences you have had. **Discuss** how these have contributed to your wellbeing. (2 marks)

Lesson 16.6
Mindfulness

Key ideas

- → Mindfulness is the practice of attending to one's present environment without judgment (acceptance).
- → Attention refers to how we pay attention to stimuli, including time and preference.
- → Acceptance involves the practice of embracing all thoughts, feelings and experiences without judgment, resistance or attempts to change them.
- → Mindfulness-based therapies can lead to reduced stress and greater wellbeing.

Learning intentions and success criteria

Introducing mindfulness

Founded in Buddhism, **mindfulness** has grown in popularity since its introduction to psychology in the 1970s. As a growing field of study, mindfulness is gaining credibility, and ongoing rigorous research is helping to establish its application as a therapeutic approach. For example, neuroimaging studies are currently exploring the neural mechanisms underlying mindfulness meditation to establish the effects of mindfulness practice on the brain.

mindfulness the practice of attending to one's present environment without judgment (acceptance)

Buddhism and other religions have practised mindfulness for centuries, alongside yoga and meditation. Mindfulness was introduced to psychology by Jon Kabat-Zinn in the late 1970s. Kabat-Zinn was introduced to mindfulness while studying at Massachusetts Institute of Technology and then began to practise living with mindfulness. Kabat-Zinn had a background in science and medicine and, after practising mindfulness, chose to remove the religious and spiritual background, and focus on mindfulness in a clinical sense. At its core, mindfulness is intentionally focusing attention on the present in an accepting way (Baer & Krietemeyer, 2006).

Understanding the theory behind mindfulness is important. It is also important to realise that knowing the theory behind living a mindful life is not the same as living mindfully. This textbook will only focus on explaining the concepts of mindfulness – attention and acceptance – and will not teach you how to live mindfully.

FIGURE 1 Mindfulness was founded in Buddhism and introduced to psychology by Jon Kabat-Zinn in the late 1970s.

Attention

attention (mindfulness)
how we pay attention to stimuli, including time and preference

Attention is the first component of mindfulness. In Lesson 7.2, we considered attention in the context of consciousness. There, attention was considered to be the amount of focus that we are able to provide to a certain internal or external stimulus. In the context of mindfulness, attention is concerned with how we actually attend to an environmental or internal stimulus, rather than what we are attending to.

FIGURE 2 Attention allows us to control our thoughts.

Mindfulness encourages individuals to self-regulate their attention. This is to encourage people to keep their attention on their immediate environment and experience, allowing for greater awareness of mental events in the present moment.

This increase in attention focuses beyond breathing and other physiological changes. It also centres on emotional fluctuations and the way we react to these changes. People who live mindfully are able to focus on the present moment and current events, rather than having their mind wander to previous or future events.

It has been said that people who regularly practise mindfulness are able to control their thoughts by controlling their attention (Kabat-Zinn, 2003).

Acceptance

acceptance (mindfulness)
the practice of embracing all thoughts, feelings and experiences without judgment, resistance or attempts to change them

Acceptance is the second major component of mindfulness. Once an individual is able to regulate their attention so that they are focusing on the present moment, they must then be able to recognise and identify these experiences in a certain way. When acknowledging present experiences, individuals should approach such experiences with openness, curiosity and acceptance (Bishop et al., 2004).

In approaching any present experience with openness, mindfulness encourages individuals to accept the experience without any criticism or judgment. The appeal of accepting the present and ourselves as we are, without judgment, has seen a rise in mindfulness-based therapies.

FIGURE 3 Approaching an experience with an open mind encourages acceptance of the experience without judgment.

Mindfulness-based therapies

Mindfulness-based therapies have been used and developed since mindfulness was introduced to psychology in 1979. Jon Kabat-Zinn developed mindfulness-based stress relief (MBSR) therapy, and since then many other psychologists have built acceptance-based therapies focused on accepting the present experience with an open mind. All mindfulness-based interventions and therapies encourage participants to change the way they pay attention and reach a non-judgmental acceptance of their experiences.

It is thought that mindfulness therapy can change the typical relationship between internal experiences and behaviour without directly needing to target emotions or cognitions for change.

Mindfulness is different from other psychological theories in that it encourages people to change their entire way of thinking and living. Mindfulness, as a therapy for life, is not something people can pick up whenever they feel like it. It is something that must be practised so that you can attend to things in a mindful way, and so that you can approach what you attend to with acceptance. Mindfulness is not about achieving a goal, but learning to just "be".

FIGURE 4 Mindfulness can be practised anywhere, so long as attention is focused on the present in an accepting way.

Challenge

Mindfulness-based stress reduction

Investigate mindfulness-based stress reduction (MBSR), as originally developed by Jon Kabat-Zinn. **Evaluate** this as a treatment for depression and anxiety.

Check your learning 16.6

Check your learning 16.6: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** the key aspects of mindfulness. (2 marks)
2 **Describe** mindfulness. (1 mark)
3 **Explain** what is meant by attention and acceptance in mindfulness. (2 marks)

Knowledge utilisation

4 Mindfulness has many applications. **Predict** two challenges with practising mindfulness. (2 marks)

Lesson 16.7
The flow experience

Key ideas

- → The flow experience describes the way that some people are able to fully immerse themselves in a task.
- → The flow experience includes six features: intense and focused concentration on the present moment, merging of action and awareness, loss of reflective self-consciousness, a sense of personal control over the situation/activity, an altered experience of time, and experiencing the activity as rewarding.
- → Experiencing flow is associated with increased positive affect and life satisfaction.

Learning intentions and success criteria

Introducing the flow experience

Have you ever been so involved in something that you forgot about everything else? Perhaps you were learning to ride a bike. Do you remember how long you spent trying to learn? Did you still remember to eat? Can you recall how it felt when you had finally mastered riding a bike? You may have been experiencing flow. **Flow** is a mental state where we are entirely focused on what we are doing, to the point that we may forget about our basic needs.

flow
a psychological state where a person is deeply focused and involved in what they are doing, to the point that basic needs are ignored and they may be unaware of anything else

The flow experience was identified in 1975 by Mihaly Csikszentmihalyi, a Hungarian psychologist. Csikszentmihalyi became fascinated with artists and musicians and how they could become so focused on their work that they would become almost lost in it, to the point that they could go without food and sleep because they were so intent on what they were creating.

Csikszentmihalyi began to try to understand this experience and the artists who entered it. From this came the idea of the **flow experience**. Csikszentmihalyi was also fascinated by happiness, and how people could achieve a state of being happy. The flow experience was largely based around the notion that people could be at their happiest when they were in a state of flow.

flow experience
a theory developed by Csikszentmihalyi and Nakamura to describe the immersion people find themselves in when focusing on a task

FIGURE 1 Artists getting lost in their work was the inspiration behind Csikszentmihalyi's research into the flow experience.

Features of the flow experience

Csikszentmihalyi and Jeanne Nakamura (2002) proposed six factors that are featured in the flow experience:

1. intense and focused concentration on the present moment
2. merging of action and awareness
3. loss of reflective self-consciousness
4. sense of personal control over the situation/activity
5. altered experience of time
6. experiencing the activity as rewarding.

Any of the six components can be experienced individually, or you may experience several at once, but unless you are experiencing all six at the same time, you are not having a flow experience.

Since the original six factors were proposed by Csikszentmihalyi and Nakamura, an additional three factors have been suggested: receiving immediate feedback, feeling that you have the potential to succeed, and being so involved in the experience that other people are no longer a concern.

Challenge

Experiencing flow

Csikszentmihalyi identified flow in artists who were painting. Many athletes, artists and surgeons have reported having the flow experience. Remember a time when you may have been experiencing flow, and consider the feelings that you had at the time.

Identify the six factors in your experience.

Enhancing life through flow

Since its introduction, the flow experience has become a centre point for positive psychology. Positive psychology is a movement that focuses on mental health as a whole, rather than mental illness. As such, the flow experience has been shown to have positive benefits for life as a whole. The greater the amount of time spent in a flow state, the happier and more successful people have been found to be.

Positive affect and life satisfaction

By nature, the flow experience should be a positive experience. When a person enters a state of flow, it is typically associated with enjoyment, and often while participating in an activity that the person is passionate about. An increase in enjoyment has been linked to increases in positive affect, and in turn, happiness and wellbeing.

The flow experience also leads to increased growth and personal development. Recall that the broaden-and-build theory (Lesson 16.5) identifies that feelings of growth and personal development contribute to psychological wellbeing. The flow experience fosters growth, which should increase positive affect and wellbeing (Nakamura & Csikszentmihalyi, 2002; 2009).

FIGURE 2 The more time spent in flow, the happier and more successful people have been found to be.

These increases in positive affect have been linked with increased life satisfaction (a component of Diener's model of subjective wellbeing, Lesson 16.5). Several aspects of entering a flow state increase positive affect. For example, those who frequently experience flow are likely to have greater life satisfaction than those who do not, possibly because of what they achieve while in the flow state. For example, an artist who enters flow and finishes work on a masterpiece may feel accomplished.

Performance and learning

Flow experiences allow people to develop their skills and strengths in a positive way. When someone is in a state of flow, they are directing their attention to become an expert at the task they are working on or towards. For an artist, this may be completing their painting; for a surgeon, this could be mastering a certain procedure. To continue their flow state, the individual must continue to seek greater challenges.

By taking on new challenges, or pushing ability, people are building and stretching their skills. When one finishes a flow experience, they may leave it feeling more competent and capable of new challenges.

Flow has been associated with an increase in intrinsic motivation and self-directed learning, and increased performance in the specific area that their flow state was related to. Flow has been shown to increase achievement in activities as well as lowering anxiety and increasing self-esteem. Flow experiences can strengthen performance as they encourage people to work harder and take on more challenges (Nakamura & Csikszentmihalyi, 2002; 2009). However, performance also makes entering a flow experience more likely as people are more comfortable practising their skills.

FIGURE 3 It is easy to imagine this teen is having a flow experience, practising shooting hoops from sunrise to sunset and giving them a sense of achievement when they have mastered the skill.

FIGURE 4 Leaving a flow state can leave you feeling capable of new challenges.

Criticisms and concerns

The flow experience is overall a positive one and is linked to increases in positive affect and learning. However, despite these positive effects of the flow experience, like all good things, the flow experience has some drawbacks.

Flow experiences can become addictive to those who experience them frequently. When an individual is addicted to the flow experience, they may find it harder to cope with general life experiences because they are used to experiencing flow, which can make their general life seem less interesting.

Check your learning 16.7

Check your learning 16.7: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Define** "flow". (1 mark)

2 **Describe** the six factors of the flow experience. (6 marks)

3 **Explain** how the flow experience leads to positive emotions. (2 marks)

Analytical processes

4 **Consider** how the positive consequences of the flow experience can enhance life satisfaction, and performance and learning. (3 marks)

Knowledge utilisation

5 Jasper is a competent maths student. Recently, Jasper has noticed that he is able to study and complete maths equations for hours without stopping, not even becoming aware of being hungry. Jasper gets great intrinsic reward from solving the problems, but his parents complain when he stays up too late to work on his maths. Jasper is usually unaware of the time. **Assess** if Jasper is experiencing flow. **Justify** your response. (2 marks)

MODULE 16

Lesson 16.8
Review: Emotion and wellbeing

Summary

16.1
- There are three components to emotion: physiological changes, subjective feelings and behaviour associated with these.
- Schachter and Singer's two-factor theory of emotion considers that we experience emotions based on our interpretation of physiological changes experienced in response to an event or situation.
- Lazarus's appraisal theory of emotion considers that we experience emotions based on our evaluation of a situation or event.

16.2
- The limbic system is a collection of interconnected brain areas involved in experience and expression of emotion.
- Structures in the limbic system include the thalamus, hypothalamus, amygdala, hippocampus, cingulate gyrus and basal ganglia.
- LeDoux's biological model of emotion identifies a short (unconscious) and long (conscious) neurological pathway for emotion.
- The short pathway bypasses the sensory cortex and hippocampus to reach the amygdala. This results in a "thoughtless" response to a stimulus, which is useful for survival.
- The long pathway receives sensory information from the thalamus and relays this to the cortex, the hippocampus and then to the amygdala, allowing more time for us to make a "thoughtful" appraisal and plan a more appropriate response.

16.3
- Practical: Can emotions be influenced?

16.4
- Happiness is a complex and multifaceted construct that relates to wellbeing and positive emotions.
- Factors that have the potential to affect happiness include age, physical health, culture, religion, income and employment, and intentional activities.

16.5
- Subjective wellbeing developed by Diener (1984) proposes that wellbeing is determined by one's global satisfaction with life and overall balance of positive and negative affect.
- Psychological wellbeing as discussed by Ryff (1989) proposes that six dimensions contribute to our overall wellbeing: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life and self-acceptance.
- The broaden-and-build theory of emotion developed by Fredrickson (2004) proposes that increasing frequency of positive emotions leads to improved wellbeing.

16.6
- Mindfulness is the practice of attending to one's present environment without judgment (acceptance).
- Attention refers to how we pay attention to stimuli, including time and preference.
- Acceptance involves the practice of embracing all thoughts, feelings and experiences without judgment, resistance or attempts to change them.
- Mindfulness-based therapies can lead to reduced stress and greater wellbeing.

16.7
- The flow experience describes the way that some people are able to fully immerse themselves in a task.
- The flow experience includes six features: intense and focused concentration on the present moment, merging of action and awareness, loss of reflective self-consciousness, a sense of personal control over the situation/activity, an altered experience of time, and experiencing the activity as rewarding.
- Experiencing flow is associated with increased positive affect and life satisfaction.

Key studies

Diener, 1984
Fredrickson, 2004
Lazarus, 1982
Nakamura & Csikszentmihalyi, 2002
Ryff & Keyes, 1995
Schacter & Singer, 1962

Review questions 16.8A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 What are the components of emotion as identified by psychologists?
- **A** Physiological changes and cognitive assessment
- **B** Mood, subjective feelings and appraisal
- **C** Subjective feelings, associated behaviour and physiological changes
- **D** Cognitive labelling, subjective evaluation and valence

2 What is the most appropriate representation of the two-factor theory of emotion?
- **A** Emotion + physiological response = cognitive label
- **B** Cognitive label + emotion = physiological response
- **C** Physiological arousal + cognitive label = emotion
- **D** Environment + appraisal = emotional response

3 Consider the following scenario. Each evening on the way home from athletics training, Armand walks the same way. On one of the streets there is an unfriendly dog but it is usually behind a fence. This evening when Armand walked home, the dog was wandering along the street. Armand instantly crossed to the other side of the street, and felt his pulse quicken. Which response best describes what Armand was doing?
- **A** Experiencing the primary appraisal stage
- **B** Participating in secondary appraisal
- **C** Providing a cognitive label for the situation
- **D** Reacting to the environment

4 How is cognitive appraisal best defined?
- **A** The cognitive processes that occur before an emotion is displayed
- **B** Thinking about a situation and deciding how to act
- **C** Allowing people to assess how well they can handle a situation
- **D** Our emotional and physiological responses

5 What is the role of the amygdala in emotion?
- **A** It receives most sensory information and relays it to different parts of the brain.
- **B** It assesses the emotional relevance of stimuli and triggers appropriate responses.
- **C** It combines emotional, attentional and body information to bring about conscious emotional experience.
- **D** It is involved in processing and regulating emotions.

6 Which neurotransmitter is primarily involved in the brain's reward system and processed by the basal ganglia?
- **A** Serotonin
- **B** Dopamine
- **C** Epinephrine
- **D** Acetylcholine

7 Which researcher proposed that happiness is measured differently at different stages of life?
- **A** LeDoux
- **B** Schachter
- **C** Diener
- **D** Frederickson

8 What is the difference between subjective wellbeing and psychological wellbeing?

A Subjective wellbeing looks at six aspects of life that people need to have positive feelings about and psychological wellbeing only views your life satisfaction.

B Subjective wellbeing emphasises the importance of affective balance and psychological wellbeing is only concerned with looking at life satisfaction.

C Psychological wellbeing is a multi-dimensional model of wellbeing, whereas subjective wellbeing is based on an individual's life satisfaction and affective balance.

D Psychological wellbeing is only concerned with mental health, and subjective wellbeing is concerned with physical health too.

9 Someone who scores highly on purpose in life on Ryff's questionnaire is likely to

A find meaning in their past, current and future life, and have goals that reflect this meaning.

B have meaningful relationships with others and feel empathy for people in their life.

C rarely feel dissatisfied with themselves.

D have no beliefs that provide their life with meaning.

10 According to the broaden-and-build theory, what is one benefit of playing when you are young?

A Building social resources

B Being physically active, which may encourage you to be active as an adult

C Developing interests, which may encourage you to gain knowledge

D Learning how to climb trees

11 What would a person practising mindfulness experience?

A Paying attention to everything around them, and agonising over their life

B Attending to the present moment, and accepting their life as a whole

C Focusing on their past and future

D Not paying attention to their lives, and not accepting their feelings towards their life

12 What is the best explanation of mindfulness?

A Practising yoga on a daily basis

B Meditating every time you have a bad day

C Paying attention to the present and accepting the present

D Meditating and paying attention to the present

13 Someone in a state of flow would experience

A intense and focused concentration on the present moment, merging of action and awareness and an altered experience of time

B an altered experience of time, finding the activity rewarding, and a sense of no personal control over the activity

C merging of action and awareness, extreme self-awareness, and a sense of personal control over the situation

D feeling that they have no control over the activity, and getting limited reward from completing the activity, and intense and focused concentration

14 Which of these are benefits of the flow experience?

A Increased positive affect and life satisfaction by making people feel that they can't achieve anything

B Increased positive affect and life satisfaction by creating feelings of personal development and growth

C Increased learning and performance by encouraging people to take on new challenges

D Decreased learning, performance and life satisfaction

15 Samir is a dancer and often says that she is "in the zone". What may be a problem with frequently being in the zone?

A Samir may become dissatisfied with other aspects of her life.

B Samir would experience greater enjoyment from her dancing.

C Samir would become a better dancer and try more challenging tasks.

D Samir may lose track of time because she is so immersed in dancing.

Review questions 16.8B Short response

Review questions: Complete these questions online or in your workbook.

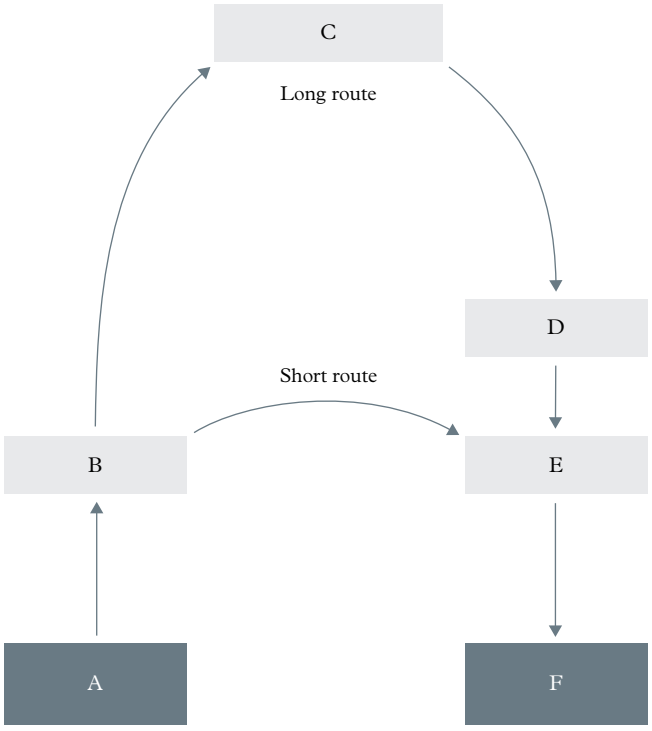
Retrieval and comprehension

16 **Define** happiness. (1 mark)

17 **Identify** the part of the brain that plays an important role in habit formation. (1 mark)

18 Shintaro often thinks about his past and his future, and forgets to focus on his present life. When he thinks about the future he thinks about everything he hasn't done and what he will need to do. **Explain** how mindfulness, with reference to attention and acceptance, may help Shintaro have a more optimistic outlook on his life. (3 marks)

19 **Identify** the components of LeDoux's biological model labelled A to F in the diagram. (6 marks)



20 **Describe** the physiological processes associated with emotion, with reference to LeDoux's biological model of emotion. (4 marks)

21 **Summarise** the broaden-and-build theory, with reference to the four stages of the spiral. (4 marks)

22 **Describe** the components of appraisal. (2 marks)

23 **Describe** the positive consequences of the flow experience with reference to performance and learning. (2 marks)

Analytical processes

24 In a social interaction, Mia struggles to interpret the facial expressions of others. **Determine** which part of her limbic system might be underactive. (1 mark)

25 **Classify** the following experiences according to a theory of emotion.

- **a** Experiencing a fright when you see a piece of black cotton, and then realising that it was not a spider (1 mark)
- **b** Stepping on a stick and thinking it is a snake (1 mark)
- **c** Having a racing heart when you hang out with friends and laugh at their jokes (1 mark)

26 **Compare** the broaden-and-build theory and psychological wellbeing. (2 marks)

Knowledge utilisation

27 **Construct** an argument in favour of subjective wellbeing over psychological wellbeing. (1 mark)

28 When Malcolm was a child, his parents were very nervous, and didn't tend to let him play with other children a lot. He would attend school and then come home, and his only social interaction outside of school was when he was playing or competing in sports. As an adult, Malcolm sometimes struggles to talk to people, and often feels that he cannot ask anyone for help when he needs it. **Evaluate** Malcolm's level of wellbeing with reference to the broaden-and-build theory. (4 marks)

29 **Discuss** the advantages and disadvantages of Carol Ryff's multi-dimensional model of psychological wellbeing. In your discussion, consider why categorising certain aspects of life can assist wellbeing, and how it may be detrimental. (4 marks)

30 **Consider** your position on this statement: "Negative emotions are more important than positive emotions." **Justify** your position using theories of happiness and emotion. (3 marks)

31 **Evaluate** whether flow and mindfulness can enhance the positive emotions identified in Fredrickson's broaden-and-build theory. (4 marks)

Data drill

Emotional stimuli and physiological response

A psychology class conducted an experiment to investigate how emotional stimuli affect physiological response.

- The experiment used a convenience sample of 31 Year 11 psychology students.
- The class used a repeated measures experimental design. In the experimental condition, students watched a 3-minute emotive video about friendship and loss. In the control condition, students watched an informative 3-minute video on rain.
- Students recorded their baseline heart rate and then recorded their heart rates at the end of each video. The control condition followed the experimental condition.
- Heart rate was measured using an external monitor and recorded in beats per minute (BPM).
- Assumptions for normality were met, and students used a two-tailed, paired t-test.

Descriptive and inferential statistics are summarised in Table 1.

TABLE 1 Statistical results from the experiment

Condition	*n*	*M*	SD	SE	*p*-value
Baseline	31	65.50	7.89	1.42	
Emotive	31	74.53	8.43	1.51	<0.001
Informative	31	65.83	7.70	1.38	

Apply understanding

1 **Identify** one assumption that makes it appropriate to use a paired *t*-test. (1 mark)

2 **Determine** which group (emotive or informative) had the greatest change in heart rate from the baseline. (1 mark)

Analyse data

3 **Distinguish** between the standard deviations for the emotive and informative conditions. (1 mark)

Interpret evidence

4 **Deduce** which condition had the most precise estimate of the sample mean. Use evidence to support your answer. (2 marks)

5 **Determine** whether a type I or type II error is most likely. **Justify** your response using evidence. (2 marks)

6 **Draw a conclusion** about the effect of emotional stimuli (emotive vs informative) on physiological response (measured by change in heart rate), with reference to data. (2 marks)

Module 16 checklist: Emotion and wellbeing

Quizlet: Revise key terms online to test your understanding

MODULE 17

Motivation

Introduction

At the most basic level, humans are motivated to survive, and certain physiological processes and responses exist for this reason. Beyond survival, people are motivated to do many different things; going to school, work, playing sport and exercising are just some examples. Identifying the things people are motivated to do is relatively easy, but identifying the reasons why people actually complete these tasks is more complex. This module will explore why people are able to achieve certain outcomes as well as the reasons behind that motivation.

Prior knowledge

Prior knowledge quiz Check your understanding of concepts related to motivation before you start.

Subject matter

Science understanding

→ Compare the achievement goal (task orientation and ego orientation), cognitive evaluation (intrinsic and extrinsic motivation), and self-efficacy (outcome expectations and efficacy expectations) theories of motivation.

→ Describe the role of goal setting in motivation (Locke 1996).

Science as a human endeavour

→ Consider that psychological research into flow can influence strategies used by employers to motivate and engage employees.

Science inquiry skills

→ distinguish between types of investigations
→ distinguish between levels of measurement
→ use mathematical techniques to summarise data, establish relationships and identify uncertainty through
  - descriptive statistics
  - correlation, e.g. Pearson *r* correlation coefficient
  - parametric inferential statistics

Source: *Psychology 2025 v1.1 General Senior Syllabus* © State of Queensland (QCAA) 2024

Key studies

Key study summaries

Read a summary of the key study for this module.
→ Locke, 1996

Lesson 17.1
Theories of motivation

Key ideas

- → The cognitive evaluation theory of motivation aims to explain how factors enhance or diminish internal motivation.
- → The achievement goal theory of motivation suggests that people are more motivated when they have clear goals they believe they are capable of achieving.
- → The self-efficacy theory of motivation suggests that a person's self-perception of whether they can achieve a task influences how much effort they devote to achieving it, and therefore whether they do, in fact, achieve it.

Learning intentions and success criteria

Introducing motivation

Think of a time you really wanted to achieve something. Maybe it was winning a game, acing a test, or even going on a date. Whatever the activity, just wanting a certain outcome wasn't enough – you needed the motivation to work towards it. But what is motivation and what motivates us?

Simply put, **motivation** is the reason we do things. It is the driving force that propels us to start and stick with the actions that help us achieve our goals. Without motivation, even the most capable people struggle to achieve their potential. Motivation also affects our emotions. Motivated individuals typically experience greater enjoyment and satisfaction in their efforts. Motivation is an important area of research in psychology as it is a key process to help individuals achieve success, as well as for organisations and schools to create environments that foster engagement and productivity.

Several theories propose reasons to explain why we are motivated by different factors for different events. These include the cognitive evaluation theory, the achievement goal theory and the self-efficacy theory. Each theory is discussed in turn.

motivation
the process that propels us to start and stick with goal-directed behaviours

Study tip

Goals in this context refers to anything that we want to achieve, whether it's getting a slice of cake from the fridge, catching up with friends, getting better grades or even climbing Mount Everest!

Types of motivation

Researchers distinguish between two main types of motivation: intrinsic and extrinsic (Deci & Ryan, 1985). **Intrinsic motivation** is when a person does something for no apparent reward, but because they genuinely enjoy it or find it interesting. For example, participating in sport because it is fun, studying a subject out of curiosity or passion, or persisting with music lessons because it's satisfying to see improvement. This type of motivation is closely linked to internal desires such as the need for autonomy (choice), competence (capability) and connection with others (Ryan & Deci, 2000).

On the other hand, **extrinsic motivation** is when a person does something to achieve a separate outcome. For example, doing an activity to receive a reward (such as money, medals, good grades or fame) or to avoid negative consequences that may occur if they don't complete the task (such as punishment).

intrinsic motivation
when people are motivated by internal factors, such as excitement, pleasure or joy, to complete a task

extrinsic motivation
when people are motivated by external factors, such as receiving a reward or avoiding punishment

FIGURE 1 A goal to study law could be intrinsically or extrinsically motivated, or a combination of the two.

Intrinsic and extrinsic motivation are not mutually exclusive; people may be motivated by both at the same time, or they may be more motivated by one, depending on the task or situation. You may be motivated intrinsically to study psychology because you find it interesting, and you are curious about understanding why people do the things they do. Simultaneously, you may be motivated extrinsically to get good grades that could lead to a higher paying job.

Cognitive evaluation theory

Cognitive evaluation theory (CET), developed by Edward Deci and Richard Ryan (1985), aims to explain variations in a person's level of intrinsic motivation by considering the effects of external social and environmental factors on internal motivation.

cognitive evaluation theory (CET)
aims to explain the effects of external environments on our internal motivation

In early experiments, Deci (1971, 1972) found that participants who received monetary rewards for completing a puzzle activity experienced a decrease in internal motivation after the reward stopped, while those who received positive verbal feedback experienced an increase in internal motivation and persisted with the puzzles longer (1972). These findings demonstrate that external rewards affect internal motivation, by either reducing or enhancing it. According to CET, these variations can be explained by considering our evaluation of how external events affect our perceived competency and autonomy. These are clarified through three key principles identified by CET.

FIGURE 2 CET aims to explain the effects of external consequences on internal motivation.

Perceived locus of causality

This principle refers to whether we see our actions as self-driven or controlled by external forces. CET proposes that external rewards, like money or deadlines, can shift our perceived locus of causality (deCharms, 1968) from internal (self-determined) to external (controlled). The perceived loss of autonomy (choice) can lower intrinsic motivation (Ryan & Deci, 2017). This could explain why the monetary reward lowered participants' motivation in Deci's 1972 study.

Impact on competence

CET also suggests that how we perceive our competence is important. Positive feedback or praise boosts our sense of competence and can enhance intrinsic motivation (as seen in the study by Deci, 1972), as long as it is not seen as controlling. In contrast, if external factors make us feel less competent, our intrinsic motivation drops.

Controlling vs informational aspects of rewards

CET distinguishes between the controlling and informational aspects of rewards. Controlling rewards pressure us to act in specific ways. Controlling events interfere with feeling autonomous which, can diminish intrinsic motivation. On the other hand, rewards that provide useful feedback can enhance our sense of competence without diminishing autonomy and thus increase intrinsic motivation.

Applying cognitive evaluation theory

CET helps us understand how different external factors – like rewards, praise and feedback – affect our intrinsic motivation. This understanding has practical implications in various areas, including education, work and parenting.

For example, in the workplace, managers can boost employees' intrinsic motivation by offering autonomy and meaningful feedback, rather than relying solely on incentives like bonuses.

Challenge

Putting CET into practice

What goals are you currently trying to achieve? Reflect on whether you are intrinsically motivated, extrinsically motivated or both. **Determine** how you could improve your motivation using principles from CET.

achievement goal theory
a theory that suggests people will be more motivated when they have clear goals that they believe they are capable of achieving

task-orientation goal
a goal that is focused on mastering a skill

ego-orientation goal
a goal that is focused on becoming the best at a skill

Achievement goal theory

The achievement goal theory is used often in sports to motivate players and athletes to perform at a higher standard. The **achievement goal theory** focuses on the aim or purpose of an individual's behaviour, and suggests that people seek competence and will be more motivated to achieve when they have clear goals (Wolters, 2004).

There are two particular goals that achievement goal theory focuses on: **task-orientation goals** and **ego-orientation goals**. Task-orientation goals are focused on mastering a skill, whereas ego-orientation goals are focused on comparing yourself to others.

FIGURE 3 The achievement goal theory is used often in sports.

Task orientation

When people are striving towards a task, they are motivated by mastering the task at hand. This involves learning as much as they can about the task, and applying this to their approach to the task. People who are motivated by tasks have a strong belief that the more effort they put in, the more successful they will be (Wolters, 2004).

Being task-oriented often relies on being intrinsically interested in the activity. People who are task-oriented will often use self-comparison to judge their success. They demonstrate their competence by learning and displaying new skills.

For example, if you are an aspiring tennis player who wants to enter the world circuit and you are task-oriented, you would focus on mastering your forehand and backhand shots, as well as your serve. You would feel great pleasure when you achieved the right spin on the ball and when you could see yourself mastering the performance, regardless of the outcomes of your matches.

FIGURE 4 A task-oriented tennis player focuses on mastering skills and gains satisfaction from improvement (intrinsic motivation). An ego-oriented tennis player focuses on being better than their opponent to win (extrinsic motivation).

Ego orientation

Ego-oriented people are likely to strive towards a task because they want to be better than someone or the best at something. Ego-oriented goals focus on a person's ability compared to someone else's ability. Competence in ego-oriented goals is displayed by being better than a competitor, not by mastering a task.

Being ego-oriented often relies on extrinsic motivators. People who are ego-oriented will use comparison to others as their main source of feedback and will feel little pride when they improve if they have not improved enough to be the best.

If you are an aspiring tennis player who wants to enter the world circuit and you are ego-oriented, you would feel disappointment when your backhand was not as good as your competitors, and even more disappointment if you realised it was worse than your competitors. You would be motivated to become better because you want to beat the competitor, and would feel little reward when you improved your technique if it didn't mean you would win.

Applying achievement goal theory

The achievement goal theory asserts that motivation is the result of the goals that we set ourselves and our perceived ability to succeed in achieving them. The result of the interaction between our goals and our competency varies according to whether we are task- or ego-oriented.

Intrinsic motivation tends to be a stronger motivator than extrinsic motivation. As task-oriented goals are more closely linked with intrinsic interest, people who are task-oriented are more likely to continue to work towards their goals even in the event that they are not successful (Wolters, 2004). Those who are ego-oriented, in contrast, are more likely to think that their ability is set and that no amount of effort they put in will change this. Ego-oriented people are therefore less inclined to try to improve their ability.

Task-oriented individuals will find ways to continue their motivation levels, despite any setbacks. In contrast, those who are ego-oriented may lose motivation if they face disappointment.

self-efficacy
belief in one's capability to achieve a specific task or action

self-esteem
an individual's general confidence in themselves and their capability

Self-efficacy theory

FIGURE 5 A person with a strong belief that they can achieve something (high self-efficacy) is motivated to keep working until they achieve the goal.

Self-efficacy theory was developed by Albert Bandura, a psychologist who has contributed research to several areas including social psychology and developmental psychology.

Self-efficacy is a personal judgment or belief of how likely it is that you will succeed in a task or activity (Bandura, 1977). A person's sense of self-efficacy can affect how they perceive or approach challenges or sources of stress. People with high levels of self-efficacy will be able to put effort in that will lead to successful outcomes. People with low levels of self-efficacy are likely to give up earlier or fail.

It is important to distinguish between self-efficacy and **self-esteem**. Self-esteem is a general feeling about yourself as a whole, while self-efficacy applies to particular skills and situations.

Effects of self-efficacy on motivation

Motivation can be affected by both low and high levels of self-efficacy. Essentially, people are more likely to participate in activities in which they think they can achieve success.

Those who believe that they are capable of performing a task are more likely to initiate and succeed in completing the task.

People are also influenced by how effective their actions will be at reaching the final outcome; this is their **outcome expectancy** (Bandura, 1977). If you have positive beliefs about the outcome, you are more likely to be committed to achieving your goal and, as a result, achieve your goal.

outcome expectancy an individual's assessment of how effective their actions will be at reaching a particular outcome

People who have high levels of self-efficacy can be more inclined to make a greater effort towards the task they are working on. They may also be more motivated to continue to try for longer than those with low self-efficacy (Bandura, 1977). Despite this tendency, people with high self-efficacy can also show less motivation to learn about a new topic, and as a result, perform worse than someone with low self-efficacy who may be more motivated to learn about an unfamiliar subject.

Skill drill

Types of data

Science inquiry skills: Planning investigations (Lesson 1.4); Collecting data (Lesson 1.6); Processing and analysing data (Lesson 1.7)

A principal is interested in studying the relationship between self-efficacy and academic performance for students in the school. The school engages a psychologist to conduct the investigation. The psychologist surveys a random sample of 20 students from each grade (7 to 12). The survey collects their age, gender, academic results in maths, science and English as well as their self-efficacy. Self-efficacy is measured using the General Self-Efficacy Scale (GSE; Schwarzer & Jerusalem, 1995) which consists of eight items, rated on a scale from 1 (strongly disagree) to 5 (strongly agree). Ratings are summed to calculate a total score. Higher scores indicate higher levels of self-efficacy.

Practise your skills

1 **Identify** the type of investigation being conducted by the psychologist. (1 mark)
2 **Determine** the level of measurement for each of the following
   a age (1 mark)
   b gender (1 mark)
   c self-efficacy (1 mark)
   d academic grade. (1 mark)
3 **Select** the most appropriate statistical test to establish the relationship between academic performance and self-efficacy. **Justify** your response. (2 marks)

Check your learning 17.1

Check your learning 17.1: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Describe** intrinsic and extrinsic motivation and provide an example of each. (4 marks)
2 **Describe** the cognitive evaluation theory of motivation with reference to the three key principles. (3 marks)
3 **Explain** the achievement goal theory with reference to task orientation and ego orientation. (3 marks)
4 **Explain** self-efficacy using an example. (2 marks)

Analytical processes

5 Ronnie has a chemistry test this week. Recently her parents have been encouraging her to try to study medicine, but Ronnie hates chemistry. Despite this, Ronnie is trying to study to achieve a good mark in chemistry.
   a **Apply** one of the theories of motivation to Ronnie and **determine** the likelihood of her maintaining motivation. (2 marks)
   b **Explain** why Ronnie is motivated with reference to the theory. (2 marks)
6 **Compare** the cognitive evaluation, achievement and self-efficacy theories by creating a Venn diagram. (2 marks)

Lesson 17.2
Goal setting in motivation

Key ideas

→ The goal-setting theory of motivation, developed by Edwin Locke in 1981 and expanded in 1996, proposes that goal setting can increase motivation.

→ According to the goal-setting theory, effective goals are clear and challenging, yet achievable. Additionally, the person must be committed to achieving the goal, and receive and act on helpful feedback, and the complexity of the task must be realistic given the available timeframe or strategy.

Learning intentions and success criteria

Introducing Edwin Locke

In Lesson 17.1, we discussed why people are motivated by different things and how these motivations can increase or decrease performance and facilitate task completion. But is there a "better" way to motivate yourself?

Edwin Locke's extensive research over 30 years has significantly shaped our understanding of how setting conscious goals can enhance performance in various tasks. Fundamentally, Locke argues against the notion that only external stimuli (i.e. consequences to actions such as reward or punishment) and subconscious factors (i.e. internal physiological impulses) are the primary motivators for human behaviour. Instead, Locke places consciousness (awareness) and volition (free will) as the core drivers of our actions.

Locke's goal-setting theory of motivation

In 1981, Locke and his colleagues discovered a relationship between how difficult a task is, and how well people perform when trying to complete the task. Their research found that a difficult goal provides more incentive to work towards achieving the goal. Furthermore, people are more likely to achieve goals that are specific, while vague goals may not be achieved. In other words, goals have two attributes: difficulty and specificity. A more difficult goal leads to greater sense of achievement since it pushes us to extend our efforts. A specific goal clearly defines the outcome, helping us to focus and regulate our actions more precisely. These attributes formed the basis of Locke's **goal-setting theory of motivation**, which was later expanded (1996) to five core principles of goal setting.

goal-setting theory of motivation
people are motivated to achieve tasks when they have clear, challenging goals to which they can commit fully and about which they receive feedback

Locke's five core principles of effective goal setting

Locke describes **goals** as the object or aim of an action – they are the end points we strive to reach. Locke's five core principles of effective goal setting, proposed in his 1981 work, are:

1. clarity
2. challenge
3. commitment
4. feedback
5. task complexity.

goal
the object or aim of an action

Locke's 1996 paper extends these principles, which are summarised in the following paragraphs.

Study tip

Locke's (1996) paper has a strong focus on the role of goal setting for motivation within an organisational context, focused on improving employee productivity and leadership capability. However, in this section, we contextualise Locke's ideas into an educational setting.

Clarity

Goals should be clear and understandable. When people have clear goals, they know what they need to do to complete them; if a goal is not clear, it can be hard to identify whether it has been achieved.

Challenge

Goals should be challenging enough to stimulate effort. Goals that are harder to accomplish provide greater motivation and result in higher satisfaction when they are achieved, provided the individual believes they can achieve the goal. In other words, it is pointless to set a challenging goal if one does not believe it can be achieved, as this can have the opposite, demotivating effect. This can lead to lower satisfaction, or even prevent us from trying in the first place.

Commitment

There must be a strong attachment or commitment to the goal, especially when it is specific and difficult. Commitment can be fostered through belief in the goal's importance and attainability. In organisations, effective leaders can enhance an individual's commitment to goals by providing an inspiring vision, acting as a role model, and demonstrating confidence in the individual's capabilities.

FIGURE 1 Locke's third principle: be committed to the goal

Feedback

Information on how well one is progressing towards the goal is important. Locke identified feedback as a key moderating factor for motivation. Feedback can provide opportunities to track progress, confirm expectations, and adjust goal difficulty or efforts in relation to your goal. It is important to have clear targets to reach so that people can see for themselves how they are progressing.

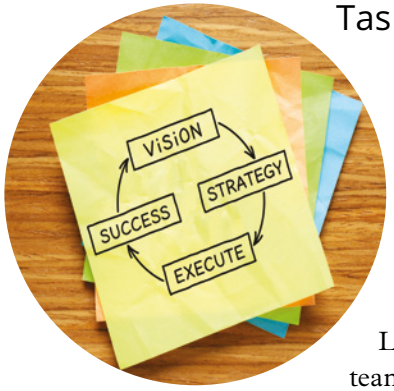


FIGURE 2 Locke's fifth principle: keep it simple while maintaining the challenge

Task complexity

Consideration must be given to the complexity of the task, with enough time or strategy for complex goals. It is important to keep things as simple as possible; for example, breaking down a complex task into smaller, more manageable steps, while maintaining the challenge. If a goal doesn't have sufficient time dedicated to it, or enough time allowed to work towards it, people can lose motivation.

Applying Locke's theory of goal setting

Let's put these five principles into practice. Imagine that you are part of a hockey team that is trying to get into the grand final after coming fourth for the last two seasons. The hockey league has 10 teams in it.

1. **Clarity:** The goal is easy to measure as it will be clear when the team makes the grand final, and their place on the league ladder will indicate their success.
2. **Challenge:** Reaching the grand final is challenging as the team has not been able to do so for the past two seasons. It is also achievable as they have placed fourth each season.
3. **Commitment:** If everyone thinks it is a nice idea to be in the final, but no one is prepared to commit to the goal and put in the extra effort required, it is unlikely that the team will make the grand final. All team members must be committed to the goal.
4. **Feedback:** Feedback on how the team is playing would highlight the team's strengths and weaknesses. Feedback could be provided by their coach, video recordings and the team's performance in matches throughout the season.
5. **Task complexity:** The team's goal is to reach the grand final, but they have not specified if they want to achieve it in the next or the following season. The team would need to assess if it is realistic to reach the grand final in the next season based on their current level of achievement, or if they would need two or more seasons.

Without goals, motivation cannot be directed anywhere. Goals help people channel their motivation into specific areas, to achieve or accomplish specific tasks. Locke's five principles form a comprehensive approach to goal setting that can enhance motivation, leading to better performance and greater likelihood of success.

Locke's theory and SMART goals

In your studies, you may have come across SMART goals. SMART is a mnemonic acronym developed by Doran (1981) as a framework for setting effective goals. The acronym stands for Specific, Measurable, Achievable, Relevant and Time-bound. The SMART framework relates closely to Locke's five principles of goal setting in the following ways:

- **Specific (S)** aligns with **Clear** from Locke's principles. A goal should be well-defined and clear to anyone who has a basic understanding of the project or task at hand.
- **Measurable (M)** corresponds with the **Feedback** principle. There should be clear criteria for measuring progress towards the attainment of each goal set, allowing for tracking and feedback.
- **Achievable (A)** is about setting goals that are **Challenging** yet attainable, which resonates with Locke's principle that goals should be challenging but still within one's capabilities.
- **Relevant (R)** ties into **Commitment**. The goals should matter to the person and align with other relevant goals. For someone to commit, the goal needs to be meaningful and important to them.
- **Time-bound (T)**, while not directly mentioned in Locke's principles, adds an element of task complexity in that it requires consideration of the time constraints and potential complexities within that timeframe.

Challenge

Putting Locke's theory into practice

Use Locke's five principles to **create** a goal that is meaningful to you. Consider both academic goals, like increasing your grade in a particular subject, and personal goals, like learning a new skill or improving at a sport.

Self-efficacy and motivation

Locke (1996) adds further insights to support goal-setting theory. Self-efficacy, the belief in one's own capability to achieve a goal, is also highlighted as a crucial element to motivation and goal achievement. Self-efficacy not only affects performance directly but also influences goal-setting behaviours, such as the level of goal difficulty one is willing to commit to and how one responds to feedback, especially after setbacks. Self-efficacy can be strengthened through past success, encouragement, and observing others succeed. There is also a reciprocal relationship between self-efficacy and goal setting (Artino, 2012): setting and achieving goals increases a person's belief in their capability (self-efficacy), and higher self-efficacy increases the quality and quantity of goals a person sets.

Limitations of goals

Can setting goals be harmful? Locke argues that goals set for the wrong outcome or goals that conflict with other goals can be harmful. While having a clear goal makes it easier to obtain feedback and track progress, the specificity can reduce creativity and discovery. Additionally, setting goals that are too high can lead to discouragement, and setting goals that are too low can lead to underachievement. This suggests that goals are most effective if there is a balance between high aspirations and realistic expectations.

Challenge

Goals and the zone of proximal development

Consider how setting goals that are too high relates to Vygotsky's zone of proximal development (Lesson 6.3).

Real-world psychology

Motivation in the workforce

For a long time, employers assumed that to motivate employees, they had to offer them more money. Employers assumed that this would make employees more dedicated to their work because they were getting a greater reward. Money is a good source of motivation, but employees also have higher rates of productivity if they can

FIGURE 3 Employees who are able to enter flow will be more motivated and have increased productivity.

be motivated to perform or deliver in other ways. Recently, employers have begun to realise that employees may want different rewards, such as increased work-life balance and flexibility, or wanting to create a quality product, or deliver quality service.

When Csikszentmihalyi developed the theory of flow (Lesson 16.7), it focused on athletes and artists, whose work is intrinsically motivating, and usually a passion of the individual. But research has built on this to suggest that if employees can engage in flow, they may be more productive and happier at work. This offers a different motivating strategy to the "If we pay you more you will do more" idea.

For employees to find a state of flow, they need to see value in their work, and receive appropriate feedback from their managers. They also need to feel that they are being challenged, without being stressed. If an employee feels that the work is within their capability but will challenge their skills, they are more likely to enter a flow state. Companies have also found that by turning work tasks that are routine into games, employees are more likely to complete them.

Flow encourages greater intrinsic motivation, as well as needing intrinsic motivation to occur. If employers can instil intrinsic motivation in their employees, their employees will find it easier to enter a state of flow and increase productivity. When an employee can see value in their work, they are more likely to be intrinsically motivated. This value can increase their productivity and the likelihood of entering flow. Employers need to recall that boredom can kill flow, and that something that is too challenging can equally kill flow. By using flow in the work environment, employers are likely to see greater efforts from their staff.

Apply your understanding

1 **Identify** one example each of intrinsic and extrinsic motivation from the scenario. (2 marks)
2 Use your understanding of achievement goal theory to **deduce** whether achieving a flow state at work is an example of task orientation or ego orientation. (1 mark)
3 The scenario describes how employees can achieve a state of flow. **Compare** this to Locke's five principles of goal setting theory. (2 marks)

Check your learning 17.2

Check your learning 17.2: Complete these questions online or in your workbook.

Retrieval and comprehension

1 **Identify** Locke's five principles of goal setting. (5 marks)
2 **Describe** two ways that feedback influences goal attainment. (2 marks)
3 **Explain** the relationship between goal difficulty and performance. (1 mark)

Analytical processes

4 Jules works part-time in a fast-food store on weekends. Jules is promoted to Saturday manager and tasked with motivating junior employees. Jules researches the goal-setting theory of motivation and decides to try to apply this to junior staff. Jules decides that the goal will be decreasing cleaning time by 30 minutes. **Determine** how Jules can use the goal-setting theory to motivate junior staff, including four actions that he will need to take. (4 marks)

Knowledge utilisation

5 **Discuss**, with reference to two arguments, the importance of aligning personal values with goal setting. (2 marks)

MODULE 17

Lesson 17.3
Review: Motivation

Summary

17.1
- The cognitive evaluation theory of motivation aims to explain how factors enhance or diminish internal motivation.
- The achievement goal theory of motivation suggests that people are more motivated when they have clear goals they believe they are capable of achieving.
- The self-efficacy theory of motivation suggests that a person's self-perception of whether they can achieve a task influences how much effort they devote to achieving it, and therefore whether they do, in fact, achieve it.

17.2
- The goal-setting theory of motivation, developed by Edwin Locke in 1981 and expanded in 1996, proposes that goal setting can increase motivation.
- According to the goal-setting theory, effective goals are clear and challenging, yet achievable. Additionally, the person must be committed to achieving the goal, and receive and act on helpful feedback, and the complexity of the task must be realistic given the available timeframe or strategy.

Key studies

Locke, 1996

Review questions 17.3A Multiple choice

Review questions: Complete these questions online or in your workbook.

(1 mark each)

1 Which theory of motivation aims to explain the effects of external environments on our internal motivation?
- **A** Appraisal theory
- **B** Informational theory
- **C** Self-determination theory
- **D** Cognitive evaluation theory (CET)

2 Which term describes an individual's sense of their ability to control and succeed in life?
- **A** Self-efficacy
- **B** Self-esteem
- **C** Outcome expectancy
- **D** Extrinsic motivation

3 Which of the following should you consider when setting goals?
- **A** They should be written clearly.
- **B** They should be challenging.
- **C** There should be opportunity for feedback.
- **D** All of the above should be considered when setting goals.

4 What does it mean if you are intrinsically motivated to play tennis?
- **A** You are motivated because your parents think tennis is a good skill to have in life.
- **B** You are motivated so that you can win a lot of money in a grand slam competition one day.
- **C** You are motivated by seeing your friends and the enjoyment you get out of playing.
- **D** You are motivated by your parents giving you money for playing.

5 Jonah is only extrinsically motivated to get into university. Which of the following applies to him?
- **A** Jonah is motivated because he enjoys studying.
- **B** Jonah is motivated by his parents expecting him to go to university.
- **C** Jonah is motivated because he wants to learn more.
- **D** Jonah is motivated by the lifestyle studying at university offers.

6 What are the three key principles of cognitive evaluation theory?
- **A** Perceived locus of causality, impact on competence and intrinsic motivation
- **B** Perceived locus of causality, ego orientation and self-efficacy
- **C** Perceived locus of causality, task orientation and extrinsic motivation
- **D** Perceived locus of causality, impact on competence and controlling vs informational aspects of rewards

7 Someone who is task-oriented
- **A** wants to be better at something so that they can master the task.
- **B** tries to learn more about the task because they believe that the more effort they put in the more successful they will be.
- **C** is intrinsically motivated.
- **D** is all of the above.

8 Robert is ego-oriented in rugby. This means that Robert
- **A** wants to play better than he did last week.
- **B** wants to be the best player on the field.
- **C** is externally motivated.
- **D** experiences both **B** and **C**.

9 What is low self-efficacy?
- **A** Thinking that you are not good at a particular task
- **B** Having a general belief that you aren't good at anything, and general negative feelings about your life as a whole
- **C** Thinking that you are capable of doing anything
- **D** Having a belief that there is no point in trying, because no matter what the task is, you will perform badly

10 What are the five factors of goal setting?
- **A** Having a clear goal that is challenging and that you want to commit to, receiving feedback on any progress and having the resources necessary
- **B** Having a clear goal that is challenging and that you want to commit to, receiving feedback on any progress and having adequate complexity
- **C** Having a clear goal that is challenging and that you can commit to, receiving feedback on any progress and having adequate time to complete the task
- **D** Having a clear goal that is easily achievable and that you want to commit to, receiving feedback on any progress and having adequate complexity

11 Which of these applies to the cognitive evaluation theory?
- **A** Self-efficacy
- **B** Ego orientation
- **C** Task orientation
- **D** Impact on competence

12 According to goal-setting theory, you are more likely to be motivated if you
- **A** have a clear goal and are challenged.
- **B** are challenged and comprehend the task.
- **C** experience low task complexity and minimal feedback.
- **D** are not committed to the task and receive accurate feedback.

13 Aarav is a manager trying to motivate his team. He tells them to "do their best" on the next project. Based on Locke's research, what might improve the team's performance further?
- **A** Offering a large financial bonus
- **B** Setting specific, challenging targets
- **C** Avoiding any form of feedback
- **D** Encouraging competition among team members

14 Jane sets a goal to read 20 pages of her textbook each night. According to Locke's principles, what attribute of goal setting is Jane utilising most effectively?
- **A** Clarity
- **B** Task complexity
- **C** Feedback
- **D** Volition

Review questions 17.3B Short response

Review questions: Complete these questions online or in your workbook.

Retrieval and comprehension

15 **Explain** perceived locus of causality, impact on competence, and controlling vs informational aspects of rewards, with respect to cognitive evaluation theory. (3 marks)

16 **Describe** two ways that goal setting is used in motivation. (2 marks)

17 **Define** each of the following. Use examples to support your answers.
- **a** A clear goal (2 marks)
- **b** A challenging goal (2 marks)
- **c** Commitment to a goal (2 marks)
- **d** Feedback towards the goal (2 marks)
- **e** An appropriate level of task complexity (2 marks)

Analytical processes

18 **Differentiate** between the achievement goal theory and the self-efficacy theory of motivation. (1 mark)

19 **Distinguish** between intrinsic and extrinsic motivation. (1 mark)

20 **Contrast** the cognitive evaluation theory and self-efficacy theory of motivation. (1 mark)

21 **Compare** cognitive evaluation theory and achievement goal theory of motivation. (2 marks)

Knowledge utilisation

22 Imagine that you are a motivational psychologist. Your local sports team coach has approached you as they are struggling to motivate their players.
- **a** **Propose** how one of the motivational theories discussed in this lesson could be applied to build the team's motivation. (2 marks)
- **b** **Identify** examples of one intrinsic and one extrinsic factor that could motivate players. (2 marks)

23 According to achievement goal theory, people can be task-oriented or ego-oriented. **Predict** which will achieve better
- **a** short-term results. (1 mark)
- **b** long-term results. (1 mark)

24 **Discuss** the importance of self-efficacy in the goal-setting process. (3 marks)

Data drill

Effect of rewards on internal motivation

Imagine you're working hard at school or in your job. Now, think about how it feels when your effort is rewarded with a good grade, a bonus or some other kind of recognition. These performance-based rewards are common in both educational and professional settings, but have you ever wondered how they really affect your motivation? Do they make you want to work harder, or do they sometimes take the fun out of what you're doing?

This is the question that researchers Houlfort and colleagues (2002) aimed to answer. Their study investigated how performance-contingent rewards – those given based on how well you perform – impact two key aspects of motivation: your sense of autonomy (how in control you feel of your actions) and your sense of competence (how capable you feel in what you're doing).

The study included 145 primary school children (65 boys, 80 girls) who were randomly assigned to either the reward condition, where they received a decorative pencil for completing the task, or the no reward condition, where they were simply asked to complete the task. The task was easy enough that most children would be successful.

Afterwards, the children were asked to rate the extent to which they felt they "did well" (competence), "pressured" (autonomy) and "enjoyed the task" (interest) on a 6-point Likert-type scale. Results from the study are summarised in the tables.

TABLE 1 The mean and standard deviations of ratings of participants' perceived competence, autonomy and interest in the task

Factor	Reward		No rewards	
Dependent variables	*M*	SD	*M*	SD
Perceived competence	4.24	0.87	4.09	0.86
Perceived autonomy	4.98	1.18	5.36	0.89
Self-reported interest	4.66	0.58	4.31	0.95

TABLE 2 Correlations among the dependent variables

		1	2	3
1	**Perceived competence**	–	0.23**	0.17*
2	**Perceived autonomy**	–	–	0.05
3	**Self-reported interest**	–	–	–

*$p < 0.05$, **$p < 0.01$

Apply understanding

1 **Identify**, with reference to Table 1, the condition with the highest mean perceived autonomy score. (1 mark)

2 **Calculate**, with reference to Table 1, the difference in mean perceived competence between the reward and no reward conditions. (2 marks)

Analyse data

3 **Sequence** the correlation values (Table 2) from weakest to strongest. (1 mark)

4 **Contrast** the standard deviation scores (Table 1) for self-reported interest in the reward and no reward conditions. (2 marks)

Interpret evidence

5 **Infer** the relationship between performance-contingent rewards and perceived autonomy. (1 mark)

Module 17 checklist: Motivation

Quizlet: Revise key terms online to test your understanding

UNIT 2

Topic 4 review

Multiple choice

(1 mark each)

1 In psychological terms, arousal is best described as
- **A** an increase in body activity preparing an individual for action in response to emotions.
- **B** a prolonged feeling that does not require a specific trigger.
- **C** a temporary emotional state triggered by specific events.
- **D** a decline in physiological activity as emotions subside.

2 Secondary appraisal
- **A** always occurs after primary appraisal.
- **B** only occurs after primary appraisal if a situation is evaluated as neutral.
- **C** only occurs after primary appraisal if a situation is evaluated as positive.
- **D** only occurs after primary appraisal if a situation is evaluated as dangerous.

3 During an intense argument, Mark's brain activity likely involves heightened interaction between the hippocampus and which other brain region critical for assessing the emotional significance of stimuli?
- **A** Thalamus
- **B** Amygdala
- **C** Hypothalamus
- **D** Cingulate gyrus

4 Le Doux's circuits for emotions can be described as
- **A** a long route that involves conscious thought and a short route that bypasses conscious awareness, providing quicker emotional responses.
- **B** a short route that involves conscious thought and a long route that bypasses conscious awareness, providing quicker emotional responses.
- **C** a long route that involves unconscious thought and a short route that bypasses conscious awareness, providing quicker emotional responses.
- **D** a long route that involves conscious thought and a short route that allows for more accurate appraisal of the situations.

5 What is the primary goal of mindfulness-based therapy?
- **A** To enhance performance in professional and personal life
- **B** To eliminate all negative thoughts and emotions
- **C** To improve physical health and vitality
- **D** To learn to just "be"

6 Alice, feeling fulfilled by her loving relationships and successful career, often reflects positively on her life choices. Which aspect of psychological wellbeing does this reflect?
- **A** Purpose in life
- **B** Self-acceptance
- **C** Positive relations
- **D** Environmental mastery

7 While painting, Maria loses track of time and is fully immersed in the activity, enjoying the process and feeling accomplished. What is the consequence that being in a state of flow has on Maria?
- **A** Increased stress levels
- **B** Enhanced life satisfaction
- **C** Decreased cognitive function
- **D** Reduced emotional intelligence

8 Which theory of motivation involves the belief in one's capabilities to achieve a goal?
- **A** Cognitive evaluation theory
- **B** Achievement goal theory
- **C** Self-efficacy theory
- **D** Incentive theory

9 A study found that employees performed better when they set specific, challenging goals for themselves, especially when they received regular feedback. This finding supports which aspect of goal-setting theory?
- **A** The importance of goal clarity
- **B** The role of external rewards
- **C** The irrelevance of feedback
- **D** The need for goal simplicity

10 Sameem enjoys playing chess primarily because he likes the challenge and the process of strategising. This exemplifies which motivational concept?

A Ego orientation
B Task orientation
C Extrinsic motivation
D Outcome expectations

Use Figure 1 to answer questions 11 and 12.

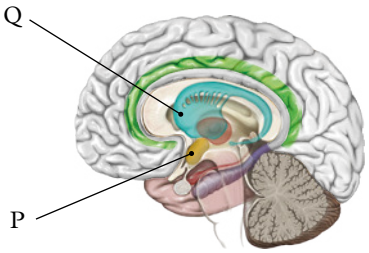


FIGURE 1 Diagram of the brain

11 Which part of the limbic system is shown by P on the diagram?

A Hypothalamus
B Hippocampus
C Amygdala
D Thalamus

12 What is the role of the part of the limbic system shown by Q on the diagram?

A Helps us recognise emotion in others such as understanding facial expressions and body language
B Receives sensory information and relays it to different parts of the brain
C Plays an important role in the formation and retrieval of memories
D Links the nervous system to the endocrine system

Use the following information to answer questions 13 to 15.

In a university psychology class, students conducted an experiment to explore how different emotional stimuli affect emotional responses, as measured by changes in heart rate. The class was divided into three groups, each exposed to a different type of video clip: horror (to elicit fear), comedy (to elicit joy) or documentary (neutral stimulus). Researchers measured participants' heart rates before (baseline) and after the stimulus. Results are shown in the table.

Stimulus	Mean heart rate (bpm)	
	Baseline	After
Horror	70	85
Comedy	72	78
Documentary	71	72

13 The independent and dependent variables in the study are

A movie preference and emotional response.
B heart rate and type of stimulus.
C type of stimulus and heart rate.
D baseline heart rate and after-stimulus heart rate.

14 What is the trend in before (baseline) and after mean values?

A Watching a stimulus increased participants' heart rate.
B Watching a stimulus decreased participants' heart rate.
C Watching a stimulus does not affect participants' heart rate.
D Watching a stimulus caused a change in participants' heart rate.

15 The researchers conducted inferential analysis on the change in heart rate of the experimental conditions (horror and comedy) compared to the neutral condition (documentary). Results from the paired *t*-tests are shown in the table.

Stimulus	Documentary
Horror	$p = 0.003$
Comedy	$p = 0.048$

What conclusion can be drawn about the findings?

A Watching emotive versus informative stimuli does not cause an emotional response.
B Watching emotive versus informative stimuli causes an emotional response.
C Watching emotive stimuli does not cause an emotional response.
D Watching informative stimuli causes an emotional response.

Short response

16 **Describe** the three components of emotion. (3 marks)

17 **Describe** how age and intentional activities influence happiness. (2 marks)

18 During a job interview, Mikhail notices his heart racing and palms sweating. He assesses the situation as challenging but manageable. Considering his preparation and support from his mentors, Mikhail believes he will be able to handle the questions. Halfway through the interview, he gets stuck on a few questions and considers how this will affect his interview. To manage his growing anxiety, he takes deep breaths and focuses on positive outcomes, and the remainder of his interview goes well.

Identify which aspect of Lazarus's cognitive appraisal theory is demonstrated by Mikhail's

- **a** initial assessment of the situation as challenging but manageable (1 mark)
- **b** doubt after getting stuck on a few questions (1 mark)
- **c** management of his growing anxiety by breathing and positive focus. (1 mark)

19 Mei has been diagnosed with Parkinson's disease and experiences difficulty in social interactions due to an impaired ability to read facial expressions and body language.

- **a** **Determine**, from the symptoms, which part of the limbic system has been impacted by Mei's Parkinson's disease. (1 mark)
- **b** **Describe** how this structure contributes to learning and habit formation. (2 marks)

20 During a very stressful week at work, Sophia decides to try mindfulness to manage her stress. She sets aside 10 minutes each morning to sit quietly and focus on her breathing. Whenever thoughts about her workload cross her mind, she notices them but does not engage with them, instead returning her focus to her breath.

Explain mindfulness, in terms of attention and acceptance, and with reference to the scenario. (4 marks)

21 **Identify** the two key components of Diener's model of subjective wellbeing. (2 marks)

22 **Compare** the concepts of "affective balance" and "psychological wellbeing" as proposed by Diener and Ryff, respectively. (2 marks)

23 **Discriminate** between motivation and goals. Provide examples to support your answer. (3 marks)

24 **Explain** the cognitive evaluation theory of motivation with respect to intrinsic and extrinsic motivation. (3 marks)

25 Megan experiences an increase in heart rate and sweaty palms before going on stage to perform. She interprets these signals as excitement rather than fear.

Compare Schachter and Singer's two-factor and Lazarus's appraisal theories of emotion with reference to the scenario. (2 marks)

26 **Describe** the effect of goal specificity on performance with reference to Locke. (1 mark)

27 **Describe** how feedback influences goal attainment. (1 mark)

28 Cognitive evaluation theory (CET) of motivation aims to explain the effects of external consequences on internal motivation. **Describe** the three aspects of external influences. (3 marks)

29 While walking through a deserted car park late at night, Alex hears footsteps behind her. Her heart rate increases, she starts sweating, and she feels her muscles tense up as she prepares to either run or confront the potential threat.

a **Determine** which part of the nervous system is primarily responsible for Alex's immediate physical responses to this potentially threatening situation? (1 mark)

b **Explain** the advantage of LeDoux's short route of emotional processing with reference to the scenario. (1 mark)

30 Barbara Fredrickson's 2008 study, "Open hearts build lives: Positive emotions, induced through loving-kindness meditation, build consequential personal resources", investigated how positive emotions, cultivated through the practice of loving-kindness meditation, can enhance personal resources that contribute to increased life satisfaction and mental wellbeing. In the experimental group, participants took part in a meditation program designed to increase their experiences of positive emotions, for 8 weeks. Participants in the control group were put on a "waitlist". Composite measures of nine different positive emotions were averaged over the week; results are shown in Figure 2.

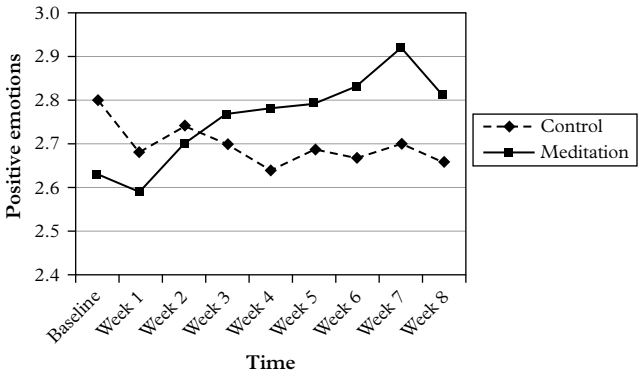


FIGURE 2 Average composite scores of emotion of the control group versus the meditation group

a **Identify** the highest positive emotional score from the control group. (1 mark)

b **Analyse** the results in Figure 2 and describe the trend observed in the scores of each group. Use data as supporting evidence. (2 marks)

c **Explain** the findings of the study with reference to the broaden-and-build theory of positive emotions. (2 marks)

TOTAL MARKS
/54 marks

UNIT 2

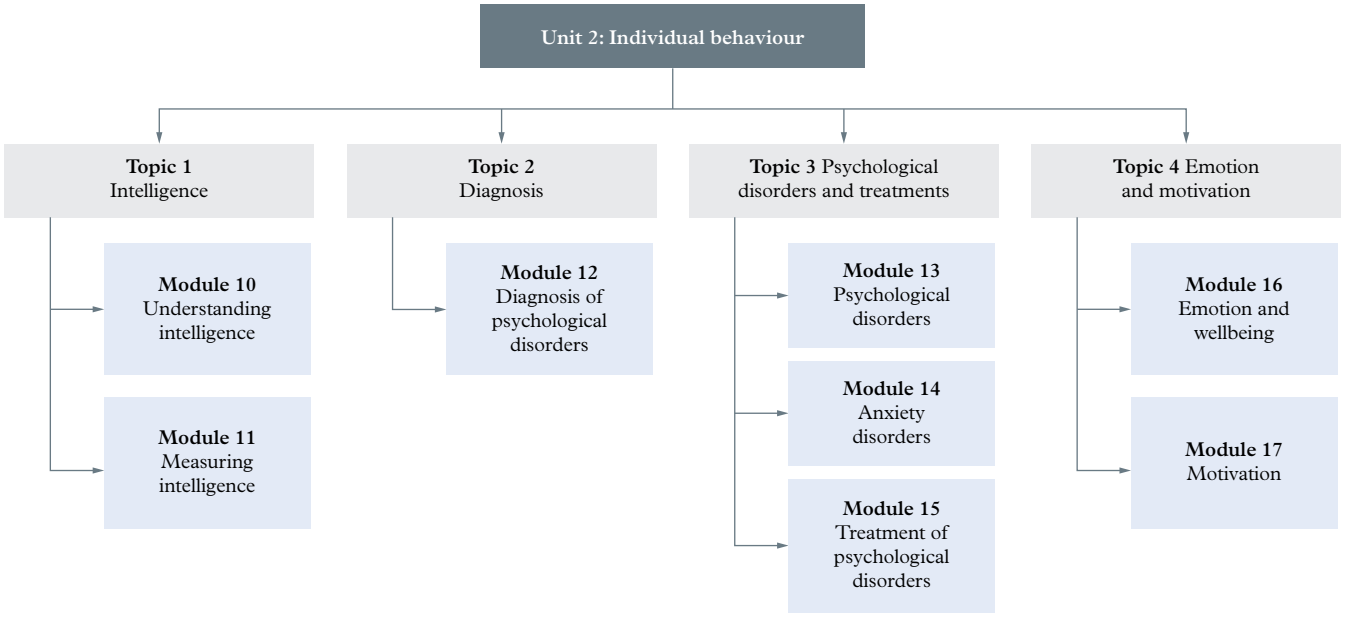
Review

This unit review is designed to help you revise your understanding of key concepts for all the content covered in Unit 2, learn some expert tips for answering exam questions, and practise your skills answering a range of exam-style questions.

Part A: Revisit and revise

Unit 2 overview

The chart shows all the topics in Unit 2 and where you can find information about them in your *Psychology for Queensland Units 1 & 2 Second edition* resource.



Part B: Exam essentials

Now that you have completed your revision for Unit 2, it is time to learn and practise some of the skills you'll need to answer exam questions like a pro! Our expert authors have created the following advice and tips to help you maximise your results on the end-of-year examination.

Exam tip 1: Use a "contrast" word or phrase.

When answering questions with a verb that requires you to identify a difference between terms or concepts, like "contrast", "discriminate" and "distinguish", be sure to use a contrast word or phrase, like "whereas", "on the other hand", "however", "unlike" or "in contrast to".

See it in action

Read the exam-style question and see how the tip has made a difference between a response that has scored full marks and a response that has scored only partial marks.

Question 1 (2 marks)
Discriminate between adaptive and maladaptive behaviour.

Complete response

Adaptive behaviour refers to actions or responses that are helpful and functional, and promote wellbeing in various situations, whereas maladaptive behaviour refers to actions or responses that are harmful or dysfunctional, or hinder personal growth and wellbeing.

Correctly identifies a difference between adaptive and maladaptive behaviours and uses a contrast word to clearly indicate the difference [1 mark]

Incomplete response

Adaptive behaviour refers to actions or responses that are helpful and functional, and promote wellbeing in various situations. Maladaptive behaviour refers to actions or responses that are harmful or dysfunctional, or hinder personal growth and wellbeing.

Correctly describes adaptive and maladaptive behaviours, but does not use a contrast word or phrase to clearly indicate a difference between them [0 marks]

Think like an assessor

To maximise your marks on an exam, it can help to think like a QCAA assessor. Consider how many marks each question is worth and what information the assessor is looking for.

A student has given the following response in a practice exam. Imagine you are a QCAA assessor and use the marking guide to mark the response.

Question 2 (1 mark)

Contrast the two-factor (Schachter & Singer, 1962) and appraisal (Lazarus, 1982) theories of emotion.

The two-factor theory highlights the role of physiological arousal followed by cognitive interpretation, and the appraisal theory focuses on cognitive appraisal as the primary determinant of emotion.

Marking guide

Question 2	• Correctly identifies a difference between the two-factor and appraisal theories of emotion and uses a contrast word or phrase. (1 mark)

Fix the response

Consider where you did and did not award marks in the response. How could the response be improved? Write your own response to the same question to receive full marks from a QCAA assessor.

Exam tip 2: Respond fully to the cognitive verb "discuss".

The cognitive verb "discuss" is defined as "examine by argument; sift the considerations for and against; debate; talk or write about a topic, including a range of arguments, factors or hypotheses; consider, taking into account different issues and ideas, points for and/or against, and supporting opinions or conclusions with evidence" (QCAA).

Questions asking you to "discuss" will require you to explain the concept **and** explain arguments for and against the concept, or strengths and limitations of a model or theory.

See it in action

Read the exam-style question and see how the tip has made a difference between a complete and an incomplete response.

Question 3 (3 marks)

Discuss the sociocultural concept of normality.

Complete response

Explains the sociocultural concept of normality [1 mark]

The sociocultural concept of normality emphasises how cultural and societal factors influence our understanding of what is considered normal behaviour, thoughts and emotions within a specific cultural context. By considering the influence of cultural and societal factors, the sociocultural concept provides a contextual understanding of normality that can be overlooked by other approaches. However, defining normality solely based on cultural and societal factors can be challenging, as cultural norms evolve. This can lead to ambiguity in determining what constitutes normal behaviour and may hinder efforts to address mental health issues effectively.

Explains an argument against the sociocultural concept of normality [1 mark]

Explains an argument in support of the sociocultural concept of normality [1 mark]

Incomplete response

Explains the sociocultural concept of normality [1 mark]

The sociocultural concept of normality emphasises how cultural and societal factors influence our understanding of what is considered normal behaviour, thoughts and emotions within a specific cultural context.

Does not provide any support for, or arguments against, the sociocultural concept of normality [0 marks]

Think like an assessor

To maximise your marks on an exam, it can help to think like a QCAA assessor. Consider how many marks each question is worth and what information the assessor is looking for.

A student has given the following response in a practice exam. Imagine you are a QCAA assessor and use the marking guide to mark the response.

Question 4 (3 marks)

Discuss the statistical concept of normality.

The statistical concept of normality involves defining normality based on statistical measures of central tendency and dispersion within a population. This concept is sometimes considered a poor measure of normality just because something is statistically common does not mean that it is mentally healthy.

Marking guide

Question 4	• Explains the statistical concept of normality (1 mark) • Provides one argument or perspective in support of the statistical concept of normality (1 mark) • Provides one argument or perspective against the statistical concept of normality (1 mark)

Fix the response

Consider where you did and did not award marks in the response. How could the response be improved? Write your own response to the same question to receive full marks from a QCAA assessor.

Exam tip 3: Include both a similarity and a difference.

The cognitive verb "compare" is defined as "display recognition of similarities and differences". (QCAA)

Questions using the cognitive verb "compare" require you to identify both a similarity of, and a difference between, concepts. When stating a difference, be sure to use a contrast word or phrase, like "whereas", "on the other hand", "however", "unlike" or "in contrast to".

If the question is worth more than 2 marks, then you will need to identify more than one similarity and difference.

See it in action

Read the exam-style question and see how the tip has made a difference between a complete and an incomplete response.

Question 5 (2 marks)

Compare the use of psychotherapies and electroconvulsive therapy (ECT) in the treatment of psychological disorders.

Complete response

Similarity [1 mark] → *Both pharmacotherapies (medications) and electroconvulsive therapy (ECT) are used in the treatment of psychological disorders. Pharmacotherapies often require several weeks or months of treatment before significant improvement is seen, as the medications need time to build up in the system and exert their effects. In contrast, ECT typically produces more rapid results, with improvements often seen after just a few sessions.*

Difference, with a contrasting word [1 mark]

Incomplete response

No similarity identified, and no contrasting word or phrase used. [0 marks]

Pharmacotherapies often require several weeks or months of treatment before significant improvement is seen, as the medications need time to build up in the system and exert their effects. ECT typically produces more rapid results, with improvements often seen after just a few sessions.

Think like an assessor

To maximise your marks on an exam, it can help to think like a QCAA assessor. Consider how many marks each question is worth and what information the assessor is looking for.

A student has given the following response in a practice exam. Imagine you are a QCAA assessor and use the marking guide to mark the response.

Question 6 (4 marks)

Compare the *Diagnostic and Statistical Manual of Mental Disorders* (5th edition-TR, 2022) and the *International Classification of Diseases* (11th revision, 2022).

Both the DSM-5-TR and the ICD-11 provide sets of diagnostic criteria for various psychological disorders. The DSM-5-TR is updated by the American Psychiatric Association and the ICD-11 is updated by the World Health Organization.

Marking guide

Question 6	• Identifies two similarities between the DSM-5-TR and the ICD-11 (2 marks) • Uses a contrast word or phrase to indicate two differences between the DSM-5-TR and ICD-11 (2 marks)

Fix the response

Consider where you did and did not award marks in the response. How could the response be improved? Write your own response to the same question to receive full marks from a QCAA assessor.

Part C: Exam practice

Now it's time to put the tips and advice you've received into practice while you complete these exam-style questions! During your examination, you will most likely be asked multiple-choice questions, short-response questions, and more complex, multi-part short-response questions. The questions here, in Part C, give you practice at these types of questions.

Multiple choice

(1 mark each)

1 Maddy is feeling depressed and finds herself not wanting to go out, socialise or attend school. This is not usual behaviour for Maddy. According to which concept of normality would she be considered abnormal?

A Medical
B Historical
C Statistical
D Functional

2 Lachlan just received a poor score for his recent Psychology test. He took this result to be an indicator that he needs to put more work into his study from now on. According to Lazarus and Folkman, this would be an example of

A threat.
B challenge.
C harm/loss.
D cognitive appraisal.

3 Samira was walking home alone on Friday night from the train station. She began feeling uneasy when she noticed a man standing on her front lawn. Samantha was experiencing

A fear.
B the long route.
C the short route.
D cognitive appraisal.

4 Mr Johnson was told by his students that he had high emotional intelligence. Which of the following is Mr Johnson likely to display?

A Inability to perceive emotions in others and an inability to control his emotions
B Good linguistic skills, musical awareness, nature awareness and intrapersonal skills
C Happiness, an ability to empathise, good control of his emotions, and musical awareness
D Perceiving of emotions, facilitating thought, understanding of emotions and good control of his emotions

5 The scale best used for measuring intelligence in children under the age of 10 is

A WAIS-IV.
B WISC-IV.
C intelligence quotient.
D Stanford–Binet scale.

6 Diego likes to wear a watermelon helmet and goggles. Diego attends university and goes to his part-time job wearing the watermelon. He is always polite and submits all of his assignments on time, and never misses a shift at work. Which concept of normality would suggest that Diego is normal?

A Historical
B Functional
C Situational
D Sociocultural

7 Which of the following is an example of an adaptive behaviour?

A Ignoring stress and hoping it will go away
B Screaming and pulling one's hair when stressed
C Yelling at your teacher when you get a bad mark
D Asking your teacher how you could improve your test results in the future

8 Which of the following is part of the flow experience?
- **A** Distracted thoughts
- **B** Increased awareness of time
- **C** A sense of control over the situation
- **D** Finding an activity stressful, but rewarding

9 Mr Lewinski was trying to motivate his class to study for a test. He decided to try to encourage them by using the achievement goal theory of motivation. This means that his students would
- **A** be either task-oriented or ego-oriented.
- **B** experience extrinsic motivation for the task.
- **C** set several goals to achieve a good result on the test.
- **D** be concerned with the outcome expectancy of the task.

10 Mr Lewinski decided to run a study on his class to evaluate if his motivation had worked. He did not tell the students this and did not get their permission to be involved. Which ethical principle has Mr Lewinski breached?
- **A** Debriefing
- **B** Confidentiality
- **C** Withdrawal rights
- **D** Voluntary participation

11 Which term describes an estimate of the amount by which IQ scores may increase or decrease as a result of the interaction of heredity and the environment?
- **A** Reaction range
- **B** Intelligence quotient
- **C** Reliability coefficient
- **D** Heritability coefficient

12 The information processing approach to intelligence primarily focuses on
- **A** multiple independent intelligences.
- **B** emotion regulation and social skills.
- **C** genetic factors influencing intelligence.
- **D** cognitive processes such as memory and problem-solving.

13 Unlike the behavioural model, the cognitive model of diagnosis emphasises the importance of
- **A** thought processes.
- **B** psychodynamic factors.
- **C** personality predispositions.
- **D** cultural and environmental elements.

14 Protective factors against a psychological disorder include
- **A** good fitness, poor parental attachment, and having a home.
- **B** having a home, missing school or work, and economic wellbeing.
- **C** exercise and diet, good sleep patterns, and staying connected with family and friends.
- **D** staying connected with family and friends, good sleep patterns, and a weakened immune system.

15 What are the three components of Sternberg's triarchic theory of intelligence?
- **A** Adaptive, analytic and creative
- **B** Practical, analytic and creative
- **C** Internal, external and experiential
- **D** Practical, analytic and experiential

16 Disorganised attachment is
- **A** caused by separation anxiety as a child.
- **B** the only cause of psychological disorders.
- **C** when a person is panicked that their caregiver will leave them.
- **D** when an individual finds it difficult to share their feelings or empathise.

17 Which hormone(s) are associated with stress?
- **A** Cortisol
- **B** Oxytocin
- **C** Adrenalin
- **D** Melatonin

18 Research suggests that differences in intelligence result from
- **A** genetic factors.
- **B** environmental factors.
- **C** heritability coefficients.
- **D** a combination of environmental and genetic factors.

19 The best definition of psychosis is
- **A** false perceptions in the absence of sensory input.
- **B** a state where someone experiences a loss of reality.
- **C** normal thoughts that most people experience on a daily basis.
- **D** where a sense of reality remains but there are difficulties with thoughts and feelings.

20 Perpetuating risk factors for psychological disorders
- **A** are triggered by trauma.
- **B** trigger a psychological disorder.
- **C** inhibit recovery from a psychological disorder.
- **D** prevent the occurrence or recurrence of a psychological disorder.

Short response

21 **Describe** the psychometric approach to intelligence. (1 mark)

22 **Describe** the biopsychosocial approach to understanding psychological disorders. (1 mark)

23 **Describe** the role of physiological processes associated with emotion. (1 mark)

24 **Identify** one cognitive, one psychological and one social risk factor for the development of psychological disorders. (3 marks)

25 **Identify** two symptoms of anxiety disorders. (2 marks)

26 **Explain** a strength and a limitation of the statistical concept of normality. (2 marks)

27 **Explain** mindfulness, with reference to attention and acceptance. (3 marks)

28 **Distinguish** between adaptive and maladaptive behaviour, using an example. (2 marks)

29 **Distinguish** between bipolar disorder and depression. (1 mark)

30 **Compare** the *Diagnostic and Statistical Manual of Mental Disorders* (5th edition-TR, 2022) and the *International Classification of Diseases* (11th revision, 2022). (2 marks)

31 This question refers to the investigation conducted by Bouchard et al. (1990).
- **a** **Identify**, with reference to the results of this investigation, the extent to which intelligence is inherited. (2 marks)
- **b** **Identify** the research design used in this investigation and describe a limitation of this type of research design. (2 marks)
- **c** IQ tests were used on participants. **Discuss** the degree to which intelligence tests are valid and reliable. (4 marks)

32 A study by Vøllestad et al. (2010) investigated the effect of mindfulness-based stress reduction (MBSR) for patients with anxiety disorders. For this, 76 patients were randomly allocated to either an 8-week MBSR therapy group or a control group. A statistically significant improvement was found for patients in the MBSR group compared to the control group in symptoms of anxiety and depression. It was concluded that MBSR is an effective treatment for anxiety disorders.
- **a** **Identify** one symptom of anxiety disorders. (1 mark)
- **b** **Describe** two risk factors for developing anxiety disorders. (2 marks)
- **c** **Explain** how mindfulness-based therapy can impact symptoms of anxiety, with reference to the investigation. (2 marks)

33 This question refers to the investigation conducted by Schachter & Singer (1962) in relation to the two-factor theory of emotion.

- **a** **Identity** one ethical principle that was violated in this investigation. (1 mark)
- **b** **Discriminate** between physiological reaction and emotional labelling with reference to the findings of the investigation. (2 marks)
- **c** **Compare** the two-factor theory of emotion and the cognitive appraisal (Lazarus, 1982) theory of emotion. (2 marks)

34 This question refers to the investigation conducted by Locke (1996).

- **a** **Describe** the role of goal setting in motivation, with reference to the investigation. (2 marks)
- **b** **Explain** the results of the investigation using the cognitive evaluation theory. (2 marks)
- **c** **Explain** the relationship between the specificity of a goal and task performance, with reference to the investigation. (2 marks)

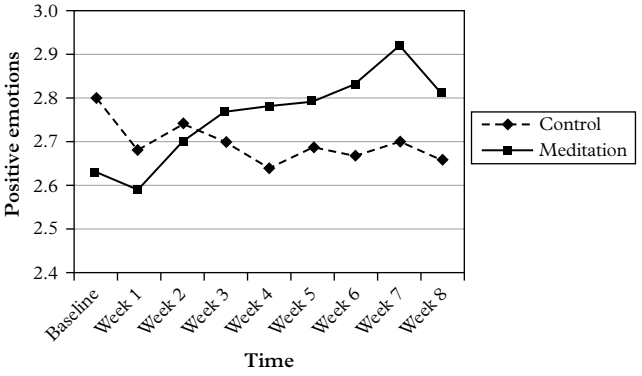
35 Geddes et al. (2003) carried out a systematic review of 31 randomised trials with 4410 patients and concluded that anti-depressant drugs are an effective way to treat depression and prevent relapse. Drugs have been effective in reducing the number of hospital in-patients who are being treated for psychological disorders.

- **a** **Identify** two symptoms of depression. (2 marks)
- **b** **Explain** how SSRIs work to alleviate symptoms of depression. (2 marks)
- **c** **Identify** a strength and a limitation of using antidepressant medication to treat people with depression. (2 marks)

36 To investigate the broaden-and-build theory of positive emotions, Fredrickson and colleagues (2008) devised a meditation intervention aimed at illustrating how sustained positive emotions can develop personal resources, subsequently influencing life satisfaction. Participants were randomly allocated to either a meditation intervention group or a control group. Those in the meditation group underwent training in loving-kindness meditation (LKM), designed to expand mental perspectives through fostering feelings of love and compassion.

The LKM practice involved initially directing these emotions towards oneself, then extending them to close individuals, acquaintances and strangers. Participants were instructed to engage in LKM exercises at least 5 days a week for 8 weeks. Including the baseline period, the study spanned a total of 9 weeks. The graphical representation depicts the change in positive emotion over time.

Change in positive emotion over 9-week period for control and meditation groups



- **a** **Describe** the broaden-and-build theory (Fredrickson, 2004) of positive emotions. (1 mark)
- **b** **Identify** the highest level of positive emotions for the meditation group. (1 mark)
- **c** **Identify** the week of the lowest positive emotion for the control group. (1 mark)
- **d** An inferential test was used to analyse the difference between the meditation and control groups, which produced a p-value of 0.032. **Draw a conclusion** from the p-value. (1 mark)

TOTAL MARKS
/72 marks

MODULE 18

Practical manual

Part of studying psychology is researching existing literature, as well as conducting your own experiments to investigate phenomena. This module provides examples of how you can approach experiments, as well as things to look out for when conducting research.

In Module 1, Psychology toolkit, ethical considerations are discussed (Lesson 1.5). As psychological research typically involves people and animals, it is important that you read through the ethical requirements and ensure that they are met before conducting an experiment. No psychological research can be conducted without informed consent.

Consult with your teacher before participating in or completing any practicals in this manual.

oxforddigital

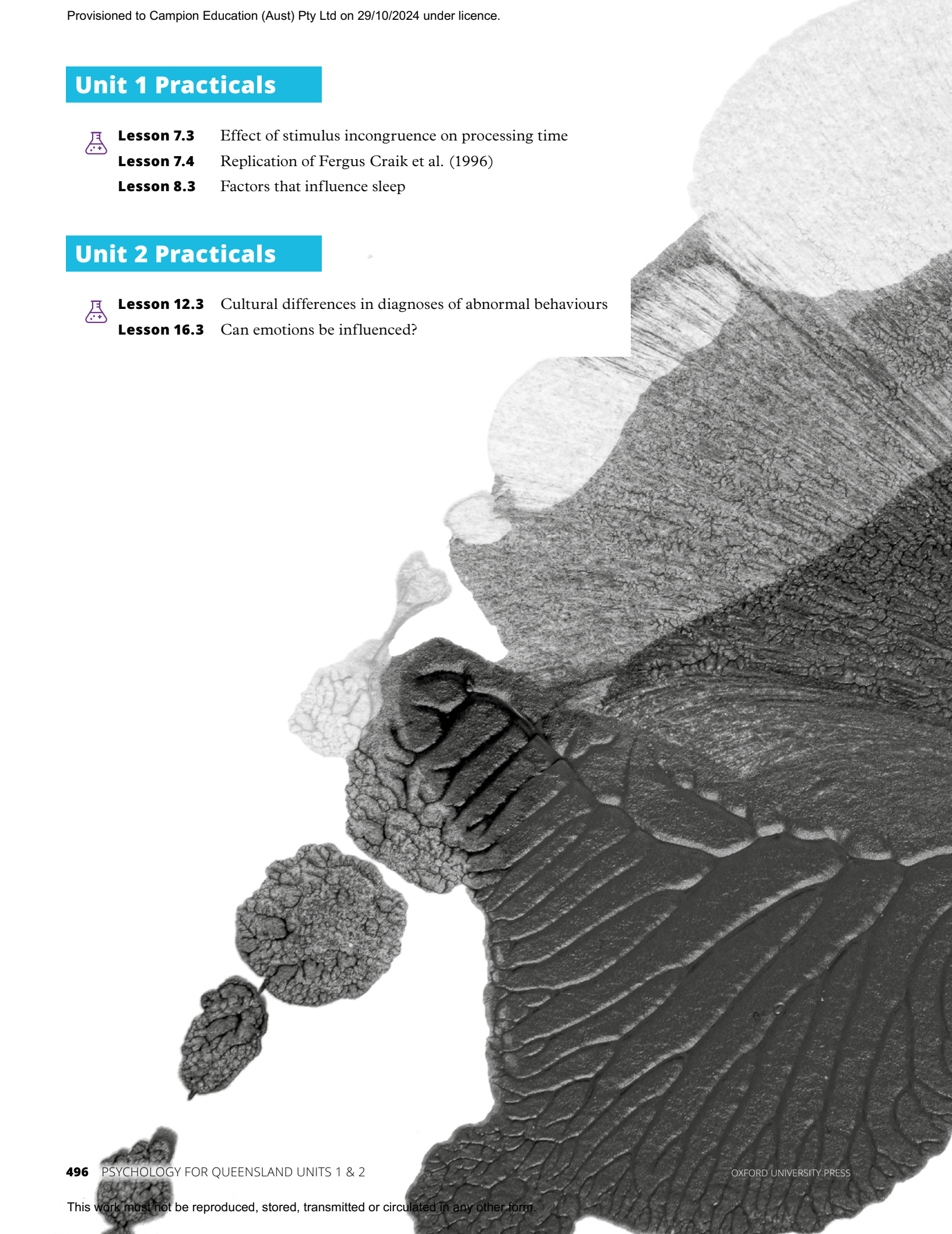
Full lessons for this module are available on Oxford Digital. They are also provided as part of a printable resource that can be used in class.

Unit 1 Practicals

Lesson 7.3 Effect of stimulus incongruence on processing time
Lesson 7.4 Replication of Fergus Craik et al. (1996)
Lesson 8.3 Factors that influence sleep

Unit 2 Practicals

Lesson 12.3 Cultural differences in diagnoses of abnormal behaviours
Lesson 16.3 Can emotions be influenced?



Glossary

A

ablation
the damaging or removing of sections of the brain

Aboriginal and Torres Strait Islander peoples
past and current descendants of the original inhabitants and custodians of the land we know today as Australia

acceptance
(mindfulness) the practice of embracing all thoughts, feelings and experiences without judgment, resistance or attempts to change them

accommodation
Piaget's term for when new situations, objects or information are encountered and the person's schema is either modified or a new schema is created

accuracy
how close a measured value is to a true or known value

achievement goal theory
a theory that suggests people will be more motivated when they have clear goals that they believe they are capable of achieving

adaptive behaviour
actions or responses that enable an individual to effectively navigate and cope with the demands of their environment, interact with others and achieve personal goals.

adenosine
a neurotransmitter produced when our cells use energy and that accumulates when we are awake

adolescence
a lifespan stage, between childhood and young adulthood (approximately 12 or 13 years to 18 or 19 years of age)

advanced sleep–wake phase disorder
a circadian phase disorder that brings sleep patterns forward, often seen in the elderly

affective balance
the moods, emotions and feelings that a person experiences

agoraphobia
fear of crowds, assemblies of people and open spaces

alpha wave
typical brainwave pattern (reasonably high frequency, but not as high as beta waves; low amplitude, but slightly higher than beta waves) that occurs when awake but very relaxed

altered state of consciousness
a state of consciousness that deviates from normal waking consciousness; can be deliberately induced or occur naturally

alternative hypothesis
predicts that there will be a relationship between the variables, causal or otherwise

amplitude
in terms of brainwaves, the height of the peaks and troughs of the curved graph that represents brainwave activity

amygdala
an almond-shaped structure, located in the medial temporal lobe of the brain that is central to emotion, aggression and implicit learning; it is vital in initiating and processing emotional responses and in forming emotional memories

analytical intelligence
in the context of Sternberg's dimensions of intelligence, refers to problem-solving abilities, reasoning, and the ability to analyse

animism
Piaget's term for the preoperational stage where children will believe that inanimate objects are alive

antisocial personality disorder (ASPD)
characterised by persistent disregard for, and violation of, the rights of others

anxiety disorder
a psychological disorder in which the frequency and intensity of feeling anxious is out of proportion to the situation and interferes with everyday life

aphasia
the impairment of language caused by damage to the brain

appraisal
the mental evaluation of an event or situation that occurs before an emotion is displayed

appraisal theory of emotion
a theory that suggests we experience emotions based on our evaluation of a situation or event

arousal
how responsive a person is to the external environment; a psychological state of being physically awake and alert

artificiality
the extent to which the tasks and environments used in research differ from those encountered in real life

assimilation
according to Piaget, the process where new experiences are combined with existing schemata

associated behavioural
(or expressive response) the behavioural changes that result from subjective feelings and physiological changes

association area
region of the cerebral lobes that is not part of the primary sensory (visual, auditory, somatosensory) or motor cortices; integrates the information between the motor and sensory areas and higher order mental processes

attachment
the emotional bond created between infants and their caregivers; the tendency in adulthood to seek emotionally supportive social relationships

attention (mindfulness)
how we pay attention to stimuli, including time and preference

attention
information you are actively processing, either consciously or unconsciously

attrition
the loss of participants from a study over time, which can lead to a too-small sample or a biased sample if the attrition is not random

automatic process
a process that requires little attention and thought, and can allow you to do two things at once

autonomic nervous system
branch of the PNS responsible for communications between the body's non-skeletal muscles and the internal organs and glands that carry out bodily functions

autonomy
independence and a feeling of being able to use one's own free will

awareness
how conscious (aware) we are of internal and/or external event(s); level of awareness can vary in normal waking consciousness

axon
the part of a neuron along which the electrochemical nerve impulse is transmitted

axon terminal
located at the end of the axon branch and transmits messages to the next neuron by releasing neurotransmitters from terminal buttons

B

behavioural approach
uses the principles of classical and operant conditioning to examine how factors or stimuli in the environment can influence behaviours

beta wave
typical brainwave pattern – high frequency (fast) and low amplitude (small) – during normal waking consciousness, associated with being alert, active, anxious and paying (selective) attention

biased sample
a sample that does not accurately reflect the characteristics of the target population, with certain characteristics over- or under-represented

biopsychosocial model
a holistic approach to treating psychological disorders by looking at biological, psychological and sociocultural factors

bipolar disorder
characterised by periods of great euphoria, delusion, overactivity and excitement (mania), and periods of sadness, guilt and hopelessness (depression).

body
the physical being, including the brain

box and whisker plot
graph showing the distribution of data that shows the median, quartiles and outliers

brain
the main organ of the CNS that controls thinking, memory, emotion, vision and motor skills

brain stem
part of the brain that connects the brain to the spinal cord

bright light therapy
the use of a high-intensity light to advance or delay sleep and therefore treat circadian phase disorders

broaden-and-build theory
focuses on the effect of positive emotions on wellbeing

Broca's aphasia
a result of damage to Broca's area that leads to difficulty in expressing messages in words or sentences, but the ability to comprehend speech is largely unaffected

Broca's area
part of the left frontal lobe; the speech production centre of the brain

C

case study
in-depth examination of a person, group, organisation or event using various methods

cell body
the largest part of the neuron containing the nucleus; controls metabolism and maintenance of the cell

central limit theorem
given a sufficiently large sample size, the sampling distribution of the sample mean will approximate a normal distribution, regardless of the shape of the population distribution

central nervous system (CNS)
comprises the brain and the spinal cord; controls the body by processing and responding to sensory input from the peripheral nervous system

centration
Piaget's term for the preoperational stage where children can only focus on one aspect of a task at a time

cerebellum
a component of the hindbrain that coordinates the sequence of body movements

chronic sleep deprivation
not getting enough sleep over an extended period of time; long-term sleep deprivation

circadian phase disorder
a sleep disorder that affects a person's internal sleep–wake clock, resulting in disturbed sleep

circadian rhythm
a biological rhythm that occurs approximately once every 24 hours; for example, the sleep–wake cycle and body temperature

circuit formation
a process that involves axons of new neurons growing out to target cells, forming new synapses

clinician
a professional involved in the diagnosis and treatment of patients; uses diagnostic manuals; in this context a mental health professional

cognitive approach
examines how thought processes influence feelings and behaviours, and the role distorted thinking plays in the development and maintenance of psychological conditions

cognitive behavioural therapy (CBT)
a form of psychotherapy that focuses on breaking unhealthy patterns of thinking or behaving and replacing them with positive habits and coping skills

cognitive development
the development of mental processes and abilities throughout the lifespan

cognitive evaluation theory (CET)
aims to explain the effects of external environments on our internal motivation

cognitive strategy
mental strategy that an individual uses to solve both simple and complex cognitive problems

cohort effect
differences in characteristics or experiences of particular age groups that may affect outcomes

column graph
graph typically used for experimental designs where the height of the vertical bar corresponds to the mean and each column represents a condition of the independent variable

comorbid
the presence of more than one medical condition at the same time

conclusion
an evidence-based decision about the hypothesis and/or research question

concurrent validity
the extent to which a test correlates with a benchmark test or measure taken at the same time

confidence interval
range of values, derived from sample statistics, that is likely to contain the value of an unknown population parameter

confidence level
a percentage that reflects the proportion of times the confidence interval is likely to contain the true population parameter (e.g. mean)

confidentiality
the right of participants to not be identified in any way from test results, by their involvement in the study or from any other confidential data provided during a study

confounding variable
an uncontrolled extraneous variable that could explain changes in the dependent variable other than those caused by the independent variable; if a confounding variable exists, no valid conclusions about the research can be drawn

consciousness
our awareness of our own thoughts, feelings and perceptions (internal events) and our surroundings (external events) at any given moment

conservation
Piaget's term for understanding that one object can take different forms

content validity
whether a test comprehensively accounts for all the relevant aspects of the construct it aims to assess

continuous data
data that can take on any value within a range

contra-lateral
the physiological nature of how one side of the brain controls the opposite side of the body

control group (C-group)
the group of research participants not exposed to variations in the independent variable

controlled observation
observation of voluntary behaviours within a structured environment such as a laboratory

controlled process
a process that requires mental effort to focus attention on the required task

controlled variable
a variable that is kept constant to prevent it from influencing the outcome of an experiment

convenience sampling
a sampling technique where participants are selected based on ease of access and availability that often leads to a biased sample

coping mechanism
functional or dysfunctional strategy to reduce anxiety or stress

coping potential
a person's ability to use either problem-focused coping or emotion-focused coping

corpus callosotomy
a surgical procedure that severs the corpus callosum

corpus callosum
the thick band of about 200 million nerve fibres connecting the right and left hemispheres of the brain

correlation
a statistical measure of the strength and direction of the relationship between two variables; does not show a cause-and-effect relationship, but describes the way in which the variables vary in relation to each other

correlational design
a non-experimental design used to identify the relationship between two or more variables

correlational hypothesis
predicts there will be a relationship or association between two variables

cortisol
a hormone released by the adrenal glands that is thought to play a role in initiating wakefulness, with levels peaking in the morning right before you wake up

counterbalancing
a method for controlling order effects in a repeated measures design

Country
(and/or Place) an area (not just geographically) that is traditionally owned and looked after by an Aboriginal language group/s or community; a place of spiritual meaning with deep feelings of connection and attachment

creative intelligence
in the context of Sternberg's dimensions of intelligence, refers to innovation, imagination and the ability to generate new ideas

critical period
a period in development when certain experiences must happen for typical development to proceed

cross-sectional design
a form of independent groups design where data is collected at one time from participants of all ages and different age groups, and compared

cultural bias
when an examinee performs poorly on an intelligence test because some of the questions are about things that are culturally unfamiliar

cumulative risk
the combined risks or factors that may interact with each other to influence a psychological disorder

D

debriefing
the experimental process when, after the experiment, subjects are told of the purpose of the research, and any deception is explained; a vital ethical component of any psychological research

deception in research
only permitted if the results would be confounded if the participants had too much information before participating in the study; the researcher must ensure that there is no distress and the research must cease immediately if distress occurs

deficit discourse
a mode of thinking that frames and represents people through a negative or lacking perspective

delayed sleep–wake phase disorder
a circadian phase disorder that delays sleep patterns

delta waves
typical brainwave pattern – a steady pattern of low frequency (slow) and high amplitude (large) – associated with NREM deep sleep

delusion
fixed but false beliefs that are difficult to change despite the presence of conflicting evidence

demand characteristics
cues or signals that convey the researcher's expectations to the participants, causing a change in their behaviour that may confound the results

dendrite
branch-like segments of a neuron that receive signals from other neurons or sensory receptors via the synapses and deliver these to the cell body

dependent variable (DV)
the variable that is measured in psychological research, to look for effects of the independent variable

deprivation
the loss of or damage to an existing attachment

deprived environment
an environment that lacks brain stimulation

developmental plasticity
the development and consolidation of neural pathways in babies, children and adolescents

Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR)
a diagnostic manual that includes over 300 identified psychological disorders and provides descriptions of diagnostic categories

directional hypothesis
predicts the specific nature or direction of the relationship between two variables

directionality problem
in correlational research, when the direction of the cause-and-effect relationship is unclear

discrete data
data that can only take specific values within a range

disorganised attachment
experienced by individuals who find it difficult to share their feelings or empathise with others

dissociative symptoms
experiences that involve detachment or disconnection from one's feelings, thoughts, identity or environment

divided attention
the ability to attend to and perform multiple activities at the same time

dizygotic (DZ) twins
twins who develop from two separate eggs and share about 50 per cent of their genes

double-blind procedure
the method of allocating participants to groups so that neither the experimenter nor the participants are aware of who is in the E-group or C-group

dualistic approach
the view that the mind is a separate entity from the body and that our conscious awareness is not physical

dysphoria
a feeling of unease or dissatisfaction with life

E

early-morning awakening insomnia
a form of insomnia characterised by problems with waking up too early and not being able to go back to sleep

ecological validity
the extent to which the findings of research studies can be generalised to real-world settings

egocentrism
Piaget's term for when a person does not make distinctions between their own thoughts, feelings and perceptions and those of others

ego-orientation goal
a goal that is focused on becoming the best at a skill

electrical stimulation of the brain (ESB)
a technique that sends mild electrical impulses through a probe to map the brain

electroconvulsive therapy (ECT)
psychological treatment where seizures are induced in individuals

electroencephalograph (EEG)
a device that detects, amplifies and records electrical activity in the brain in the form of brainwaves

electroencephalography (EEG)
a technique used to detect, amplify and record electrical activity in the brain in the form of brainwaves

electromyography (EMG)
a technique that detects, amplifies and records the electrical activity of muscles

electrooculography (EOG)
a technique that detects, amplifies and records electrical activity in the muscles that allow the eye to move

emotion
a response to a specific event or stimulus involving experiential, behavioural and physiological elements

emotional development
the development of a human's ability to experience, express and understand emotions and to cope with them appropriately throughout their life

emotional intelligence
the ability to perceive, use, understand and manage emotions in oneself and in others

emotional regulation
the ability to control and productively use one's emotions

emotion-focused coping
reducing the negative emotional responses associated with stress such as embarrassment, fear, anxiety, depression, excitement and frustration

enriched environment
an environment that provides social and physical brain stimulation

environmental mastery
being able to direct our own lives

error bar
graphical representation of the variability of uncertainty in data, usually either the standard deviation, standard error or confidence interval

Eurocentrism
a worldview that focuses on or favours Western or European histories and thinking

evolutionary theory of sleep
the theory that sleep serves to increase an animal's or human's chance of survival in its environment

experience-dependent learning
learning that occurs at any time during an individual's life as a result of experience

experience-expectant learning
experiences necessary for learning to occur, most often during sensitive periods

experimental group (E-group)
the group of research participants exposed to the experimental condition of the independent variable

experimental hypothesis
predicts that a change in the independent variable will cause a change in the dependent variable

experimenter effect
the outcome of an experiment being influenced by the person conducting the experiment

external reliability
consistency of a measure or test across different occasions or different observers

external validity
the extent to which the findings of a study can be generalised

extraneous variable
a variable other than the independent variable that could cause changes in the dependent variable

extrapolate
extend or project known information to estimate unknown values or outcomes beyond the original observation range, based on the trends and patterns identified in the data

extrinsic motivation
when people are motivated by external factors, such as receiving a reward or avoiding punishment

F

face validity
a subjective judgement on the extent to which a psychological instrument appears to measure what it is supposed to measure

factor analysis
a statistical method used to find patterns in data by grouping similar things together

fatigue effect
a type of order effect that results in boredom or fatigue causing a decline in participants' performance

fight-flight-freeze response
a physiological response to stress that causes an organism to react in a combative manner (fight), remove themselves from the situation (flight) or not react at all (freeze)

flow
a psychological state where a person is deeply focused and involved in what they are doing, to the point that basic needs are ignored and they may be unaware of anything else

flow experience
a theory developed by Csikszentmihalyi and Nakamura to describe the immersion people find themselves in when focusing on a task

forebrain
part of the brain responsible for higher order thinking processes; includes the cerebral hemispheres

frequency
the number of brainwaves per second

frequency table
table that displays the number of occurrences of each category of a variable

frontal lobe
the largest lobe of the brain; has several functions, including initiating movement of the body, language, planning, judgment, problem-solving, aspects of personality and emotions

functional approach to normality
suggests that behaviour is normal if it helps an individual to live independently in an age-appropriate way

functional magnetic resonance imaging (fMRI)
special imaging technology used to see which parts of the brain are active

functional plasticity
the ability of the brain to alter the location of functions to compensate for brain injury

G

generalisation
a judgment about the extent to which the research findings can be applied outside the study

generalised anxiety disorder (GAD)
a psychological disorder characterised by constant and excessive worrying about events, activities or topics that interferes with daily activities

Geschwind's territory
area of the brain that provides a connection between Broca's area and Wernicke's area; helps to process the multiple properties of words, and classify and label things, which is a prerequisite for developing concepts and thinking abstractly

glial cell
type of cell that supports neurons by surrounding and holding them in place, supplying nourishment and oxygen, removing dead ones and insulating them

goal
the object or aim of an action

goal-setting theory of motivation
people are motivated to achieve tasks when they have clear, challenging goals to which they can commit fully and about which they receive feedback

H

hallucination
false perception in the absence of sensory stimuli

happiness
a complex and multifaceted construct that relates to wellbeing and positive emotions

heredity
the process by which biological parents transmit physical and psychological traits to their offspring through their genetic material (genes)

heritability coefficient
how much heredity contributes to a trait, expressed as a coefficient from 0 to 1, where 0 means there is no genetic influence and 1 means heredity has 100 per cent influence, i.e. the trait is exclusively determined by genes

hindbrain
the primitive parts of the brain comprising the medulla, pons and cerebellum; adjacent to the spinal cord and mainly supports bodily functions such as breathing, digestion and voluntary movement

hippocampus
located in the brain's medial temporal lobe and involved in the transfer of information from short-term memory to long-term memory

histogram
visual representation of a frequency table in the form of a column graph

historical approach to normality
suggests what normal behaviour is based on cues from different periods in time

homeostasis
a self-regulating process by which the body maintains a stable internal balance while adjusting to a changing environment

homogeneity of variance
the assumption that different samples or groups have similar variances in their respective distributions

hyperarousal
an altered state of consciousness and heightened (or hyper) arousal

hypnic jerk
involuntary muscle contraction or sudden twitch that occurs as a person is falling asleep, often accompanied by a sensation of falling

hypnogogic state
the transitional period between wakefulness and sleep, characterised by vivid and dreamlike sensory experiences as an individual drifts off to sleep

hypnogram
graphic representation of the transition between stages of sleep over time

hypomania
a less severe form of mania, where manic symptoms do not affect a person's ability to function in everyday life

hypothalamus
structure of the forebrain that plays a major role in controlling emotion and motivated behaviours such as eating, drinking and sexual activity

hypothesis
a scientific prediction about the relationship between two variables

hypothetical construct
a concept that is not directly measurable or observable, but gives rise to measurable phenomena and patterns of data

I

illusory correlation
the perception of a relationship between two variables when no such relationship exists

imprint
an immediate attachment that is formed soon after birth

independent groups design
also known as "between groups design"; an experimental design in which each participant only takes part in one condition

independent variable (IV)
the variable that is manipulated by the experimenter who then measures resulting changes in the dependent variable

Indigenous knowledge systems
Aboriginal and Torres Strait Islander traditional systems of knowledge, that include understandings, practices, skills, spirituality and innovations

infancy
a lifespan stage, between birth and childhood (approximately 0 to 2 years of age)

information processing approach to intelligence
examines the mental processes that underlie intelligence such as speed of processing, knowledge base and the ability to learn and apply mental strategies

informed consent
the ethical basis for psychological treatment or experimentation requiring that the subject (or client) is fully aware of all procedures and their likely and possible effects, and participates on a voluntary basis

insomnia
a sleep disorder characterised by difficulties falling asleep, staying asleep and waking up at the right time

intelligence
can be defined in many ways, including one's capacity for learning, problem-solving, and applying knowledge and skills to adapt to unfamiliar situations

intelligence quotient (IQ)
standardised score for an individual's intelligence as measured by a specific intelligence test; IQ scores are based on how much an individual's test score deviates from the mean score for the normative sample

intergenerational trauma
trauma that is passed down from those who have directly experienced an incident to their future generations

internal consistency
internal reliability calculated across items within a test instrument

internal reliability
the extent to which a study or instrument is consistent within itself

internal validity
the extent to which the observed changes in a study can be attributed to the manipulation of the independent variable and not other factors

International Classification of Diseases (ICD)
a global standard for classification of all documented health conditions, including behavioural and mental disorders

interneuron
neuron that transmits information between motor and sensory neurons and the CNS

inter-rater reliability
the extent to which different observers or raters agree in their assessments

interval data
numerical data where the intervals between numbers are equal, but there is no true zero point

intrinsic motivation
when people are motivated by internal factors, such as excitement, pleasure or joy, to complete a task

irreversibility
children's inability to realise that an action can be done and then undone

J

jet lag
the disruption of the sleep–wake cycle when travelling across time zones

justify
to provide sound reasons or evidence in support of a decision

K

knowledge acquisition
in the context of Sternberg's componential subtheory, used in learning new things

L

LeDoux's biological model of emotion
a model that proposes there are two neural pathways of emotion

life satisfaction
a subjective and global judgment of satisfaction with one's life

limbic system
a group of structures in the brain involved in the experience and expression of emotions; includes the amygdala, hippocampus, thalamus, hypothalamus, cingulate gyrus and the basal ganglia

limitations
assumptions, features or constraints from an investigation that limit a researcher's ability to confidently answer the research question, generalise findings or extrapolate to a claim

line graph
a pictorial representation of data linking two variables, where one is plotted on the *y*-axis and the other on the *x*-axis

line of best fit
a straight line drawn through a scatterplot of data points that best expresses the relationship between those points

linguistic bias
the words in a test are more familiar to examinees who speak one language than those who speak another

long route
environmental stimuli are sent from the thalamus to the cortex and the hippocampus before the amygdala, allowing time to appraise the situation (i.e. a "thoughtful" response)

longitudinal design
a form of repeated measures design where the same participants are investigated over a period of time

M

magnetic resonance imaging (MRI)
a neuroimaging procedure that uses harmless magnetic fields and radio waves to produce a computer-enhanced image of brain structure

major depressive disorder (MDD)
characterised by persistent feelings of worthlessness, sadness and a lack of desire to engage in activities that were once pleasurable

maladaptive behaviour
actions or responses that are counterproductive or harmful to an individual's wellbeing, functioning or goals

mania
an experience of excessive happiness

Mann-Whitney U test
non-parametric test of statistical significance used to compare differences between two independent groups with either ordinal data or continuous data that does not have a normal distribution

matched participants design
a subject-selection procedure that attempts to eliminate confounding variables by "matching" participants in different groups on key characteristics

materialist approach
the view that consciousness (the mind) results from the complex physical interactions between the neurons

mean
the average of all the scores, calculated by adding up all the scores and dividing that total by the number of scores

median
the middle number (or mean of the two middle numbers) of a number series listed in numerical order

medical approach to normality
diagnosing someone with a psychological illness, in the same way a person may be diagnosed with a physical illness

melatonin
a sleep hormone secreted by the pineal gland that causes sleepiness and is released when it is dark

metacognition
an understanding and use of the way one thinks when solving problems, reasoning, planning and making decisions

metacomponent
in the context of Sternberg's componential subtheory, a higher order process that involves planning, monitoring and decision-making

midbrain
connects the hindbrain with the forebrain and controls arousal levels, attention and consciousness

migration
during developmental plasticity, the movement of newly formed neurons

mindfulness
the practice of attending to one's present environment without judgment (acceptance)

mind-versus-body problem
a much debated and controversial question of whether the mind is a separate entity from the body, including the brain

mnemonic strategies
techniques to improve memory retention

Mob
a family unit, Traditional Owner group, nation or wider community group that a First Nations person identifies with

mode
the most commonly occurring score in the dataset

model of subjective wellbeing
Diener's model that wellbeing is based on life satisfaction and affective balance

monism
the view that the mind is the same thing as the brain

monozygotic (MZ) twins
twins who come from the same fertilised egg and thus share all their genetic material

mood disorder
a mood that is severe or persistent and disrupts a person's life or daily functioning

more knowledgeable other
another individual with greater knowledge about a particular topic

motivation
the process that propels us to start and stick with goal-directed behaviours

motor neuron
neuron that communicates messages from the CNS to the particular muscles that an organism intends to move at any particular moment; described as efferent

mundane realism
the degree to which the tasks of an experiment are similar to those of the real world

myelin
a white, fatty, waxy substance that covers the axon to insulate it from the surrounding fluid and from other neurons

myelin sheath
an insulating fatty coating that helps facilitate the transmission of information to other neurons

myelination
the production of myelin, the white, fatty covering that insulates a neuron's axon, speeds transmission and aids coordination

N

narcolepsy
a sleep disorder that causes sudden and unexpected sleeping

Nation
a collective of language groups linked through geographic, social, political and or linguistic ties

naturalistic observation
observation of voluntary behaviours occurring within the subject's natural environment

nature
the internal biological and genetic factors that influence human traits and behaviours such as personality, intelligence and physical attributes

negative correlation
two variables change in opposite directions; as one increases, the other decreases

negatively skewed
the tail of the distribution heads towards zero

nerve
bundle of axons running together in the peripheral nervous system

neural pathway
bundle of neurons that provides connections between one part of the nervous system and another

neural plasticity
the ability of the brain's synapses to be modified where neural networks change through growth and reorganisation

neuron
nerve cells, responsible for communication within the body

neurotransmitter
chemical that helps the communication across nerve synapses

node of Ranvier
a small gap occurring at regular intervals in the myelin sheath that speeds up the transmission of the electrical impulse along the axon

nominal data
data is organised into qualitative categories that cannot be quantified or ranked

non-directional hypothesis
a prediction that does not specify the nature or direction of the relationship between two variables

non-rapid eye movement (NREM) sleep
one of two phases of sleep, characterised by little or no rapid eye movement, and often divided into three stages of NREM sleep that are determined mainly by predominant brainwave patterns

norepinephrine
a neurotransmitter involved in regulating arousal that helps keep us alert during the day

norm
established standard of performance derived from the statistical analysis of a normative sample's test results

normal behaviour
a behaviour that is accepted within society and is typical for the specific situation or context

normal distribution
a symmetrical, bell-shaped distribution of data where most observations are clustered around the mean and decrease with distance from the centre

normal waking consciousness
the state of consciousness we experience when we are awake and aware of our thoughts, feelings and perceptions from internal events and the surrounding environment

normality
state of being normal, defined in terms of typical and atypical behaviours, and how some behaviours are adaptive and others are maladaptive

normative sample
a group selected to reflect the demographics of a wider population, used as a benchmark for test score comparisons

null hypothesis
predicts that there will be no relationship between the variables, causal or otherwise

nurture
the environmental influences that influence human behaviours, including all external factors post-birth, such as social interactions, cultural background, education and life experiences

O

object permanence
realising that an object still exists when it is no longer visible

objective data
data that is measured according to an identifiable external criterion

observational research
a research design where the researcher observes and records behaviour or outcomes without intervening or manipulating any variables

occipital lobe
the cerebral cortex at the rear of the brain; the location of the primary visual cortex and association areas involved with integration of visual stimuli

operationalisation
defining variables in a way that means they can be empirically measured or manipulated in research

order effects
changes in participants' responses caused by the order in which the experiment was conducted, rather than experimental manipulation

ordinal data
data that has a definite sequence, but the gap between one level and the next is not constant

outcome expectancy
an individual's assessment of how effective their actions will be at reaching a particular outcome

outlier
extreme score that can be objectively calculated as an observation greater than three standard deviations above or below the mean

P

parameter
numerical value that describes aspects of a population

paranoid ideation
persistent thoughts of mistrust and suspicion

parasympathetic nervous system
branch of the autonomic nervous system responsible for maintaining day-to-day functioning of the body, such as digestion, heart rate, breathing and some glandular functions; reverses changes in bodily function caused by the sympathetic nervous system

parietal lobe
the location of the primary somatosensory cortex in the brain; it enables a person to perceive their own body and where things are located in their immediate environment

partial sleep deprivation
having some sleep in a 24-hour period but not getting enough to meet your needs; may occur for just one night or for several nights and can have serious consequences

participant variables
individual characteristics of study participants that could influence the outcome of the experiment

Pearson product moment correlation
a measure of the strength of the linear relationship between two continuous variables

peer review
process where experts in a field evaluate the quality and accuracy of a research paper, study or scholarly work before it is published

percentile
measure that indicates the value below which a given percentage of observations in a group fall

performance component
in the context of Sternberg's componential subtheory, related to execution of a task

peripheral nervous system (PNS)
comprises all the nerves and ganglia outside the brain and spinal cord that communicate information to and from the central nervous system

personal growth
feeling that one can continue to develop and try new things

personality
lasting and distinctive behaviours, thoughts, motives and emotions that typify how we react and adapt to other people and situations

personality disorder
where a person's thoughts, feelings and behaviour deviate from what is expected by the society and culture in which they live

pharmacotherapy
the use of drugs and medication to assist mental health

phobia
an irrational fear of a specific object or situation

phrenology
a pseudoscience that suggests our mental abilities and personality are controlled by 37 areas of the brain and that the shape and size of the skull can be measured to determine a person's character

physiological change
a change to the normal functioning of the body, such as heart and breathing rates

physiological measures
the observation of a measurable bodily (physical or physiological) response (such as heart rate, brainwave activity and galvanic skin response)

pie chart
a circular graph divided into sections that are that are proportional to the data they represent

pineal gland
an endocrine gland in the middle of the brain that receives information about the level of light from the environment, and controls the production and secretion of melatonin

placebo
a substance or treatment with no active therapeutic effect, often administered to the control group

placebo effect
participants experience perceived or actual improvement due to their belief about the treatment rather than the treatment itself

polysomnogram
a continuously moving chart that displays data collected simultaneously from EEG, EOG, EMG and other devices

positive correlation
two variables change in the same direction; as one increases (or decreases), so does the other

positive relations with others
when one can develop and maintain close relationships with others

positively skewed
the tail of the distribution heads away from zero

positron emission tomography (PET)
a technique that measures the volume and location of blood flow in the brain by tracking a radioactive substance (e.g. glucose) that has been injected into the person's bloodstream

practical intelligence
in the context of Sternberg's dimensions of intelligence, refers to the ability to apply existing knowledge and common sense to real-world situations

practice effect
a type of order effect that causes an improvement in participants' performance due to learning

precision
the extent to which repeated observations or measurements yield similar results

predictive validity
how well a test score or measure predicts outcomes or behaviours in the future

primary appraisal
initial evaluation and categorisation of a situation as dangerous, positive or irrelevant

primary auditory cortex
located in the upper part of the temporal lobe; receives sound information from the ears in the temporal lobe

primary data
data collected firsthand

primary motor cortex
located at the rear of each frontal lobe; responsible for movement of the skeletal muscles of the body

primary somatosensory cortex
located at the front of each parietal lobe; processes sensations such as touch, pressure, temperature and pain from the body

primary visual cortex
located in the occipital lobe and involved in the processing of information from the eyes

privation
when attachment never occurs; an infant/child never forms a close relationship with anyone

problem-focused coping
addressing a negative situation by using practical ways to deal with it

processing speed
the time it takes for an individual to mentally perform a cognitive (or mental) task

proliferation
the first stage in the development of the nervous system, where cells destined to become neurons divide and multiply

protective factor
factor that guards against the onset or relapse of a psychological disorder

psychodynamic psychotherapy
an approach used mainly for depressive symptoms, whereby an individual explores repressed problems to gain insight into present beliefs and problems

psychograph
an electric-powered device that uses the principles of phrenology to measure a person's head to provide an assessment of their personality

psychological construct
hypothetical concept created to explain a phenomenon that is believed to exist or occur, but cannot be directly observed or measured

psychological development
the development of a human's cognitive, emotional, intellectual and social capabilities and functioning throughout their life

psychological disorder
any condition characterised by cognitive and emotional disturbances, abnormal behaviours, impaired functioning, or any combination of these

psychological dysfunction
a breakdown in the way a person thinks, feels and behaves

psychological wellbeing
wellbeing conceived as a multi-dimensional model with six key domains: autonomy, environmental mastery, personal growth, positive relations with others, purpose in life and self-acceptance

psychology
the systematic study of the mind (mental processes) and behaviour

psychometric approach
(to intelligence) involves quantifying aspects of intelligence through the use of standardised tests developed from factor analysis

psychometric property
an essential feature that determines the quality of psychological instruments such as measures for reliability and validity

psychometric test
a standardised measure of a selected aspect of an individual's behaviour, used to identify individual differences in psychological functioning

psychosurgery
brain surgery including removing parts of the brain and deep brain stimulation to treat mental health disorders

psychotherapy
a form of psychological support administered by a qualified practitioner, like a psychologist, who uses various communication methods and interactions to evaluate, diagnose and address maladaptive emotional responses, cognitive processes and behavioural patterns

purpose in life
when one has goals in life and feels that these goals provide life with meaning

***p*-value**
decimal value indicating the probability that observed results occurred by chance under the assumption that the null hypothesis is true

Q

qualitative data
descriptions of the characteristics of what is being studied

quantitative data
measurements (numerical information) about the variables being studied

quasi-experiment
an independent groups design that resembles an experiment but does not include random allocation to conditions

R

random allocation
a subject-selection procedure where all participants who have been selected for an experiment have an equal chance of being placed into any group

random error
unpredictable error where measurement has an equal probability of being high or low; affects precision and reliability

random sampling
a sampling procedure in which every member of the population has an equal chance of being selected

range
the difference between the highest score and the lowest score in the dataset

rapid eye movement (REM) sleep
one of two phases of sleep, characterised by rapid eye movement

ratio data
measurements that represent quantities in terms of equal intervals and an absolute zero

raw data
original, unprocessed information

raw score
the initial, unadjusted score obtained directly from test responses

reaction range of intelligence
the amount by which IQ scores may vary depending on the interaction of heredity and the environment

reappraisal
the cognitive process of re-evaluating an event or situation and potentially altering the emotional response based on new information or perspective

reflex
automatic, involuntary response to sensory information (stimulus)

relationship management
in the context of Goleman's emotional intelligence, building and maintaining healthy relationships through effective communication and motivational skills

reliability of diagnosis
the consistency of diagnoses made using a particular classification system

reliability
the extent to which a measure could be expected to produce the same result with the same subject(s) under the same conditions on other occasions

REM rebound
the significantly larger amount of time spent in REM sleep than usual that follows a period of being deprived of REM sleep

repeated measures design
also known as "within groups design"; an experimental design in which each participant takes part in all the conditions

representative sample
a sample that accurately reflects the characteristics of the target population being researched

rerouting
when a neuron removes existing connections and forms new connections with other neurons

resilience
the ability to mentally cope with or adapt to uncertainty, challenges and adversity

restoration theory of sleep
a theory stating that sleep allows us to recharge our bodies, and recover from the physical and psychological work during the day; it also allows our body's growth processes to occur

reticular formation
a network of neurons that sits across both the midbrain and hindbrain and connects the hindbrain and forebrain; plays an important role in the control of arousal and the "sleeping and waking" cycle

reversibility
Piaget's term for understanding that inversion of (reversing) an action will return it to its original state

risk factor
factor that contributes to the likelihood of a person developing (or relapsing into) a psychological disorder

rumination
excessive thinking or worrying

S

sample
the sub-set of people from the target population selected for the actual research

scaffolding
providing support to a child to help them learn and master a task independently

scaled score
a score that has been converted from a raw score to a consistent scale that allows comparison across different tests or populations

scatterplot
diagram that shows the values of the two variables for each participant in the sample by representing the intersection of those two values with a dot on a graph

schema
(pl. schemata) an organised mental framework about a person, place or thing

schizophrenia
characterised by a withdrawal from reality, possible delusions and hallucinations, illogical thinking and disturbances in emotions, behaviours or thinking

scientific method
a standardised way of making observations, gathering data, testing hypotheses and interpreting results to establish theories in order to describe and measure human behaviour

secondary appraisal
the process of consciously evaluating one's resources and coping potential for dealing with the situation

secondary data
data collected from second-hand sources

secondary evidence
evidence gathered from second-hand sources such as scientific journals, reputable and authoritative websites and databases

selective attention
the ability to focus on only select stimuli or objects in the environment and to filter out other distractions

self-acceptance
when one views oneself as a whole in a positive way

self-awareness
in the context of Goleman's emotional intelligence, recognising and understanding one's emotions

self-determination
the ability for Aboriginal and Torres Strait Islander peoples to freely decide and govern their own political, social, cultural and economic needs and rights

self-efficacy
belief in one's capability to achieve a specific task or action

self-esteem
an individual's general confidence in themselves and their capability

self-fulfilling prophecy
where a prediction of an outcome causes the outcome to occur

self-management
in the context of Goleman's emotional intelligence, controlling one's emotions and behaviours

self-report
participants' written or verbal responses to questions, statements or instructions about themselves

sensitive period
the best or optimal time for an individual to learn new things due to the nature of the growing brain

sensory neuron
neuron that carries sensory information from the body and the outside world into the CNS; described as afferent

sequential designs
a combination of longitudinal and cross-sectional designs, which draws on strengths and eliminates weaknesses of both approaches

seriation
Piaget's term for the preoperational stage where children will have difficulty arranging objects according to one dimension

short route
environmental stimuli are sent directly from the thalamus to the amygdala for fast but "thoughtless" response

single-blind procedure
allocating participants to groups in such a way that they do not know whether they are in the E-group or the C-group

situational approach to normality
determines what is or isn't normal by using situational cues

situational variables
features in the environment of a study that can unintentionally influence participants' behaviour and affect the outcome of the research

sleep
a naturally occurring altered state of consciousness marked by a diminished sense of awareness and responsiveness to the external environment

sleep apnoea
a type of sleep disorder characterised by the interruption of breathing during sleep

sleep debt
the accumulated amount of sleep loss from insufficient sleep

sleep disorders
changes in sleep–wake cycles that typically have negative effects

sleep hygiene
habits and strategies that can improve the quality and quantity of sleep

sleep-maintaining insomnia
a form of insomnia characterised by difficulty staying asleep throughout the night

sleep-onset insomnia
a form of insomnia characterised by difficulty falling asleep at the beginning of the night

sleep–wake cycle
the biological process of alternating between sleep and wakefulness

sleepwalking
a type of sleep disorder characterised by walking or completing routine activities during the night

social and emotional wellbeing
a holistic understanding of wellness for Aboriginal and Torres Strait Islander peoples that includes intrinsic connections between the relational-self, mind-emotions, body, Country, community, culture, kinship and ancestry

social awareness
in the context of Goleman's emotional intelligence, the ability to understand and empathise with others

social desirability bias
the tendency to answer questions in a way that one believes will be viewed favourably by others

social phobia
(social anxiety disorder) fear of being humiliated in front of people

sociocultural approach to normality
suggests what is normal behaviour based on cultural and societal cues

somatic nervous system
branch of the PNS that transmits sensory information to the CNS and carries motor commands from the CNS to the skeletal muscles

specific phobia
an intense and irrational fear of a specific situation or object

spinal cord
part of the central nervous system that carries sensory and motor signals between the peripheral nervous system and the brain

sprouting
when a neuron forms new branches

standard deviation
a statistical measure of the average deviation of scores from the mean, calculated as the square root of variance

standard error
numerical value that quantifies the variability of the sample mean estimate with respect to the true population mean

standardisation
the process of ensuring a test is consistently administered and scored across different individuals and settings

standardised instructions and procedures
the uniform set of instructions and procedures applied consistently to all participants and across all conditions within a study

state of consciousness
an individual's level of awareness of internal events (thoughts, feelings and perceptions) and external surroundings

statistic
numerical value that describes aspects of a sample

statistical approach to normality
identifies normal behaviour by the frequency of the behaviour within a specified population

stigma
a negative mark that applies to an individual and separates them from others

stigmatisation
applying a negative mark to an individual that sets them apart from others; can lead to disadvantage for the individual

Strange Situation
a method used by Ainsworth to study the differences in quality of attachment between an infant and a caregiver

stratified sampling
a sampling process that involves dividing the population into strata based on specific characteristics, and then taking a random sample from each of these strata

strengths-based approach
a mode of thinking that frames and represents people through their resilience and strengths

stress
a psychological and physical response to internal or external sources of tension (stressors) that challenge a person's ability to cope; the stressors can be real or perceived

structural plasticity
the ability of the brain to change and adapt throughout life

subjective data
information about the variables being studied based on opinion, with no external criterion by which they are measured

subjective feeling
a feeling that is associated with an emotion; it is subjective as it is personal and cannot be objectively measured

subjective wellbeing
how people evaluate their lives to determine their level of wellbeing

suprachiasmatic nucleus (SCN)
located in the hypothalamus where the left and right optic nerves cross paths, it controls circadian rhythms in response to external stimuli

symbolic thinking
development of symbols to represent objects or events

sympathetic nervous system
branch of the autonomic nervous system that changes the activity levels of internal organs, muscles and glands to prepare for increased activity during times of high physical or emotional arousal

synapse
the junction between two neurons

synaptic cleft
the small gap between the presynaptic and postsynaptic neurons

synaptic pruning
the loss of excess neurons and synapses usually formed in infancy and childhood

synaptic transmission
the process of neurons communicating with other neurons

synaptogenesis
the process of moulding or forming new synapses

systematic desensitisation
a therapy technique whereby an individual is gradually exposed to anxiety-inducing stimuli while also practising deep muscle relaxation, thereby eliminating the anxiety response

systematic error
bias in measurement causing skewed results in a consistent direction that affects accuracy and validity

systemic therapy
an approach that focuses on solving problems caused by behaviours in groups, rather than on the causes of behaviours

T

target population
the entire group of people about which researchers wish to generalise their findings

task-orientation goal
a goal that is focused on mastering a skill

temporal lobe
the part of the forebrain beneath the temporal plate of the skull, at the side of the head above the ears; contains Wernicke's area and the primary auditory cortex; responsible for processing verbal sounds and connected to memory

teratogen
an environmental agent or toxin that harms the embryo or fetus

terminal button
bulb-like structure at the end of the axon that releases neurotransmitters

test-retest reliability
the stability of test scores or measurements over time with repeated administrations

thalamus
a structure shaped like two eggs beneath the cortex; it processes incoming sensory information and transmits it to other, higher parts of the brain for further processing; also directs attention to specific sensory systems

theory of multiple intelligences
proposes that people possess different, independent types of intelligence to varying degrees

theta waves
typical brainwave pattern (medium frequency and mixed amplitude) during the early stages of sleep

third variable problem
in correlational research, when two variables misleadingly appear to be related when, instead, a change in both is caused by a third variable

total sleep deprivation
going without sleep for an entire 24-hour period; may occur for just one night or for several nights

trephination
a surgical procedure that involves creating a hole in a patient's skull while they are still awake

***t*-test**
comparison of means in data that reveals how significant the differences are

two-factor theory of emotion
a theory that suggests emotion involves two factors: physiological arousal and cognitive assessment (labelling) of the event or situation

type I error
when a true null hypothesis is incorrectly rejected, also known as a "false positive"

type II error
when a false null hypothesis is not rejected, also known as a "false negative"

U

uncertainty
ambiguity that exists in data or findings

V

valence
the associated quality of how "good" or "bad" something is

validity of diagnosis
refers to how accurately a classification system diagnoses psychological disorders so that diagnosis can lead to effective treatment

validity
the extent to which a study or instrument accurately measures what it intends to measure

variance
a statistical measure of the spread of data, calculated as the average of the squared differences from the mean

voluntary participation
the right of participants to decline to participate in a study; they must not be pressured to take part in the study and must not be tricked into taking part

W

Wernicke's aphasia
results from damage to Wernicke's area that causes difficulty in understanding written and spoken language that makes sense to others

Wernicke's area
part of the left temporal lobe, responsible for language reception and interpretation and for creation of grammatically correct speech

Wilcoxon signed-rank test
non-parametric test used to compare two matched samples, or repeated measurements with either ordinal data or continuous data that does not have a normal distribution

withdrawal rights
the right of participants to leave a study at any stage, including the right to withdraw their results after the study has been completed, regardless of the possible effects on the results

Z

zeitgeber
external or environmental cue that affects the sleep–wake cycle, such as the level of light in a room

zone of proximal development
continuum of cognitive development stretching from solo performance to collaborative cooperation

References

Ainsworth, M., Blehar, M., Waters, E., & Wall, S. (1978). *Patterns of Attachment*. Erlbaum.

Alanko, L., Laitinen, J. T., Stenberg, D., & Porkka-Heiskanen, T. (2004). Adenosine Al receptor-dependent G-protein activity in the rat brain during prolonged wakefulness. *Neuroreport, 15*, 2133–2137.

Allison, T., & Cicchetti, D. V. (1976). Sleep in mammals: Ecological and constitutional correlates. *Science, 194*, 732–734.

American Psychological Association. (n.d.). *APA dictionary of psychology*. https://dictionary.apa.org

Artino, A. R., Jr (2012). Academic self-efficacy: From educational theory to instructional practice. *Perspectives on medical education, 1*(2), 76–85. https://doi.org/10.1007/s40037-012-0012-5

Aserinsky, E., & Kleitman, N. (1953). Regularly appearing periods of eye mobility and concomitant phenomena during sleep. *Science, 188*, 273–274.

Australian Bureau of Statistics (ABS). (2020–2022). *National Study of Mental Health and Wellbeing*. https://www.abs.gov.au/statistics/health/mental-health/national-study-mental-health-and-wellbeing/latest-release.

Australian Bureau of Statistics (ABS). (2023). *Two in five Australians have experienced a mental disorder*. https://www.abs.gov.au/media-centre/media-releases/two-five-australians-have-experienced-mental-disorder#:~:text=%E2%80%9CAnxiety%20was%20the%20most%20common,in%20the%20previous%2012%20months.%E2%80%9D

Australian Bureau of Statistics. (2015). *Australian Health Survey*. http://www.abs.gov.au/australianhealthsurvey

Australian Institute of Health & Welfare. (2022). *Children with mental illness*. www.aihw.gov.au/reports/children-youth/australias-children/contents/health/children-mental-illness

Baer, R. A., & Krietemeyer, J. (2006). Overview of mindfulness- and acceptance-based treatment approaches. In R. A. Baer (Ed.), *Mindfulness-based treatment approaches: Clinician's guide to evidence base and applications* (pp. 3–27). Elsevier Academic Press. https://doi.org/10.1016/B978-012088519-0/50002-2

Bandura, A. (1977). Self-efficacy: Toward a unifying theory of behavioral change. *Psychological Review, 84*(2), 191–215. https://doi.org/10.1037/0033-295X.84.2.191

Barlow, D.H., & Durand, V.M. (2012). *Abnormal psychology: An integrative approach* (6th ed.). Wadsworth/Cengage Learning.

Basner, M., & McGuire, S. (2018). WHO environmental noise guidelines for the European region: A systematic review on environmental noise and effects on sleep. *International Journal of Environmental Research and Public Health, 15*(3), 519. https://doi.org/10.3390/ijerph15030519

Beck, A. T., Emery, G., & Greenberg, R. L. (2005). *Anxiety disorders and phobias: A cognitive perspective*. Basic Books/Hachette Book Group.

Beckett, C., Maughan, B., Rutter, M., Castle, J., Colvert, E., & Groothues, C. (2006). Do the effects of early severe deprivation on cognition persist into early adolescence? Findings from the English and Romanian adoptees study. *Child Development, 77*(9), 696–711.

Bedosky, L. (2018). I tried light therapy and it made a huge difference in my life, *Women's Health*.

Beland, L. P., & Murphy, R. (2015). CEP Discussion Paper No 1350: *Ill Communication: Technology, Distraction & Student Performance*. Centre for Economic Performance, London School of Economics and Political Science. http://cep.lse.ac.uk/pubs/download/dp1350.pdf

Bell, V. (2004). *Finding Geschwind's territory*. Mind Hacks. https://mindhacks.com/2004/12/14/findinggeschwinds-territory

Belzung, C., Willner, P., & Philippot, P. (2015). Depression: From psychopathology to pathophysiology. *Current opinion in neurobiology, 30*, 24–30. https://doi.org/10.1016/j.conb.2014.08.013

Best, D. L. (1993). Inducing children to generate mnemonic organizational strategies: An examination of long-term retention and materials. *Developmental Psychology, 29*(2), 324–336. https://doi.org/10.1037/0012-1649.29.2.324

Birbaumer, N., Veit, R., Lotze, M., Erb, M., Hermann, C., Grodd, W., & Flor, H. (2005). Deficient fear conditioning in psychopathy: a functional magnetic resonance imaging study. *Archives of general psychiatry, 62*(7), 799–805. https://doi.org/10.1001/archpsyc.62.7.799

Bishop, S. R., Lau, M., Shapiro, S., Carlson, L., Anderson, N. D., Carmody, J., Segal, Z. V., Abbey, S., Speca, M., Velting, D., & Devins, G. (2004). Mindfulness: A proposed operational definition. *Clinical Psychology: Science and Practice, 11*(3), 230–241. https://doi.org/10.1093/clipsy.bph077

Black Dog Institute. (n.d.). *Facts & figures about mental health*. https://www.blackdoginstitute.org.au/wp-content/uploads/2020/04/1-facts_figures.pdf

Boddy, J. (1988). Spirits and selves in Northern Sudan: The cultural therapeutics of possession and trance. *American Ethnologist*, *15*(1), 4–27.

Boivin D. B., Czeisler C. A., Dijk, D. J., Duffy, J. F., Folkard, S., Minors, D. S., Totterdell, P., Waterhouse, J. M. (1997). Complex interaction of the sleep–wake cycle and circadian phase modulates mood in healthy subjects. *Archives of General Psychiatry, 54,* 145–152.

Boring, E. G. (1961). Intelligence as the Tests Test It. In J. J. Jenkins & D. G. Paterson (Eds.), *Studies in individual differences: The search for intelligence* (pp. 210–214). Appleton-Century-Crofts. https://doi.org/10.1037/11491-017

Borrell-Carrió, F., Suchman, A. L., & Epstein, R. M. (2004). The biopsychosocial model 25 years later: Principles, practice, and scientific inquiry. *Annals of Family Medicine, 2*(6), 576–582. https://doi.org/10.1370/afm.245

Bouchard, T. J., Jr. (1997). IQ similarity in twins reared apart: Findings and responses to critics. In R. J. Sternberg & E. L. Grigorenko (Eds.), *Intelligence, heredity, and environment* (pp. 126–160). Cambridge University Press.

Bouchard, T. J., Lykken, D. T., McGue, M., Segal, N. L., & Tellegen, A. (1990). Sources of human psychological differences: The Minnesota study of twins reared apart, *Science, 250*(4978), 223–228.

Bowlby, J. (1969). *Attachment and loss, Vol.1: Attachment*. Basic Books.

Bratsberg, B., & Rogeberg, O. (2018). Flynn effect and its reversal are both environmentally caused. *Proceedings of the National Academy of Sciences, 115*(26), 6674–6678. https://doi.org/10.1073/pnas.1718793115

Bridges, K. M. (1931). *The social and emotional development of the preschool child*. Kegan Paul.

Bruck, D., & Thomas, I. (2008). Towards a better smoke alarm signal: An evidence based approach. *Fire Safety Science: Proceedings of the ninth international symposium, 9*, 403–414.

Burton, L. J. (2018). *An interactive approach to writing essays and research reports in psychology* (4th ed.). John Wiley & Sons.

Burton, L. J., Westen, D., & Kowalski, D. (2018). *Psychology* (5th ed.). Wiley.

Bussey, T. J., Muir, J. L., Everitt, B. J., & Robbins, T. W. (1996). Dissociable effects of anterior and posterior cingulate cortex lesions on the acquisition of a conditional visual discrimination: Facilitation of early learning vs. impairment of late learning. *Behavioural Brain Research, 82*(1), 45–56. https://doi.org/10.1016/S0166-4328(97)81107-2

Butterworth, P., Schurer, S., Trinh, T.-A., Vera-Toscano, E., & Wooden, M. Effect of lockdown on mental health in Australia: Evidence from a natural experiment analysing a longitudinal probability sample survey. *Lancet Public Health*, *7*(5), e427–e436.

Campione, J. C., Brown, A. L., Ferrara, R. A., Jones, R. R., & Steinberg, E. (1985). Breakdowns in flexible use of information: Intelligence-related differences in transfer following equivalent learning performance. *Intelligence, 9*(4), 297–315. https://doi.org/10.1016/0160-2896(85)90017-0

Canivez, G. (2010). Review of the Wechsler Adult Intelligence Test-Fourth Edition. *The eighteenth Mental Measurements Yearbook*. 684–688.

Carney, C. E., Edinger, J. D., Meyer, B., Lindman, L., & Istre, T. (2006). Daily activities and sleep quality in college students. *Chronobiology International, 23,* 623–637.

Carskadon, M. A., Wolfson, A. R., & Acebo, C. (1998). Adolescent sleep patterns, circadian timing, and sleepiness at a transition to early school days. *Sleep, 21,* 871–881.

Chen, J-Q., & Gardner, H. (2018). Assessment from the perspective of multiple-intelligences theory: Principles, practices, and values. In D. P. Flanagan & E. M. McDonough (Eds.), *Contemporary intellectual assessment: Theories, tests, and issues* (pp. 164–173). Guilford Publications.

Chesson, A. L. Jr, Littner, M., Davila, D., Anderson, W. M., Grigg-Damberger, M., Hartse, K., Johnson, S., & Wise, M. (1999). Practice parameters for the use of light therapy in the treatment of sleep disorders. Standards of Practice Committee, American Academy of Sleep Medicine. *Sleep, 22*(5), 641–660.

Cheung, C. C. Y., Lee, T. M. C., Yip, J. T. H., King, K. E., & Li, L. S. W. (2006). The differential effects of thalamus and basal ganglia on facial emotion recognition. *Brain and Cognition, 61*(3), 262–268. https://doi.org/10.1016/j.bandc.2006.01.008

Cicchetti, D., Ackerman, B. P., & Izard, C. (1995). Emotions and emotion regulation in developmental psychopathology. *Development and Psychopathology, 7*(1), 1–10.

Climie, E. A., & Rostad, K. (2011). Test Review: Wechsler Adult Intelligence Scale. *Journal of Psychoeducational Assessment, 29*(6), 581–586. https://doi.org/10.1177/0734282911408707

Cohn, M. A., Fredrickson, B. L., Brown, S. L., Mikels, J. A., & Conway, A. M. (2009). Happiness unpacked. *Emotion (Washington, D.C.), 9*(3), 361–368. https://doi.org/10.1037/a0015952

Coleman, D., & Boyatzis, R. E. (2017). *Emotional intelligence has 12 elements. Which do you need to work on?* Harvard Business Review. https://hbr.org/2017/02/emotional-intelligence-has-12-elements-which-do-you-need-to-work-on

Collins, R. L., Wong, E. C., Breslau, J., Burnam, M. A., Cefalu, M., & Roth, E. (2019). Social marketing of mental health treatment: California's mental illness stigma reduction campaign. *American Journal of Public Health, 109*(S3). S228–S235. https://doi.org/10.2105/AJPH.2019.305129

Cooper, J. E. (1972). *Psychiatric diagnosis in New York and London: A comparative study of mental hospital admissions*. Oxford University Press.

Coren, S. (1996). *Sleep thieves*. Free Press.

Corkin, S., Amaral, D. G., González, R. G., Johnson, K. A., & Hyman, B. T. (1997). H. M.'s medial temporal lobe lesion: findings from magnetic resonance imaging. *Journal of Neuroscience*, *17*(10), 3964–3979. https://doi.org/10.1523/jneurosci.17-10-03964.1997

Corrigan, P. W., & Rao, D. (2012). On the self-stigma of mental illness: Stages, disclosure, and strategies for change. *Canadian Journal of Psychiatry, 57*(8), 464–469. https://doi.org/10.1177/070674371205700804

Craik, F. I. M., Govoni, R., Naveh-Benjamin, M., & Anderson, N. D. (1996). The effects of divided attention on encoding and retrieval processes in human memory. *Journal of Experimental Psychology: General, 125*(2), 159–180. https://doi.org/10.1037/0096-3445.125.2.159

Critchley, H., Daly, E., Phillips, M., Brammer, M., Bullmore, E., Williams, S., Van Amelsvoort, T., Robertson, D., David, A., & Murphy, D. (2000). Explicit and implicit neural mechanisms for processing of social information from facial expressions: A functional magnetic resonance imaging study. *Human Brain Mapping, 9*(2), 93–105. https://doi.org/10.1002/(sici)1097-0193(200002)9:2<93::aid-hbm4>3.0.co;2-z

Cumming, G., & Finch, S. (2005). Inference by eye: Confidence intervals and how to read pictures of data. *American Psychologist, 60*(2), 170–180.

Curtiss, S. (1977). *Genie: A psycholinguistic study of a modern-day 'Wild Child'*. Academic Press.

Czeisler, C. A., Duffy, J. F., Shanahan, T. L., Brown, E. N., Mitchell, J. F., Rimmer, D. W., Ronda, J. M., Silva, E. J., Allan, J. S., Emens, J. S., Dijk, D.-J., & Kronauer, R. E. (1999). Stability, precision, and near-24-hour period of the human circadian pacemaker, *Science,* 284(5423), 2177–2181. https://doi:10.1126/science.284.5423.21

DeCharms, R. (1968). *Personal causation: The internal affective determinants of behavior.* Academic Press.

Deci, E. L. (1971) Effects of externally mediated rewards on intrinsic motivation. *Journal of Personality and Social Psychology, 18*, 105–115. https://doi.org/10.1037/h0030644

Deci, E. L. (1972). Intrinsic motivation, extrinsic reinforcement, and inequity. *Journal of Personality and Social Psychology, 22*(1), 113–120. https://doi.org/10.1037/h0032355

Deci, E. L., & Ryan, R. M. (1985). Intrinsic motivation and self-determination in human behavior. Plenum.

Dement, W. (1960). The effect of dream deprivation. *Science, 131*(3415), 1705–1707.

Department of Health and Human Services, Victoria. (2016). Pharmacotherapy policy in Victoria. https://www.health.vic.gov.au/drugs-and-poisons/pharmacotherapy-policy-in-victoria

Diener, E. (1984). Subjective well-being. *Psychological Bulletin, 95*(3), 542–575. https://doi.org/10.1037/0033-2909.95.3.542

Diener, E., & Seligman, M. E. P. (2004). Beyond money: Toward an economy of well-being. *Psychological Science in the Public Interest, 5*(1), 1–31. https://doi.org/10.1111/j.0963-7214.2004.00501001.x

Diener, E., Emmons, R. A., Larsen, R. J., & Griffin, S. (1985). The satisfaction with life scale. *Journal of Personal Assess, 49*(1), 71–75. https://doi:10.1207/s15327752jpa4901_13

Dierckx, B., Heijnen, W. T., van den Broek, W. W., & Birkenhäger, T. K. (2012). Efficacy of electroconvulsive therapy in bipolar versus unipolar major depression: a meta-analysis. *Bipolar disorders*, *14*(2), 146–150. https://doi.org/10.1111/j.1399-5618.2012.00997.x

Doran, G. (1981). There's a S.M.A.R.T way to write management's goals and objectives. *Management Review, 70*. 35–36.

Duckworth, A. L., Quinn, P. D., Lynam, D. R., Loeber, R., & Stouthamer-Loeber, M. (2011). Role of test motivation in intelligence testing. *Proceedings of the National Academy of Sciences, 108*(19), 7716–7720. https://doi.org/10.1073/pnas.1018601108

Durmer, J. S., & Dinges, D. F. (2005). Neurocognitive consequences of sleep deprivation. *Seminars in Neurology, 25,* 117–129.

Dweck, C. S. (2006). *Mindset: The new psychology of success*. Random House.

Engel G. L. (1977). The need for a new medical model: a challenge for biomedicine. *Science (New York, N.Y.)*, *196*(4286), 129–136. https://doi.org/10.1126/science.847460

Fabbri, C., Di Girolamo, G., & Serretti, A. (2013). Pharmacogenetics of antidepressant drugs: an update after almost 20 years of research. *American journal of medical genetics. Part B, Neuropsychiatric genetics: The official publication of the International Society of Psychiatric Genetics*, *162B*(6), 487–520. https://doi.org/10.1002/ajmg.b.32184

Fenoy, A. J., & Simpson, R. K., Jr (2014). Risks of common complications in deep brain stimulation surgery: management and avoidance. *Journal of neurosurgery*, *120*(1), 132–139. https://doi.org/10.3171/2013.10.JNS131225

Field, A. (2013). *Discovering statistics using IBM SPSS statistics* (4th ed.). SAGE Publications.

Fink, M., & Taylor, M. A. (2007). Electroconvulsive therapy: evidence and challenges. *JAMA*, *298*(3), 330–332. https://doi.org/10.1001/jama.298.3.330

Firestone, L. (2016). Disorganized attachment: How disorganizes attachments form & how they can be healed. *PSYCHALIVE*. https://www.psychalive.org/disorganized-attachment/

Fitzgerald P. B. (2011). The Emerging Use of Brain Stimulation Treatments for Psychiatric Disorders. *Australian & New Zealand Journal of Psychiatry*, *45*(11), 923–938. doi:10.3109/00048674.2011.615294

Flynn, J. R. (1984). The mean IQ of Americans: Massive gains 1932 to 1978. *Psychological Bulletin, 95*(1), 29–51. https://doi.org/10.1037/0033-2909.95.1.29

Forer, B. R. (1949). The fallacy of personal validation: a classroom demonstration of gullibility. *The Journal of Abnormal and Social Psychology, 44*(1), 118–123. https://doi.org/10.1037/h0059240

Franzen, P. L., Buysse, D. J., Dahl, R. E., Thompson, W., & Siegle, G. J. (2009). Sleep deprivation alters pupillary reactivity to emotional stimuli in healthy young adults. *Biological psychology*, *80*(3), 300–305. https://doi.org/10.1016/j.biopsycho.2008.10.010

Fredrickson, B. L. (2004). The broaden-and-build theory of positive emotions. *Philosophical Transactions of the Royal Society of London. Series B, 359*(1449), 1367–1377. https://doi.org/10.1098/rstb.2004.1512

Fredrickson, B. L., Cohn, M. A., Coffey, K. A., Pek, J., & Finkel, S. M. (2008). Open hearts build lives: positive emotions, induced through loving-kindness meditation, build consequential personal resources. *Journal of personality and social psychology*, *95*(5), 1045–1062. https://doi.org/10.1037/a0013262

Gais, S., Lucas, B., & Born, J. (2006). Sleep after learning aids memory recall. *Learning & memory (Cold Spring Harbor, N.Y.)*, *13*(3), 259–262. https://doi.org/10.1101/lm.132106

Gardner, H. (1978). *Developmental psychology: An introduction*. Little Brown & Co.

Garrett, B. (2009). *Brain and behaviour: An introduction to biological psychology*. SAGE Publications.

Garrett, B., & Hough, G. (2018). *Brain & behaviour: An introduction to behavioural neuroscience*. SAGE Publications.

Geldard, K., & Geldard, D. (2009). *Relationship counselling for children, young people and families*. Sage Publications.

Geschwind, N. (1970). The organization of language and the brain. *Science, 170*(3961), 940–944. https://doi:10.1126/science.170.3961.940

Giles, B. (2005). *History of Psychology*, Grange Books.

Gleitman, H., Gross, J., & Reisberg, D. (2011). *Psychology*. W.W. Norton & Co.

Gottfredson, L. S. (2003). Dissecting practical intelligence theory: Its claims and evidence. *Intelligence, 31*(4), 343–397. https://doi.org/10.1016/S0160-2896(02)00085-5

Gould, S. J. (1996). *The mismeasure of man*. W. W. Norton & Co.

Gravetter, F. J. & Wallnau, L.B. (2014) *Essentials of statistics for the behavioral sciences* (8th ed.). Cengage Learning.

Graybiel, A. M. (1995). Building action repertoires: Memory and learning functions of the basal ganglia. *Current Opinion in Neurobiology, 5*(6), 733–741. https://doi.org/10.1016/0959-4388(95)80100-6

Gritti, E. S., Bornstein, R. F., & Barbot, B. (2023). The smartphone as a "significant other": Interpersonal dependency and attachment in maladaptive smartphone and social networks use. *BMC Psychology, 11*, 296. https://doi.org/10.1186/s40359-023-01339-4

Gross, R., & McIlveen, R. (1998). *Psychology: A New Introduction*. London: Hodder and Stoughton.

Gulevich, G., Dement, W., & Johnson, L. (1966). Psychiatric and EEG observations on a case of prolonged (264 hours) wakefulness. *Archives of General Psychiatry, 15*, 29–35.

Haber, S. N., & Knutson, B. (2010). The reward circuit: Linking primate anatomy and human imaging. *Neuropsychopharmacology, 35*(1), 4–26. https://doi.org/10.1038/npp.2009.129

Hadland, K., Rushworth, M. F., Gaffan, D., & Passingham, R. (2003). The effect of cingulate lesions on social behaviour and emotion. *Neuropsychologia, 41*(8), 919–931. https://doi.org/10.1016/S0028-3932(02)00325-1

Hall, C. (2014). Bereavement theory: recent developments in our understanding of grief and bereavement. *Bereavement Care*, *33*(1), 7–12. https://doi.org/10.1080/02682621.2014.902610

Harlow, H. F. (1958). The nature of love. *American psychologist*, *13*(12), 673.

Heath, A. C., Kendler, K. S., Eaves, L. J., & Martin, N. G. (1990). Evidence for genetic influences on sleep disturbance and patterns in twins, *Sleep, 13*, 318–335.

Hess, K. (2018). *A local assessment toolkit to promote deeper learning.* Corwin, https://doi.org/10.4135/9781544357430

Heston L. L. (1966). Psychiatric disorders in foster home reared children of schizophrenic mothers. *The British journal of psychiatry: The journal of mental science*, *112*(489), 819–825. https://doi.org/10.1192/bjp.112.489.819

Hills, T. T., Proto, E., Sgroi, D., & Seresinhe, C. I. (2019). Historical analysis of national subjective wellbeing using millions of digitized books. *Nature Human Behaviour, 3*(12). https://doi.org/10.1038/s41562-019-0781-5

Hood, H. K., & Antony, M. M. (2012). Evidence-based assessment and treatment of specific phobias in adults. In T. E. Davis III, T. H. Ollendick, & L.-G. Öst (Eds.), *Intensive one-session treatment of specific phobias* (pp. 19–42). Springer Science + Business Media. https://doi.org/10.1007/978-1-4614-3253-1_2

Houlfort, N., Koestner, R., Joussemet, M., Nantel-Vivier, A., & Lekes, N. (2002). The impact of performance-contingent rewards on perceived autonomy and competence. *Motivation and Emotion, 26*, 279–295. https://doi.org/10.1023/A:1022819120237

Howell, D. C. (1999). StatSource to accompany David C. Howell's *Fundamental statistics for the behavioral sciences*, (4th ed.). Duxbury Press.

Hüber-Weidman, H. (1976). *Sleep, sleep disturbances and sleep deprivation*. Kiepenheuser & Witsch.

Irwin, M. L., Yasui, Y., Ulrich, C. M., Bowen, D., Rudolph, R. E., Schwartz, R. S., Yukawa, M., Aiello, E., Potter, J. D., & McTiernan, A. (2003). Effect of exercise on total and intra-abdominal body fat in postmenopausal women: a randomized controlled trial. *JAMA*, *289*(3), 323–330. https://doi.org/10.1001/jama.289.3.323

Jacofsky, D. J., Kocisky, S., Dixon, D., & Jacofsky, M. C. (2010). Secure tracks device improves functional recovery and pain after total knee arthroplasty: a prospective, randomized, pilot study. *Surgical technology international*, *20*, 357–361.

Janzen, H. L., Obrzut, J. E., Marusiak, C. W. (2004). Test Review: Roid, G. H. (2003). Stanford-Binet Intelligence Scales, Fifth Edition (SB:V). Itasca, IL: Riverside Publishing. *Canadian Journal of School Psychology, 19*(1–2), 235–244. https://doi.org/10.1177/082957350401900113

Jennings, J. R., Monk, T. H. & van der Molen, M. W. (2003). Sleep deprivation influences some but not all processes of supervisory attention. *Psychological Science, 14*(5), 473–479.

Jones, M. K., & Menzies, R. G. (2000). Danger expectancies, self-efficacy and insight in spider phobia. *Behaviour research and therapy*, *38*(6), 585–600. https://doi.org/10.1016/s0005-7967(99)00076-5

Kabat-Zinn, J. (2003). Mindfulness-based interventions in context: Past, present, and future. *Clinical Psychology: Science and Practice, 10*(2), 144–156. https://doi.org/10.1093/clipsy.bpg016

Kagan, J. (1989). Temperamental contributions to social behavior. *American Psychologist, 44*(4), 668–674. https://doi.org/10.1037/0003-066X.44.4.668

Kail, R. (1991). Developmental change in speed of processing during childhood and adolescence. *Psychological Bulletin, 109*(3), 490–501. https://doi.org/10.1037/0033-2909.109.3.490

Kalat, J. (2008). *Introduction to Psychology* (8th ed.). Wadsworth Publishing Company.

Kandel, E. R., & O'Dell, T. J. (1992). Are adult learning mechanisms also used for development? *Science, 258*(5080), 243–245. https://doi.org/10.1126/science.1411522

Kaplan, R. M., & Saccuzzo, D. P. (2017). *Psychological testing* (9th ed.). Cengage.

Karg, R. S., Bose, J., Batts, K. R., Forman-Hoffman, V. L., Liao, D., Hirsch, E., Pemberton, M. R., Colpe, L. J., & Hedden, S. L. (2014). Past year mental disorders among adults in the United States: Results from the 2008–2012 Mental Health Surveillance Study. *National Library of Medicine*. https://www.ncbi.nlm.nih.gov/books/NBK379142/

Katz, L. C. & Shatz, L. C. (1996). Synaptic activity and the construction of cortical circuits. *Nature, 274*, 1133–1138.

Kearins, J. (1986). Visual spatial memory in Aboriginal and white Australian children. *Australian Journal of Psychology, 38*, 203–214. https://doi.org/10.1080/00049538608259009

Kearins, J., (1981). Visual spatial memory of Australian Aboriginal children of desert regions. *Cognitive Psychology, 13,* 434–460. https://doi.org/10.1016/0010-0285(81)90017-7

Khoshaba, D. (2013). About complicated bereavement disorder. *Psychology Today*. https://www.psychologytoday.com/au/blog/get-hardy/201309/about-complicated-bereavement-disorder-0

Kinomura, S., Larsson, J., Gulyas, B. & Roland, P. E. (1996). Activation of attention by the human reticular formation and thalamic intralaminar nuclei. *Science, 271*, 512–515.

Kleinman, A. (1982). Neurasthenia and depression: A study of somatization and culture in China. *Culture, Medicine and Psychiatry*, *6*(2), 117–190.

Klich, L. Z., & Davidson, G. R. (1983). A cultural difference in visual memory: On le voit, on ne le voit plus. *International Journal of Psychology, 18*(3–4), 189–201. https://doi.org/10.1080/00207598308247473

Knief, U., & Forstmeier, W. (2021). Violating the normality assumption may be the lesser of two evils. *Behavior Research Methods, 53*(6), 2576–2590. https://doi.org/10.3758/s13428-021-01587-5

Kozlovskiy, S. A., Vartanov Alexsander V, Nikonova, E. Y., Pyasik, M. M., & Velichkovsky, B. M. (2012). The cingulate cortex and human memory processes. *Psychology in Russia: State of the Art, 5*(5), 231–243. https://doi.org/10.11621/pir.2012.0014

Kring, A. M., & Sloan, D. M. (2007). The Facial Expression Coding System (FACES): Development, validation, and utility. *Psychological Assessment, 19*(2), 210–224. https://doi.org/10.1037/1040-3590.19.2.210

Kumar, R., & Yeragani, V. K. (2011). Penfield - A great explorer of psyche-soma-neuroscience. *Indian Journal of Psychiatry*, *53*(3), 276–278. https://doi.org/10.4103/0019-5545.86826

Kyoto University. (2015, November 20). The search for happiness: Using MRI to find where happiness happens. *ScienceDaily*. www.sciencedaily.com/releases/2015/11/151120092144.htm

Lapidus, K. A., Shin, J. S., Pasculli, R. M., Briggs, M. C., Popeo, D. M., & Kellner, C. H. (2013). Low-dose right unilateral electroconvulsive therapy (ECT): effectiveness of the first treatment. *The Journal of ECT*, *29*(2), 83–85. https://doi.org/10.1097/YCT.0b013e31827e0b51

Lazarus, R. S. (1982). Thoughts on the relations between emotion and cognition. *American Psychologist, 37*(9), 1019–1024. https://doi.org/10.1037/0003-066X.37.9.1019

Lazarus, R. S., & Folkman, S. (1984). *Stress, appraisal, and coping.* Springer Publishing Company.

Leahy, R. L., & Holland, S. J. (2000*). Treatment plans and interventions for depression and anxiety disorders*. The Guilford Press.

LeDoux J. E. (1994). Emotion, memory and the brain. *Scientific American, 270*(6), 50–57. https://doi.org/10.1038/scientificamerican0694-50

LeDoux, J. E. (1996). The emotional brain: The mysterious underpinnings of emotional life. Simon & Schuster.

LeDoux, J. E. (2000). Emotion circuits in the brain. *Annual Review of Neuroscience, 23*(1), 155–184. https://doi.org/10.1146/annurev.neuro.23.1.155

Li, Q. S., Tian, C., Seabrook, G. R., Drevets, W. C., & Narayan, V. A. (2016). Analysis of 23andMe antidepressant efficacy survey data: implication of circadian rhythm and neuroplasticity in bupropion response. *Translational Psychiatry, 6*(9), e889. https://doi.org/10.1038/tp.2016.171

Lissek, S., Kaczkurkin, A. N., Rabin, S., Geraci, M., Pine, D. S., & Grillon, C. (2014). Generalized anxiety disorder is associated with overgeneralization of classically conditioned fear. *Biological Psychiatry, 75*(11), 909–915. https://doi.org/10.1016/j.biopsych.2013.07.025

Locke, E. A. (2005). Why emotional intelligence is an invalid concept. *Journal of Organizational Behavior, 26*(4), 425–431. https://doi.org/10.1002/job.318

Locke, E. A. (1996). Motivation through conscious goal setting. *Applied & Preventive Psychology, 5*(2), 117–124. https://doi.org/10.1016/S0962-1849(96)80005-9

Locurto, C. (1990). The malleability of IQ as judged from adoption studies. *Intelligence, 14*(3), 275–292. https://doi.org/10.1016/S0160-2896(10)80001-7

Looti, M. (2023). *Sternberg's theory of intelligence*. Psychological Scales. https://scales.arabpsychology.com/2022/11/19/sternbergs-theory-of-intelligence/

Lorenz, K. Z. (1937). The companion in the bird's world. *The Auk, 54*(3), 245–273. https://doi.org/10.2307/4078077

Lugaresi, E., Medori, R., Montagna, P., Baruzzi, A., Cortelli, P., Lugaresi, A., Tinuper, P., Zucconi, M., & Gambetti, P. (1986). Fatal familial insomnia and dysautonomia with selective degeneration of thalamic nuclei. *The New England journal of medicine*, *315*(16), 997–1003. https://doi.org/10.1056/NEJM198610163151605

Lyons-Ruth, K., Easterbrooks, M. A., & Cibelli, C. D. (1997). Infant attachment strategies, infant mental lag, and maternal depressive symptoms: Predictors of internalizing and externalizing problems at age 7. *Developmental Psychology, 33*(4), 681–692. https://doi.org/10.1037/0012-1649.33.4.681

Maciejewski, P. K., Prigerson, H. G., & Mazure, C. M. (2000). Self-efficacy as a mediator between stressful life events and depressive symptoms: Differences based on history of prior depression. *The British Journal of Psychiatry, 176*, 373–378. https://doi.org/10.1192/bjp.176.4.373

Mackes, N. K., Golm, D., Sarkar, S., Kumsta, R., Rutter, M., Fairchild, G., Mehta, M. A., Sonuga-Barke, E. J. S., & ERA Young Adult Follow-up team. (2020). Early childhood deprivation is associated with alterations in adult brain structure despite subsequent environmental enrichment. *Proceedings of the National Academy of Sciences of the USA, 117*(1), 641–649. https://doi:10.1073/pnas.1911264116

Maclean, P. D. (1952). Some psychiatric implications of physiological studies on frontotemporal portion of limbic system (visceral brain). *Electroencephalography & Clinical Neurophysiology, 4*, 407–418. https://doi.org/10.1016/0013-4694(52)90073-4

Macpherson, T., & Hikida, T. (2019). Role of basal ganglia neurocircuitry in the pathology of psychiatric disorders. *Psychiatry and clinical neurosciences, 73*(6), 289–301. https://doi.org/10.1111/pcn.12830

Madsen, B., Perkins, R., & Shay, M. (2021). Critical selection of curriculum materials: Tools for educators. In M. Shay & R. Oliver (Eds.) *Indigenous education in Australia learning and teaching for deadly futures* (pp. 133–147). Routledge.

Maguire, E. A., Woollett, K., & Spiers, H. J. (2006). London taxi drivers and bus drivers: A structural MRI and neuropsychological analysis. *Hippocampus*, *16*, 1091–1101. https://doi.org/10.1002/hipo.20233

Main, M., & Solomon, J. (1986). Discovery of an insecure-disorganized/disoriented attachment pattern. In T. B. Brazelton & M. W. Yogman (Eds.), *Affective development in infancy* (pp. 95–124). Ablex Publishing.

Mason, H. (2005, January 25). Who dreams, perchance to sleep? *Gallup Poll News Service*. http:// www.gallup.com

Mayer, J. D., Salovey, P., & Caruso, D. (2000). Models of emotional intelligence. In R. J. Sternberg (Ed.), *Handbook of intelligence* (pp. 396–420). Cambridge University Press. https://doi.org/10.1017/CBO9780511807947.019

Mayer, J.D., Salovey, P., & Caruso, D (2002). Mayer-Salovey-Caruso Emotional Intelligence Test (MSCEIT) Users Manual. Toronto, Ontario: Multi-Health Systems.

McGrath, J., Saha, S., Welham, J., El Saadi, O., MacCauley, C., & Chant, D. (2004). A systematic review of the incidence of schizophrenia: the distribution of rates and the influence of sex, urbanicity, migrant status and methodology. *BMC Medicine, 2*(13). https://doi.org/10.1186/1741-7015-2-13

McLeod, S. (2007). Maslow's Hierarchy of Needs. *Simply Psychology*, 1.

McLeod., K. (2014). Orientating to Assembling: Qualitative Inquiry for More-Than-Human Worlds. *International Journal of Qualitative Methods*, *13*(1), 377-394. https://doi.org/10.1177/160940691401300120

Medalia, A., & Choi, J. (2009). Cognitive remediation in schizophrenia. *Neuropsychology review*, *19*(3), 353–364. https://doi.org/10.1007/s11065-009-9097-y

Meek, W. (2024). Smoking with generalized anxiety disorder. *Verywellmind*. www.verywellmind.com/smoking-anxiety-1393071

Millan, M. J., Agid, Y., Brüne, M., Bullmore, E. T., Carter, C. S., Clayton, N. S., Connor, R., Davis, S., Deakin, B., DeRubeis, R. J., Dubois, B., Geyer, M. A., Goodwin, G. M., Gorwood, P., Jay, T. M., Joëls, M., Mansuy, I. M., Meyer-Lindenberg, A., Murphy, D., Rolls, E., … Young, L. J. (2012). Cognitive dysfunction in psychiatric disorders: characteristics, causes and the quest for improved therapy. *Nature reviews. Drug discovery*, *11*(2), 141–168. https://doi.org/10.1038/nrd3628

Miyake K., Chen S.-J., & Campos, J. (1985), Infant temperament, mother's mode of interaction and attachment in Japan. *Monographs of the Society for Research in Child Development, 50*(209), 276–297 Blackwell.

Motivala, S. J., & Irwin, M. R. (2007). Sleep and Immunity: Cytokine Pathways Linking Sleep and Health Outcomes. *Current Directions in Psychological Science, 16*(1), 21–25. https://doi.org/10.1111/j.1467-8721.2007.00468.x

Nakamura, J., & Csikszentmihalyi, M. (2002). The concept of flow. In C. R. Snyder & S. J. Lopez (Eds.), *Handbook of positive psychology* (pp. 89–105). Oxford University Press.

Nakamura, J., & Csikszentmihalyi, M. (2009). Flow theory and research. In C. R. Snyder & S. J. Lopez (Eds.), *Oxford Handbook of Positive Psychology* (2nd ed., pp. 195–206), Oxford University Press.

National Health and Medical Research Council (NHMRC). (2013). *Australian code for the care and use of animals for scientific purposes*. https://www.nhmrc.gov.au/about-us/publications/australian-code-care-and-use-animals-scientific-purposes

National Health and Medical Research Council (NHMRC). (2013). *Australian code for the care and use of animals for scientific purposes* (8th ed.)

Nestadt, G., Samuels, J., Riddle, M., Bienvenu, O. J., 3rd, Liang, K. Y., LaBuda, M., Walkup, J., Grados, M., & Hoehn-Saric, R. (2000). A family study of obsessive-compulsive disorder. *Archives of general psychiatry*, *57*(4), 358–363. https://doi.org/10.1001/archpsyc.57.4.358

Nettelbeck, T., & Burns, N. R. (2010). Processing speed, working memory and reasoning ability from childhood to old age. *Personality and Individual Differences, 48*(4), 379–384. https://doi.org/10.1016/j.paid.2009.10.032

Nettelbeck, T., & Wilson, C. (2002). Personal Vulnerability to Victimization of People with Mental Retardation. *Trauma, Violence, & Abuse*, *3*(4), 289–306. https://doi.org/10.1177/1524838002237331

Nevéus, T., Cnattingius, S., Olsson, U., & Hetta, J. (2001). Sleep habits and sleep problems among a community sample of schoolchildren. *Acta paediatrica (Oslo, Norway: 1992)*, *90*(12), 1450–1455. https://doi.org/10.1080/08035250152708888

Nielsen, S. M., Toftdahl, N. G., Nordentoft, M., & Hjorthøj, C. (2017). Association between alcohol, cannabis, and other illicit substance abuse and risk of developing schizophrenia: a nationwide population based register study. *Psychological medicine*, *47*(9), 1668–1677. https://doi.org/10.1017/S0033291717000162

Nietzel, M. T., Speltz, M. L., McCauley, E. A., & Bernstein, D. A. (1998). *Abnormal Psychology*. Allyn and Bacon.

Nutt, D., Wilson, S., & Paterson, L. (2008). Sleep disorders as core symptoms of depression. *Dialogues in Clinical Neuroscience*, 10(3), 329–336. https://doi.org/10.31887/DCNS.2008.10.3/dnutt

O'Boyle, M. W., Cunnington, R., Silk, T. J., Vaughan, D., Jackson, G., Syngeniotis, A., & Egan, G. F. (2005). Mathematically gifted male adolescents activate a unique brain network during mental rotation. *Brain research. Cognitive brain research*, *25*(2), 583–587. https://doi.org/10.1016/j.cogbrainres.2005.08.004

O'Connor, T. G., Rutter, M., Beckett, C., Keaveney, L., Kreppner, J. M. & English and Romanian Adoptees Study Team. (2000). The effects of global severe privation on cognitive competence: Extension and longitudinal follow-up. *Child Development*, 376–390.

Ochsner, K. N., & Gross, J. J. (2008). Cognitive emotion regulation: Insights from social cognitive and affective neuroscience. *Current Directions in Psychological Science, 17*(2), 153–158. https://doi.org/10.1111/j.1467-8721.2008.00566.x

Ohayon, M. M., Zulley, J., Guilleminault, C., & Smirne, S. (1999). Prevalence and pathologic associations of sleep paralysis in the general population. *Neurology*, *52*(6), 1194–1200. https://doi.org/10.1212/wnl.52.6.1194

Ong, J. C., Huang, J. S., Kuo, T. F. & Manber, R. (2007). Characteristics of insomniacs with self-reported morning and evening chronotypes. *Journal Clinical Sleep Medicine, 3*(3), 289–294.

Ortiz, S. O., Lella, S. A., & Canter, A. (2010). Intellectual ability and assessment: A primer for parents and educators. *National Association of School Psychologists.*

Papez, J. W. (1937). A proposed mechanism of emotion. *Archives of Neurology and Psychiatry (Chicago), 38*(4), 725–743. https://doi.org/10.1001/archneurpsyc.1937.02260220069003

Parker, G., Cheah, Y. C., & Roy, K. (2001). Do the Chinese somatize depression? A cross-cultural study. *Social psychiatry and psychiatric epidemiology*, *36*, 287–293.

Pasman, J. (2011). The consequences of labeling mental illnesses on the self-concept: A review of the literature and future directions. *Social Cosmos*, *2*, 122–127.

Pekkanen, J. (1982). Why do we sleep? *Science, 82*, 86.

Peterson, C. (2004). *Looking forward through the lifespan* (4th ed.). Frenchs Pearson Education.

Phelps, E. A. (2004). Human emotion and memory: Interactions of the amygdala and hippocampal complex. *Current Opinion in Neurobiology, 14*(2), 198–202.

Pilcher, J. J., & Walters, A. S. (1997). How sleep deprivation effects psychological variables related to college student's cognitive performance. *Journal of American College Health, 46*, 121–126.

Providence Health Care. (2022). *Self-assessment*. http://staffmentalhealth.providencehealthcare.org/staff/self-assessment

Prpić, N. (2015). Language processing – role of inferior parietal lobule. *Gyrus, 3*(3), 173–175. https://doi:10.17486/gyr.3.1037

Pulvermüller, F. (2005). Brain mechanisms linking language and action. *Nature reviews. Neuroscience*, *6*(7), 576–582. https://doi.org/10.1038/nrn1706

Queensland Government (2023). *Young drivers*. StreetSmarts. https://streetsmarts.initiatives.qld.gov.au/young-drivers

Queensland Government. (2024). 'Away for the day' – mobile phones and wearable devices at school. Learning Place.

Raine, A., Buchsbaum, M., LaCasse, L. (1997). Brain abnormalities in murderers indicated by position emission tomography. *Biological Psychiatry*, *42*(6), 495–508. https://doi.org/10.1016/S0006-3223(96)00362-9

Rainnie, D. G., Grunze, H. C., McCarley, R. W., & Greene, R. W. (1994). Adenosine inhibition of mesopontine cholinergic neurons: implications for EEG arousal. *Science (New York, N.Y.)*, *263*(5147), 689–692. https://doi.org/10.1126/science.8303279

Riehm, K. E., Feder, K. A., Tormohlen, K. N., Crum, R. M., Young, A. S., Green, K. M., Pacek, L. R., La Flair, L. N., & Mojtabai, R. (2019). Associations between time spent using social media and internalizing and externalizing problems among US youth. *JAMA Psychiatry, 76*(12), 1266–1273. https://doi.org/10.1001/jamapsychiatry.2019.2325

Rosenhan, D. L. (1973). On being sane in insane places. *Science*, *179*(4070), 250–258.

Rosenzweig, M. R., Bennett, E. L., & Diamond, M. C. (1972). Cerebral effects of differential experience in hypophysectomized rats. *Journal of Comparative and Physiological Psychology*, *79*(1), 56–66. https://doi:10.1037/h0032527

Rothman, K. J., & Michels, K. B. (1994). The continuing unethical use of placebo controls. *The New England journal of medicine*, *331*(6), 394–398. https://doi.org/10.1056/NEJM199408113310611

Royal Children's Hospital. (2018). *Obstructive sleep apnoea (OSA)*. https://www.rch.org.au/kidsinfo/fact_sheets/childhood_obstructive_sleep_apnoea_osa/#:~:text=You%20may%20notice%20snoring%20and,three%20per%20cent%20of%20children

Rutter, M., O'Connor, T. G., and the English and Romanian Adoptees (ERA) Study Team. (2004). *Developmental Psychology*, *40*, 81–94.

Ryan, R. M., & Deci, E. L. (2000). Self-determination theory and the facilitation of intrinsic motivation, social development, and well-being. American Psychologist, 55(1), 68–78. https://doi.org/10.1037/0003-066X.55.1.68

Ryan, R. M., & Deci, E. L. (2017). *Self-determination theory: Basic psychological needs in motivation, development, and wellness* (pp. 123–157) Guilford Press.

Ryff, C. D. (1989). Happiness is everything, or is it? Explorations on the meaning of psychological well-being. *Journal of Personality and Social Psychology, 57*(6), 1069–1081.

Ryff, C. D., & Keyes, C. L. M. (1995). The structure of psychological well-being revisited. *Journal of Personality and Social Psychology, 69*(4), 719–727. https://doi.org/10.1037/0022-3514.69.4.719

Salovey, P., & Mayer, J. D. (1990). Emotional Intelligence. *Imagination, Cognition and Personality*, *9*(3), 185-211. https://doi.org/10.2190/DUGG-P24E-52WK-6CDG

Santrock, J. W. (2008). *Life-span development* (12th ed.). McGraw-Hill.

Sartorius, N., Shapiro, R., & Jablensky, A. (1974). The international pilot study of schizophrenia. *Schizophrenia Bulletin*, *1*(11), 21.

Scarr, S. & Weinberg, R. A. (1977). Intellectual similarities within families of both adopted and biological children. *Intelligence, 32*, 170–190.

Scarr, S. & Weinberg, R. A. (1983). The Minnesota adoption studies: Genetic differences and malleability. *Child Development, 54*, 260–267.

Schachter, S., & Singer, J. (1962). Cognitive, social, and physiological determinants of emotional state. *Psychological Review, 69*(5), 379–399. https://doi.org/10.1037/h0046234

Schaeffer, H. R., & Emerson, P. E. (1964). The development of social attachments in infancy. *Monographs of the Society for Research in Child Development, 29*(3, Whole No. 94), 1–77. https://doi.org/10.2307/1165727

Schwarzer, R., & Jerusalem, M. (1995). Generalized self-efficacy scale. In J. Weinman, S. Wright, & M. Johnston (Eds.), *Measures in health psychology: A user's portfolio. Causal and control beliefs* (pp. 35–37). NFER-NELSON.

Scoville, W. B., & Milner, B. (1957). Loss of recent memory after bilateral hippocampal lesions. *Journal of neurology, neurosurgery, and psychiatry*, *20*(1), 11.

Senaratna, C. V., Perret, J. L., Lodge, C. J., Lowe, A. J., Campbell, B. E., Matheson, M. C., Hamilton, G. S., & Dharmage, S. C. (2017). Prevalence of obstructive sleep apnea in the general population: A systematic review. *Sleep Medicine Reviews*, *34*, 70–81. https://doi.org/10.1016/j.smrv.2016.07.002

Shaffer, L. H. (1975). Multiple attention in continuous verbal tasks. In P. M. A. Rabbitt & S. Dornic (Eds.), *Attention and performance* (vol. V; pp. 157–167). Academic Press.

Shapiro, C. M., Bortz, R., Mitchell, D., Bartel, P., & Jooste, P. (1981). Slow-wave sleep: a recovery period after exercise. *Science (New York, N.Y.)*, *214*(4526), 1253–1254. https://doi.org/10.1126/science.7302594

Sherman, M., & Key, C. B. (1932). The intelligence of isolated mountain children. *Child Development, 3*, 279–290.

Shin J. Y. & Habermann, B. (2016). Initiation of medications for Parkinson's disease: a qualitative description. *Journal of Clinical Nursing. 25*(1–2), 127–133. https://doi.org/10.111/jocn.13009

Siegel, J. M. (2001). The REM sleep-memory consolidation hypothesis. *Science (New York, N.Y.)*, *294*(5544), 1058–1063. https://doi.org/10.1126/science.1063049

Siegel, J. M. (2003). Why we sleep. *Scientific American*, *289*(5), 92–97. https://doi.org/10.1038/scientificamerican1103-92

Simpson, T., Camfield, D., Pipingas, A., Macpherson, H., & Stough, C. (2012). Improved processing speed: Online computer-based cognitive training in older adults. *Educational Gerontology, 38*(7), 445–458. https://doi.org/10.1080/03601277.2011.559858

Singer, W. (1995). Development and plasticity of cortical processing architecture. *Science, 270,* 758–764.

Sowell, E. R., Thompson, P. M., Holmes, C. J., Jernigan, T. L., & Toga, A. W. (1999). In vivo evidence for post-adolescent brain maturation in frontal and striatal regions. *Nature Neuroscience, 2*, 859–861.

Stanislav, K., Alexander, V., Maria, P., Evgenia, N., & Boris, V. (2013). Anatomical characteristics of cingulate cortex and neuropsychological memory tests performance. *Procedia, Social and Behavioral Sciences, 86,* 128–133. https://doi.org/10.1016/j.sbspro.2013.08.537

Stein, A., Vinh To, X., Nasrallah, F. A., & Barlow, K. M. (2023). Evidence of ongoing cerebral microstructural reorganization in children with persisting symptoms following mild traumatic brain injury: A NODDI DTI analysis. *Journal of Neurotrauma*, 41(1–2). http://doi.org/10.1089/neu.2023.0196

Steriade, M. & McCarley, R. W. (1990). *Brainstem control of wakefulness and sleep.* Springer.

Sternberg, R. J. (1984). Toward a triarchic theory of human intelligence. *Behavioral and Brain Sciences, 7*(2), 269–315. https://doi.org/10.1017/S0140525X00044629

Sternberg, R. J. (1988). A triarchic view of intelligence in cross-cultural perspective. In S. H. Irvine & J. W. Berry (Eds.), *Human abilities in cultural context* (pp. 60–85). Cambridge University Press. https://doi.org/10.1017/CBO9780511574603.003

Sternberg, R. J. (1995). Styles of thinking and learning. *Language Testing, 12*(3), 265–291. https://doi.org/10.1177/026553229501200302

Sternberg, R. J. (2003). Our research program validating the triarchic theory of successful intelligence: Reply to Gottfredson. *Intelligence, 31*(4), 399–413. https://doi.org/10.1016/S0160-2896(02)00143-5

Sternberg, R. J., & Detterman, D. K. (1986) *What is intelligence?: Contemporary viewpoints on its nature and definition*. Bloomsbury.

Sternberg. R. J. (2012) Intelligence. *Dialogues Clinical Neuroscience, 14*(1), 19–27. https://doi.org/10.31887/dcns.2012.14.1/rsternberg

Stix, G. (2023). Heavy cannabis use linked to schizophrenia, especially among young men. *SciAm*. https://www.scientificamerican.com/article/heavy-cannabis-use-linked-to-schizophrenia-especially-among-young-men/#:~:text=A%20study%20published%20on%20May,men%20who%20are%20heavy%20users

Stoddard, G. (1943). *The meaning of intelligence*. Macmillan.

Stroop, J. R. (1935). Studies of interference in serial verbal reactions. *Journal of Experimental Psychology*, *18*, 643–662.

Suomi, S. J., Harlow, H. F., & Domek, C. J. (1970). Effect of repetitive infant- infant separation of young monkeys. *Journal of Abnormal Psychology*, *76*(2), 161–172. https://doi:10.1037/h0029809

Taylor, J. (1982). *An introduction to error analysis: The study of uncertainties in physical measurements* (2nd ed.). University Science Books.

ten Doesschate, F., van Eijndhoven, P., Tendolkar I., van Wingen G. A., & van Waarde, J. A. (2014). Pre-treatment amygdala volume predicts electroconvulsive therapy response. *Frontiers in Psychiatry, 5*. https://doi.org/10.3389/fpsyt.2014.00169

Thompson, R. A. (2006). The development of the person: Social understanding, relationships, conscience, self. In N. Eisenberg, W. Damon, & R. M. Lerner (Eds.), *Handbook of child psychology: Social, emotional, and personality development* (6th ed., pp. 24–98). John Wiley & Sons, Inc.

Tiller, J. W. G. (2013). Depression and anxiety. *The Medical Journal of Australia, 199*(S6), S23–S31. https://doi.org/10.5694/mja12.10628

University of Western Australia (UWA). (2023, September 29). *Science of emotion: The basics of emotional psychology*. UWA Online. https://online.uwa.edu/news/emotional-psychology

van Ijzendoorn, M. H., Juffer, F. & Poelhuis, C. W. K. (2005). Adoption and cognitive development: A meta- analytic comparison of adopted and non-adopted children's IQ and school performance. *Psychological Bulletin, 131*(9), 301–316.

Vinney, C. (2020, January 19). *Understanding the triarchic theory of intelligence*. ThoughtCo. www.thoughtco.com/triarchic-theory-of-intelligence-4172497

Vogt, B. A. (2005). Pain and emotion interactions in subregions of the cingulate gyrus. *Nature Reviews Neuroscience, 6*(7), 533–544. https://doi.org/10.1038/nrn1704

Vøllestad, J., Sivertsen, B., & Nielsen, G. H. (2011). Mindfulness-based stress reduction for patients with anxiety disorders: Evaluation in a randomized controlled trial. *Behaviour Research and Therapy 49*(4), 281–288. https://doi.org/10.1016/j.brat.2011.01.007

Voort, J. L. V., He, J. P., Jameson, N. D., & Merikangas, K. R. (2014). Impact of the DSM-5 attention-deficit/hyperactivity disorder age-of-onset criterion in the US adolescent population. *Journal of the American Academy of Child & Adolescent Psychiatry*, *53*(7), 736–744. https://doi.org/10.1016/j.jaac.2014.03.005

Vygotsky, L. S. (1978). *Mind in society. The development of higher psychological processes*. Harvard University Press.

Wahlstrom, K. (2002). Changing times: Findings from the first longitudinal study of later high school start times. *Sleep, 86,* 3–21.

Walker, M. P., & Stickgold, R. (2006). Sleep, memory and plasticity, *Annual Review of Psychology, 57,* 139–166.

Ward, A. F., Duke, K., Gneezy, A., & Bos, M., W. (2017). Brain Drain: The Mere Presence of One's Own Smartphone Reduces Available Cognitive Capacity. *Journal of the Association for Consumer Research, 2*(2), 140–154.

Watkins, E. (2015). Psychological treatment of depressive rumination. *Current Opinion in Psychology, 4*, 32–36. https://doi.org/10.1016/j.copsyc.2015.01.020

Watson, D., Clark, L. A., & Tellegen, A. (1988). Development and validation of brief measures of positive and negative affect: The PANAS scales. *Journal of Personality and Social Psychology, 54*(6), 1063–1070.

Watson, J. B., & Rayner, R. (1920). Conditioned emotional reactions. *Journal of Experimental Psychology*, *3*(1), 1.

Weinberg, R. A. (1989). Intelligence and IQ: Landmark issues and great debates. *American Psychologist, 44*(2), 98–104. https://doi.org/10.1037/0003-066X.44.2.98

Weinberg, R. A., Scarr, S., & Waldman, I. E. (1992). The Minnesota Transracial Adoption Study: A follow-up of IQ test performance at adolescence. *Intelligence, 16,* 117–135.

Wever, R. A. (1984). Properties of human sleep–wake cycles: parameters of internally synchronized free-running rhythms. *Sleep, 7,* 27–51.

White, F., Hayes, B., & Livesay, D. (2005) *Developmental psychology: from infancy to adulthood*. Pearson Education Australia.

Witelson, S. F., Kigar, D. L., & Harvey, T. (1999). The exceptional brain of Albert Einstein. *Lancet, 353*(9170), 2149–2153. https://doi.org/10.1016/S0140-6736(98)10327-6

Wolfson, A. R., Spauling, N., Dandrow, C., & Baroni, E. (2007). Middle school start times: The importance of a good night's sleep for young adolescents. *Behavioural Sleep Medicine, 5*(3), 194–209.

Wolters, C. A. (2004). Advancing achievement goal theory: Using goal structures and goal orientations to predict students' motivation, cognition, and achievement. *Journal of Educational Psychology, 96*(2), 236–250. https://doi.org/10.1037/0022-0663.96.2.236

Wouters-Adriaens, M. P., & Westerterp, K. R. (2006). Basal metabolic rate as a proxy for overnight energy expenditure: the effect of age. *British journal of nutrition*, *95*(6), 1166–1170. https://doi.org/10.1079/bjn20061784

Yakovlev, P. I. (1948). Motility, behavior and the brain: Stereodynamic organization and neural co-ordinates of behavior. *Journal of Nervous and Mental Disease, 107*(4), 313–335. https://doi.org/10.1097/00005053-194810740-00001

Yildirim, F. B., & Sarikcioglu L. (2007). Marie Jean Pierre Flourens (1794–1867): An extraordinary scientist of his time. *Journal of Neurology, Neurosurgery and Psychiatry, 78*(8), 852. https://doi:10.1136/jnnp.2007.118380

Youngstedt, S. D., O'Connor, P. J., & Dishman, R. K. (1997). The effects of acute exercise on sleep: a quantitative synthesis. *Sleep*, *20*(3), 203–214. https://doi.org/10.1093/sleep/20.3.203

Zepelin, H. (1986). REM sleep and the timing of self-awakenings. *Bulletin of the Psychonomic Society, 24,* 254–256. https://doi.org/10.3758/BF03330132

Zigler, E., & Seitz, V. (1982). Head start as a national laboratory. *The ANNALS of the American Academy of Political and Social Science*, *461*(1), 81–90. https://doi.org/10.1177/0002716282461000009

Index

D

E

F

G

H

I

J

K

L

M

N

O

P

Q

R

S

T

U

V

W

Z

Acknowledgements

The author and the publisher wish to thank the following copyright holders for reproduction of their material.

Cover: Science Photo Library - PASIEKA/Getty Images. **Contents:** Corona Borealis Studio/Shutterstock**,** p.iii-v, p.x-xi.

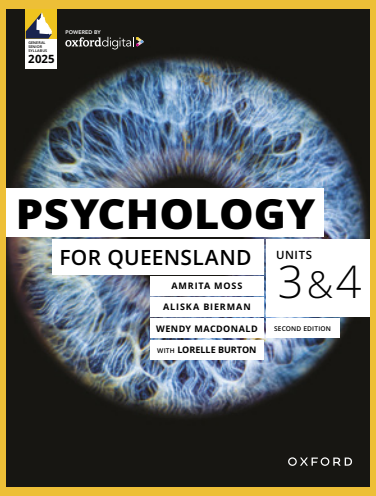
Module 1: GNT STUDIO/Shutterstock, p.2-3; Berit Kessler/Shutterstock, p.4 fig 1; Soheil/Alamy Stock Photo, p.11 fig 1; kikovic/Shutterstock, p.12 fig 2; Ground Picture/Shutterstock, p.14 fig 3; 3DMI/Shutterstock, p.20 fig 5; © Commonwealth of Australia, p.23 fig 8 **U1 opener:** StockImageFactory.com/Shutterstock, p.62-63. **Module 2:** Adrian Weston/Alamy Stock Photo, p.64-65; PRISMA ARCHIVO/Alamy Stock Photo, p.67 fig 1; Science & Society Picture Library/Contributor/GettyImages, p.67 fig 2; Miguel Zagran/Shutterstock, p.67 fig 3; Imago History Collection/Alamy Stock Photo, p.73 fig 2; Classic Image/Alamy Stock Photo, p.74 fig 3; Roman Zaiets/Shutterstock, p.78 fig 1; Science Photo Library/Alamy Stock Photo, p.79 fig 2; Katrina Brown/Shutterstock, p.79 fig 4; Signal Photos/Alamy Stock Photo, p.80 fig 5; Rocketclips, Inc./Shutterstock, p.82 fig 6. **Module 3:** ZEPHYR/SCIENCE PHOTO LIBRARY, p.87-88; Tero Vesalainen/Shutterstock, p.95 fig 3; Marina Demeshko/Shutterstock, p.96 fig 4; Antonio Guillem/Shutterstock, p.96 fig 5; RugliG/Shutterstock, p.97 fig 6; J.B.S. Jackson, MD, p.98 fig 8; © Medical and pathological anatomy collections - Sorbonne University, p.100 fig 2. **Module 4:** Rattiya Thongdumhyu/Shutterstock, p.107-108; Alexey Kotelnikov/Alamy Stock Photo, p.111 fig 4; Magic mine/Shutterstock, p.111 fig 5; Keith carroll/Shutterstock, p.113 fig 6; photomaster/Shutterstock, p.114 fig 7; Julee Ashmead/Shutterstock, p.118 fig 1; Ermolaev Alexander/Shutterstock, p.118 fig 2; Michael Klein/Newspix, p.119 fig 3; nobeastsofierce/Shutterstock, p.123. **U1T1 review:** Yok_onepiece/Shutterstock, p.127; wavebreakmedia/Shutterstock, p.128 (m); sfam_photo/Shutterstock, p.129. **Module 5:** Image Source Limited/Alamy Stock Photo, p.130-131; Rawpixel.com/Shutterstock, p.132 fig 1; Understanding Brain Development in Young Children, North Dakota State University, Sean E. Brotherson, https://www.researchgate.net/figure/Synaptic-density-in-the-human-brain_fig1_252178274., p.133 fig 3; Alexandre Laprise/Shutterstock, p.134 fig 4; Max kegfire/Shutterstock, p.135 fig 6; Carlos Caetano/Shutterstock, p.137 fig 7; BreizhAtao/Shutterstock, p.137 fig 8; Lopolo/Shutterstock, p.138 fig 9 (l); Ted Foxx/Alamy Stock Photo, p.138 fig 9 ®; Lolostock - Apex Studios/Shutterstock, p.140 fig 2; Rafal Rutkowski/Shutterstock, p.141 fig 3 (A); Skynavin/Shutterstock, p.141 fig 3 (B); Calek/Shutterstock, p.141 fig 4; Peakstock/Shutterstock, p.142 fig 5; Monkey Business Images/Shutterstock, p.142 fig 6; Bettmann/Contributor/getty images, p.145 fig 8; Liukov/Shutterstock, p.146 fig 9; Mangostar/Shutterstock, p.149 fig 4(B); fizkes/Shutterstock, p.149 fig 4(A); UfaBizPhoto/Shutterstock, p.154 (m). **Module 6:** Christin Lola/Shutterstock, p.156-157; DenisNata/Shutterstock, p.159; marilyn barbone/Shutterstock, p.160 fig 3; Jeanette Virginia Goh/Shutterstock, p.160 fig 4; Science History Images/Alamy Stock Photo, p.161 fig 5; Science History Images/Alamy Stock Photo, p.161 fig 6; Science History Images/Alamy Stock Photo, p.161 fig 7; chomplearn/Shutterstock, p.162 fig 8; ViDI Studio/Shutterstock, p.166 fig 13; Mike Abrahams/Alamy Stock Photo, p.167 fig 1; Brian A Jackson/Shutterstock, p.168 fig 2; Pumidol/Shutterstock, p.170 fig 4; Ensian published by University of Michigan, p.171 fig 1; PHOTO RESEARCHERS, INC./SCIENCE PHOTO LIBRARY, p.173 fig 3; Monkey Business Images/Shutterstock, p.174 fig 6; Jacob Lund/Shutterstock, p.174 fig 7; eggeegg/Shutterstock, p.175 fig 9; panuwat phimpha/Shutterstock, p.175 fig 10; Dragon Images/Shutterstock, p.176 fig 11; engagestock/Shutterstock, p.176 fig 12 (l); Dragon Images/Shutterstock, p.176 fig 12 (r); raigvi/Shutterstock, p.177 fig 13; ABO PHOTOGRAPHY/Shutterstock, p.178 fig 14; Ollyy/Shutterstock, p.178 fig 15. **U1T2 review:** Doug McLean/Shutterstock, p.183 (bl); lzf/Shutterstock, p.183 (mr); SUKJAI PHOTO/Shutterstock, p.184 (bl); Ulza/Shutterstock, p.184 (br); Chris JG White/Shutterstock, p.185 (lm); Yulia YasPe/Shutterstock, p.185 (tr). **Module 7:** Notman Studios (photographer) - [1] MS Am 1092 (1185), Series II, 23, Houghton Library, Harvard University, p.189 fig 1; SS 360/Shutterstock, p.189 fig 3; zhukovvvlad/Shutterstock, p.190 fig 5; Pheelings media/Shutterstock, p.190 fig 6; fizkes/Shutterstock, p.191 fig 7(A); voronaman/Shutterstock, p.191 fig 7(B); Martin Carlsson/Shutterstock, p.191 fig 7(C) ; fizkes/Shutterstock, p.191 fig 7(D); Olga Pink/Shutterstock, p.191 fig 7(E); Martin Helgemeir/Shutterstock, p.191 fig 7(F); PeopleImages.com - Yuri A/Shutterstock, p.191 fig 7(G); Ground

Picture/Shutterstock, p.192 fig 9; Oris Arisara/Shutterstock, p.192 fig 10; Skolova/Shutterstock, p.193 fig 1; Ljupco Smokovski/Shutterstock, p.194 fig 2; Ilija Ascic/Shutterstock, p.194 fig 3; fad82/Shutterstock, p.195 fig 4; Tero Vesalainen/Shutterstock, p.196 fig 6; GaudiLab/Shutterstock, p.197 fig 7; Trendsetter Images/Shutterstock, p.200 fig 3; Alina Reynbakh/Shutterstock, p.203 fig 1; Chaikom/Shutterstock, p.204 fig 2(A); kirill guzhvinsky/ Shutterstock, p.204 fig 2(B); Roman Zaiets/Shutterstock, p.206 fig 6; JAMES HOLMES/SCIENCE PHOTO LIBRARY, p.207 fig 9; Mix and Match Studio/Shutterstock, p.186-187. **Module 8:** Monkey Business Images/ Shutterstock, p.213-214; Ljupco Smokovski/Shutterstock, p.215 fig 1; Brian A Jackson/Shutterstock, p.217 fig 3; Olga Pink/Shutterstock, p.218 fig 4; Vivid Cafe/Shutterstock, p.218 fig 5; Nestor Rizhniak/Shutterstock, p.222 fig 3; Antonio Guillem/Shutterstock, p.222 fig 4; Rawpixel.com/Shutterstock, p.222 fig 5; Ground Picture/Shutterstock, p.223 fig 6; TSViPhoto/Shutterstock, p.224 fig 1; Jaco van Rensburg/Shutterstock, p.225 fig 3; Clara Bastian/ Shutterstock, p.225 fig 4; Volodymyr Burdiak/Shutterstock, p.225 fig 5; lzf/Shutterstock, p.226 fig 7; Ranta Images/ Shutterstock, p.227 fig 8; gillmar/Shutterstock, p.227 fig 9; fizkes/Shutterstock, p.227 fig 10; VGstockstudio/ Shutterstock, p.228 fig 11; Dragana Gordic/Shutterstock, p.231 fig 1; KREUS/Shutterstock, p.231 fig 2; JGA/ Shutterstock, p.231 fig 3 (l); Donna Ellen Coleman/Shutterstock, p.231 fig 3(r); NOAA's National Ocean Service, p.232 fig 4; SG SHOT/Shutterstock, p.233 fig 5; Sabphoto/Shutterstock, p.235 (m); r.classen/Shutterstock, p.235 fig 10; Ariwasabi/Shutterstock, p.235 fig 11; PrinceOfLove/Shutterstock, p.237 fig 12; Antonio Guillem/Shutterstock, p.237 fig 13; BaLL LunLa/Shutterstock, p.233 fig 6; Tara Lambourne/Shutterstock, p.234 fig 7; ViDI Studio/ Shutterstock, p.234 fig 8. **Module 9:** Phoenixns/Shutterstock, p.244-245; Dollydoll29/Shutterstock, p.246 fig 1; Colombo Photography/Shutterstock, p.247 fig 2; M101Studio/Shutterstock, p.248 fig 3; ittipon/Shutterstock, p.248 fig 4; Pixel-Shot/Shutterstock, p.250 fig 1; Antonio Guillem/Shutterstock, p.250 fig 2; frantic00/Shutterstock, p.250 fig 3; 1989studio/Shutterstock, p.251 fig 4; Tero Vesalainen/Shutterstock, p.252 fig 5; Ground Picture/Shutterstock, p.252 fig 6; Copyright 2024 SleepFoundation.org, p.252 fig7; MNBB Studio/Shutterstock, p.253 fig 9; Quintanilla/ Shutterstock, p.254 fig 10; Teeradej/Shutterstock, p.254 fig 11; New Africa/Shutterstock, p.255 fig 12; SimpleBen. CNX/Shutterstock, p.256 fig 13; Ground Picture/Shutterstock, p.259 fig 3; PhotoSGH/Shutterstock, p.261 fig 4. **U1T3 review:** CandyBox Images/Shutterstock, p.269 (bl); Master1305/Shutterstock, p.269 (mr). **U1 review:** life_in_a_pixel/Shutterstock, p.272; szefei/Depositphotos, p.275 (b). **U2 opener:** Monkey Business Images/ Shutterstock, p.280-281. **Module 10:** Juice Flair/Shutterstock, p.282-283; maruco/Shutterstock, p.284; David Clark/ Newspix, p.285 fig 2; Lyndon Mechielsen/Newspix, p.285 fig 3; Amber De Vos/Contributor/Getty Images, p.285 fig 5; Gregg Porteous/Newspix, p.285 fig 4; Everett Collection/Shutterstock, p.289 fig 1; Radachynskyi Serhii/ Shutterstock, p.289 fig 2; (c) The Triarchic Mind by Robert Sternberg, p.292 fig 1; Gorodenkoff/Shutterstock, p.292 fig 2; Gorodenkoff/Shutterstock, p.292 fig 3; © Sajaganesandip, p.294 fig 1; Selenophile/Shutterstock, p.296 fig 1; Monkey Business Images/Shutterstock, p.298 fig 3; Gio.tto/Shutterstock, p.301 fig 3; PASCAL GOETGHELUCK/ SCIENCE PHOTO LIBRARY, p.301 fig 4; JGA/Shutterstock, p.302 fig 6; Elena Eryomenko/Shutterstock, p.304 fig 8; Picture Partners/Shutterstock, p.307 fig10. **Module 11:** shironosov/Getty Images, p.314-315; fizkes/ Shutterstock, p.317 fig 1; Diego Cervo/Shutterstock, p.317 fig 2; ARCHIVIO GBB/Alamy Stock Photo, p.319 fig 3; Przemek Klos/Shutterstock, p.325 fig 3; Veja/Shutterstock, p.325 fig 4; Elnur/Shutterstock, p.326 fig 5; Antonio Suarez Vega/Shtterstock, p.328 fig 6; PANGI/Shutterstock, p.329 fig 7. **U2T1 review:** romakoma/Shutterstock, p.336 (mr). **Module 12:** Marie Killen/Getty Images, p.338-339; istock /proda kszyn, p.342 fig 2; Monkey Business Images/Shutterstock, p.342 fig 3; istock/izusek, p.343 fig 4; photobyphotoboy/Shutterstock, p.343 fig 5; megaflopp/ Shutterstock, p.345 fig 7; archana bhartia/Shutterstock, p.347 fig 1; Paul Binet/Shutterstock, p.348 fig 2; RimDream/ Shutterstock, p.349 fig 3; iStockphoto/ killerb10, p.351 fig 1; yogendrasingh.in/Shutterstock, p.351 fig 2; © Vijayan Ragavan, p.352 fig 3; Muhammad S0hail/Shutterstock, p.352 fig 4; Jayesh/Getty Images, p.353 fig 5; AJ Pics/ Alamy Stock Photo, p.357 fig 1; AlexandreNunes/Shutterstock, p.358 fig 2; Madon Arafik/Shutterstock, p.360 Table 3 (A); Mafazal Muna/Shutterstock, p.360 Table 3 (B); yabluko_draws/Shutterstock, p.360 Table 3 (C) ; HappyPictures/Shutterstock, p.360 Table 3 (D); Vector bucket/Shutterstock, p.360 Table 3 (E) ; Anatoliy Karlyuk/ Shutterstock, p.360 Fig 3; Jester-Flim/Shutterstock, p.363 fig 5; recep-bg/Getty Images, p.365 fig 1; vandervelden/ Getty Images, p.366 fig 2; RunPhoto/Getty Images, p.367 fig 3. **U2T2 review:** hikrcn/Shutterstock, p.371 (ml). **Module 13:** Sokolova Maryna/Shutterstock, p.380 fig 1; Mikael Damkier/Shutterstock, p.381 fig 2; ESB Basic/ Shutterstock, p.383 fig 1; AP Photos, p.383 fig 2; Shidlovski/Shutterstock, p.384 fig 3; SB Arts Media/Shutterstock, p.385 fig 4; Stokkete/Shutterstock, p.386 fig 5; Prajwal Shetty/Alamy Stock Photo, p.387 fig 1; Hryshchyshen Serhii/ Shutterstock, p.388 fig 2; MilanMarkovic78/Shutterstock, p.389 fig 3; Image Source Trading Ltd/Shutterstock,

p.390 fig 1; Corepics VOF/Shutterstock, p.390 fig 2; Kzenon/Shutterstock, p.391 fig 3; © 2022 Peter Butterworth et. al. Published by Elsevier Ltd., p.394 (bl); fizkes/Shutterstock, p.373-374. **Module 14:** Kichigin/Shutterstock, p.395-396; Krakenimages.com/Shutterstock, p.397 fig 1; Krakenimages.com/Shutterstock, p.398 fig 2; Pixel-Shot/Shutterstock, p.399 fig 3; antpkr/Shutterstock, p.399 fig 5; Martin Valigursky/Shutterstock, p.400 fig 6 (A); 2p2play/Shutterstock, p.400 fig 6 (B); Ken Griffiths/Shutterstock, p.400 fig 6 (C); Spiffy Digital Creative/Shutterstock, p.400 fig 6 (D); Alexander Raths/Shutterstock, p.400 fig 6 (E); Inside Creative House/Shutterstock, p.401 fig 7; Edwards Photography/Shutterstock, p.401 fig 8; Russell Johnson/Shutterstock, p.407 fig 3; Westend61 GmbH/Alamy Stock Photo, p.407 fig 4; Helen Sushitskaya/Shutterstock, p.407 fig 5; © Mental Health Commission of Canada, p.400 Table 1. **Module 15:** Pressmaster/Shutterstock, p.413-414; Southworks/Shutterstock, p.416 fig 1; © Each Mind Matters, p.416 fig 2; ESB Professional/Shutterstock, p.418 fig 1; Omeletzz/Shutterstock, p.419 fig 2; WILL & DENI MCINTYRE/SCIENCE PHOTO LIBRARY, p.420 fig 3; DR P. MARAZZI/SCIENCE PHOTO LIBRARY, p.420 fig 4; YAKOBCHUK VIACHESLAV/Shutterstock, p.421 fig 5; © 2014 ten Doesschate, van Eijndhoven, Tendolkar, van Wingen and van Waarde., p.425 (mr). **Module 16:** Rawpixel.com/Shutterstock, p.428-429; ViDI Studio/Shutterstock, p.430 fig 1; Anikin Dmitrii/Shutterstock, p.431 fig 3; engagestock/Shutterstock, p.431 fig 4; Ground Picture/Shutterstock, p.433 fig 6(A); dwphotos/Shutterstock, p.433 fig 6(B); UNIKYLUCKK/Shutterstock, p.436 fig 10; Monika Wieland Shields/Shutterstock, p.440 fig 2; Ground Picture/Shutterstock, p.444 fig 1; VGstockstudio/Shutterstock, p.444 fig 2; 4 PM production/Shutterstock, p.444 fig 3; Mark Dozier/Shutterstock, p.444 fig 4; Pawonike Gallery/Shutterstock, p.445 fig 5; fizkes/Shutterstock, p.446 fig 6; fizkes/Shutterstock, p.446 fig 7; , p.446 (b); Mizkit/Shutterstock, p.448 fig 2; Pressmaster/Shutterstock, p.449 fig 3(l); Vixit/Shutterstock, p.449 fig 3®; Hananeko_Studio/Shutterstock, p.451 fig 5; PeopleImages.com - Yuri A/Shutterstock, p.452 fig 6; Horizonman/Shutterstock, p.453 fig 1; Ground Picture/Shutterstock, p.454 fig 2; Max4e Photo/Shutterstock, p.454 fig 3; sun ok/Shutterstock, p.455 fig 4(l); Pheelings media/Shutterstock, p.455 fig 4(r); Violetta Nahachevska/Shutterstock, p.456 fig 1; DimaBerlin/Shutterstock, p.457 fig 2; Mark Herreid/Shutterstock, p.458 fig 3; StunningArt/Shutterstock, p.458 fig 4. **Module 17:** rdonar/Shutterstock, p.465-466; Vibe Images/Shutterstock, p.468 fig 1; Daisy Daisy/Shutterstock, p.468 fig 2; Mai Groves/Shutterstock, p.469 fig 3; Mike Orlov/Shutterstock, p.469 fig 4; Kues/Shutterstock, p.469 fig 5; Ground Picture/Shutterstock, p.475 fig 3; kung_tom/Shutterstock, p.473 fig 1; Ivelin Radkov/Shutterstock, p.474 fig 2. **U2T4 review:** Copyright © 2008, American Psychological Association, p.484 fig 2; Kzenon/Shutterstock, p.483 (bl); ESB Professional/Shutterstock, p.483 (mr); J Walters/Shutterstock, p.484 fig (bl). **U2 review**: javiindy/depositphotos, p.487 (b); ESB Professional/Shutterstock, p.490 (b); Copyright © 2008, American Psychological Association, p.494 (mr); Ermolaev Alexander/Shutterstock, p.491 (bl); marekuliasz/Shutterstock, p.492 (bl); G-Stock Studio/Shutterstock, p.493 (bl). **Module 18:** Suppakorn Somnuk/Shutterstock, p.495-496. **Glossary**: Gegham Davtyan/Shutterstock, p.497-505.

Notes

OTHER TITLES IN THIS SERIES:



PSYCHOLOGY FOR QUEENSLAND
UNITS 3 & 4
SECOND EDITION

OXFORD UNIVERSITY PRESS

visit us at **oup.com.au** or
contact customer support at **oup.com.au/help**