

# PSYCHOLOGY

**FOR VCE**

**UNITS**

**1 & 2**

PAIGE JESSULAT

LEO HONG

JODIE ALLEN

ELIZABETH BLAHER-LUCAS

MATTHEW ROCK

KERRI MOREY

ROGER EDWARDS





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# Using Psychology for VCE Units 1 & 2

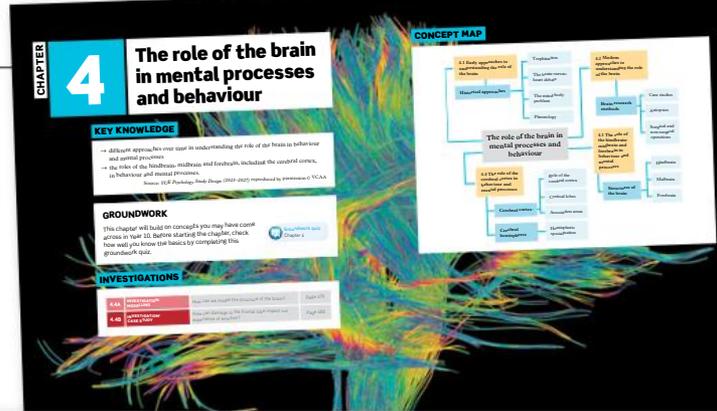
## Key features of the Student Book

- » This Student Book combines complete coverage of the VCAA Psychology Study Design 2023–2027 with clear and engaging design.
- » Each print Student Book comes with complete access to all the digital resources available on Student eBook pro.

### Chapter opener

Each chapter begins with a chapter opener that includes:

- Key Knowledge from the Study Design
- a groundwork quiz to test and support students' prior knowledge
- a list of investigations to support key concepts.



### Topic-based approach

Content is structured in clear topics with key ideas signposted at the beginning.



### Study tips

Practical tips support student success in internal assessments and exams.



**Margin glossary**  
Literacy support is provided for key terms in the chapter with clear and concise definitions.

**Skill drills**  
Students can practise their key science skills in context.

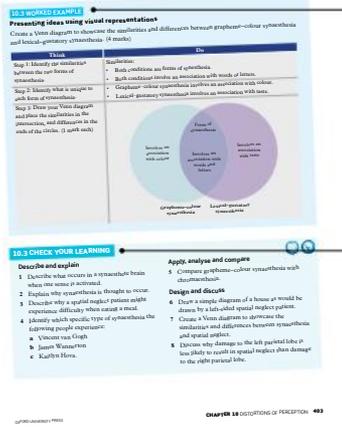
### Real-world psychology

Real-life engaging examples that provide opportunities to apply key knowledge.



**Worked examples**  
Detailed worked examples take students through how to solve different problems.

**Check your learning**  
Activity boxes with questions and tasks organised using cognitive verbs according to Bloom's taxonomy.



**TABLE 1** continued

Topic	Learning outcomes	Rate yourself	Target score distribution
The development of independence and autonomy in making individual decision-making when in a group	8. Distinguish between the terms independence and autonomy.	<input type="checkbox"/> High - I've got that <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do	Topic 8.5 Pages 232-331
	9. Provide two examples of controlled processes and two examples of automatic processes.	<input type="checkbox"/> High - I've got that <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do	Topic 9.1 Pages 144-148
	10. Provide an example of bottom-up processing.	<input type="checkbox"/> High - I've got that <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do	Topic 9.2 Pages 149-155
The role of perception in the processing and interpretation of sensory information, as demonstrated through top-down and bottom-up processing	11. Identify two psychological factors that influence a visual perception: a. visual perception b. gateway perception	<input type="checkbox"/> High - I've got that <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do	Topics 9.3 and 9.4 Pages 156, 158 and 160-177
	12. Explain how a person with prosopagnosia has different perceptions from what is considered 'normal' perception.	<input type="checkbox"/> High - I've got that <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do	Topic 10.1 Pages 184-190
The ability of visual perceptual systems, for example, visual illusion and Agnosia	13. Describe how 'miraculous' perception of near-identical food.	<input type="checkbox"/> High - I've got that <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do	Topic 10.2 Pages 191-196
	14. Identify which area of the brain is most likely to result in left-sided spatial neglect when injured.	<input type="checkbox"/> High - I've got that <input type="checkbox"/> Medium - I could use a bit more practice. <input type="checkbox"/> Low - I have some work to do	Topic 10.3 Pages 197-203

**Exam tip 1 - Use the mark allocation as a guide**

Every exam question is allocated a certain number of marks. You can use these marks to work out how much information you need to provide in your response.

- Do not just write down everything you know about a topic to answer a question, sometimes even a single word or few words is enough to answer a question. For example, a one-mark 'state the name of...' question would require you to write less information than a four-mark 'Discuss the value of...' question.
- A good rule of thumb is to follow a one mark = one piece of information. Using the mark allocation as a guide can help you structure your responses and even save you time.

**See it in action**

Read the exam question below and see how the tip has made a difference in the high-scoring and low-scoring responses.

**QUESTION 1**

Name the pictorial cue principle that describes how objects that are closer overlap objects that are further away and explain how this pictorial cue is used in Figure 1. (2 marks)

**Response 1 (High-scoring)**

One mark awarded for one piece of information, clearly and accurately. The second mark awarded for one piece of information, clearly and accurately. The second mark awarded for one piece of information, clearly and accurately.

**Response 2 (Low-scoring)**

One mark awarded for correct principle but not required. The second mark awarded for one piece of information but not required. The second mark awarded for one piece of information but not required.

**Exam essentials**

Provides tips and strategies for maximising marks on exam responses.

**Practice assessments**

Four practice assessments to familiarise students with the internal assessments.

**Sample Assessment 2**

The following excerpt has been adapted from the specimen. Read through the excerpt and answer the question.

**Player who retired from concussion excluded from landmark AFL study**

By Wendy Carlisle

26 April 2022

[Former AFL player] Dale Karpis (retired 2001) and Chad Rennie (retired 2002) were two of 41 players who retired from concussion excluded from a 2009 study by Dr Michael Maddison, which is now the AFL's chief medical officer.

Despite this, the study was used by the league as the time to finally issue a concussion policy of returning players to the field based on individual clinical assessment.

But three academics have raised concerns about the study because of the sheer number of concussion cases excluded, and because the study did not estimate the long-term effects of the players' injuries.

Maddison's study followed all players in the 2000-03 seasons, counting 199 concussions in 157 players. The study was published in the peer-reviewed *American Journal of Sports Medicine* produced by the American Orthopaedic Society for Sports Medicine. Of the 118 concussions analysed, 127 (92 per cent) did not meet a 'gold standard' of 11 concussions players missed out and the remaining 11 concussions players missed out and the remaining 11 concussions players missed out and the remaining 11 concussions players missed out.

Using cognitive and injury data, the former Hawthorn club doctor concluded players were 'at risk and at greater risk' of returning to the game 'safely and appropriately' returned to the game under the AFL's concussion protocol of that time.

He also reported players were returned to play with 'no perceptible deficits in cognitive function'.

The study excluded concussed players if their return to play was not documented, or if they returned to a lower grade, had concussed prior or had not played a game before their concussion injury. Others were excluded if they were concussed in their final or last game of the season because...

**QUESTION 4**

Veronika is invited by her friend to go to a cocktail party. When Veronika's friend explains that the party is celebrating the end of financial year for a successful and wealthy business firm, Veronika immediately feels some about attending as she thinks she might be judged by others at the party for not being wealthy. Due to this, Veronika tells her friend that she cannot attend.

Which heuristic is Veronika basing her decision-making upon?

A The self-serving heuristic  
B The representativeness heuristic  
C The availability heuristic  
D The affect heuristic

**QUESTION 5**

Hank, 16, is part of a friendship group where some members occasionally binge drink alcohol, a behaviour that never really appealed to Hank. At a party one evening, Hank is encouraged to quickly drink many shots of a strong spirit. Hank considers consuming the shots as most of his friends have done so and appear to be having fun. Instead, Hank declines and leaves the party.

Hank's decision-making and actions can best be described as:

A a position of dissent against the friendship group  
B a position of anticonformity against the friendship group  
C a position of independence without regard to the majority of the group  
D a position of counter conformity against the group

**QUESTION 6**

Angie is getting ready for a costume party at her house with some friends. Angie originally planned to go dressed as Shrek. When she sees all her friends dressing as superheroes, Angie asks her friend for an outfit and a cape that resembles Wonder Woman so the can fit in with her friends. Which of the following best describes the factor that has influenced Angie to conform?

A Normative influence  
B Informational influence  
C Group size  
D Deindividuation

**QUESTION 7**

Which of the following is a possible hypothesis for this experiment?

A Participants who are sleep deprived will experience changes in their attention levels compared to those who are not sleep deprived.  
B Participants who are sleep deprived will display lower attention levels compared to those who are not sleep deprived.  
C Sleep deprivation will have no impact on attention levels.  
D Attention levels will be higher for individuals who are not sleep deprived.

**QUESTION 8**

During the data collection phase of the research, the psychologist notices that it was difficult to determine the reaction time of each participant as there was variation in the speed in which the stop and start buttons were pressed.

Which type of error is this an example of?

A Random error  
B Systematic error  
C Personal error  
D Bias

**Practice exam questions**

Exam-style questions for students to practise writing responses; includes question sets for Unit 1, Unit 2 and combined Units 1 & 2.

**1&2 Practice exam**

This practice exam is designed to help you review your understanding of all the concepts covered in Units 1 and 2 and practice your skills on a range of exam-style questions. You can download a printable version of the exam using the buttons below.

**Practice examination**

Section	Number of questions	Number of questions to be answered	Number of marks
A	40	40	40
B	9	9	80
Total	49	49	120

**Section A - Multiple choice**

Use the following information to answer questions 1 and 2.

Kurt has been employed as an accountant at a large firm for the past three years. A promotion became available in the firm and Kurt applied for it. Kurt's boss awarded the promotion to Sabina, who, unknown to Kurt, had more qualifications and relevant experience.

**Question 1**

Which of the following attributions to explain Kurt's interpretation of his boss' decision to promote Sabina is plausible?

A Kurt holds the external attribution that his boss' decision is due to his boss' poor decision-making.  
B Kurt holds the external attribution that his boss' decision is due to his boss' poor decision-making.  
C Kurt holds the internal attribution that his boss' decision is out of the ordinary and probably due to something adverse that has recently happened.  
D Kurt holds the internal attribution that during the interview, his boss was distracted and was not paying enough attention to Kurt's responses.

**Question 2**

Prior to Sabina's promotion, Kurt perceived that Sabina and he were very similar. Kurt originally thought that both he and Sabina shared many of the same skills and abilities and produced a similar quality of work. Kurt's person perception of Sabina prior to her promotion can be explained through:

A Kurt's evaluation of physical cues surrounding Sabina.  
B Kurt's reference to self-schema in his evaluation of Sabina.  
C Kurt's attention to salient information surrounding Sabina's skills, abilities and knowledge.  
D Kurt's social categorisation of Sabina.

**Question 3**

Stereotyping can best be explained as an:

A oversimplified collection of beliefs and situational attributions towards a certain person, group, culture or subculture.  
B oversimplified collection of beliefs and personal attributions towards a certain person, group, culture or subculture.  
C oversimplified collection of attitudes towards a certain person, group, culture or subculture.  
D oversimplified collection of cognitions towards a certain person, group, culture or subculture.

### Investigations

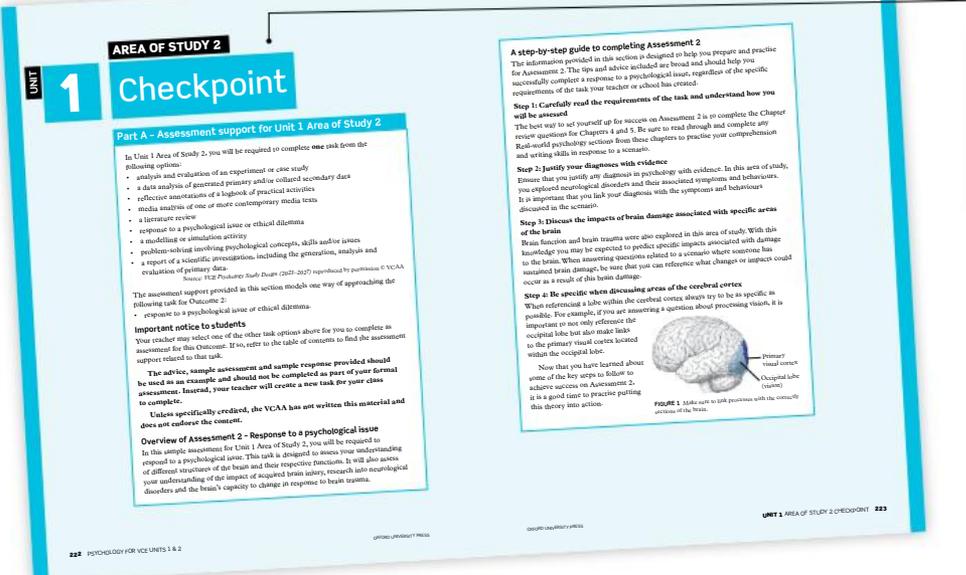
Each chapter contains a range of investigations that cover all eight scientific investigation methodologies. Investigations are available in the Student Book and via your **obook pro**.



### Chapter reviews

Each chapter review includes:

- a summary of key learning in each chapter
- revision questions written to target assessment through multiple choice and short answer questions
- digital links to your **obook pro** at the point of learning.



### Checkpoints

Practice assessments and exam-style revision questions for each Area of Study, including multiple choice and short answer questions.

**Student investigation chapters**  
 Guidance for Unit 1 AOS 3  
 Response to an investigation  
 and Unit 2 AOS 3 Student-  
 designed investigation.

**CHAPTER 6**

**Response to an investigation**

**KEY KNOWLEDGE**

**Scientific evidence**

- the distinction between primary and secondary data
- the nature of evidence and information—distinction between opinion, anecdote and evidence, and between scientific and non-scientific ideas
- the quality of evidence, including uncertainty, validity and authority of data and sources of possible errors or bias
- methods of organising, analysing and evaluating secondary data
- the use of a handbook to authenticate collated secondary data.

**Scientific communication**

- psychological concepts specific to the investigation; definitions of key terms, and use of appropriate psychological terminology, conventions and conventions.

**GROUNDWORK**

This chapter will build on concepts you have learnt in Unit 1 and will allow you to practise skills from Chapter 1. Before starting this chapter, check how well you know the basics by completing this groundwork quiz.

**KEY KNOWLEDGE**

**Scientific evidence**

- the distinction between primary and secondary data
- the nature of evidence and information—distinction between opinion, anecdote and evidence, and between scientific and non-scientific ideas
- the quality of evidence, including uncertainty, validity and authority of data and sources of possible errors or bias
- methods of organising, analysing and evaluating secondary data
- the use of a handbook to authenticate collated secondary data.

**Scientific communication**

- psychological concepts specific to the investigation; definitions of key terms, and use of appropriate psychological terminology, conventions and conventions.

**UNIT 1**

**AREA OF STUDY 3**

**1 Sample response**

**Can machine learning and artificial intelligence models accurately predict the diagnosis of mental disorders?**

**Introduction**

Mental disorders describe a range of conditions that affect a person's emotions, cognitions and behaviours (Dowdell et al., 2024). Diagnosing mental disorders is an important task for both psychologists and psychiatrists, who use the criteria outlined in the DSM-5-TR to inform their diagnoses based on information disclosed to them by patients (Dowdell et al., 2024). Diagnosis of mental disorders can be challenging as patients might not always provide accurate information about themselves or may be affected by more than one type of disorder (Liu et al., 2022). Accurate and early detection of mental disorders gives mental health professionals and patients the best chance of managing and improving symptoms (Green et al., 2009). Alternatively, misdiagnosis of mental disorders can hinder or delay successful outcomes for patients (Martens et al., 2017).

Recent studies have tested whether machine learning or artificial intelligence (AI) based systems can use data to accurately predict whether a patient will be diagnosed with a mental disorder. These modelling systems conduct analyses on a combination of genetic, medical registry, patient questionnaire and neuroimaging data to make predictions about diagnoses (Liu et al., 2022; Allsop et al., 2023). Since AI-predicted diagnoses come from a computer system and are made without in-person patient interactions, they may be limited in their ability to gain access to data about social and environmental factors that could influence or be relevant to the diagnosis of specific disorders. The issue of the specificity of whether machine learning and AI data systems can accurately predict whether an individual will be diagnosed with a mental disorder. It is hypothesised that machine learning and AI data systems will not be able to accurately predict the diagnosis of mental disorders.

**Scientific evidence/claims**

Liu et al. conducted a modelling analysis on the genomic data of 4179 participants, 134 of whom had been diagnosed with at least one of eight mental disorders.

The aim of the investigation was to determine whether their model could differentiate between participants affected with a mental disorder from those unaffected, and whether their model could predict the diagnosis of participants. Participants were aged between 0 and 21 years. Consent to use data was granted from patients over 18 years of age and parental consent granted for participants under 18. Participants' genomic data was analysed by the researchers' deep learning algorithm model to make diagnosis predictions. The first round of modelling accurately predicted 65 per cent of

**UNIT 1**

**1 Review**

This unit review is designed to help you revise your understanding of key concepts for all the content covered in Unit 1. There are some expert tips for answering exam questions, and practice your skills on a range of exam-style questions.

**Part A – Revisit and revise**

Part A of the Unit Review will help you revisit and revise all the key concepts from Unit 1 and test your understanding so that you can identify strengths and weaknesses in your understanding.

**Unit 1 Overview**

The chart below shows all the areas of study for Unit 1 and the relevant chapters in your Student Book. Go to the pages shown to revise the key concepts for each chapter.

**248 PSYCHOLOGY FOR VCE UNITS 1 & 2**

**Test your understanding**

Use the following table to guide your revision:

Step 1 – Read the key knowledge for this unit.

Step 2 – Test your understanding of the key knowledge by answering the question(s).

Step 3 – Rate your understanding of each key knowledge point from low to high.

Step 4 – Use the topic and page numbers to revise the concepts you have identified that you need to practice.

**TABLE 1 Test your understanding of Unit 1**

Key knowledge	Test yourself	Rate yourself	Target your revision
the interactive influences of hereditary and environmental factors on a person's psychological development	1 Compare the influence of hereditary factors and environmental factors on a person's psychological development.	<input type="checkbox"/> High – I've got that <input type="checkbox"/> Medium – I could use a bit more practice. <input type="checkbox"/> Low – I have some work to do!	Topic 2.1 Pages 76–82
the biopsychosocial approach as a model for considering psychological development and mental wellbeing	2 Use an example to explain how applying the biopsychosocial approach to understanding mental wellbeing can be more beneficial than looking at individual factors influencing mental health.	<input type="checkbox"/> High – I've got that! <input type="checkbox"/> Medium – I could use a bit more practice. <input type="checkbox"/> Low – I have some work to do!	Topic 2.2 Pages 83–87
the process of psychological development (emotional, cognitive and social) development over the course of the lifespan	3 Compare the four stages of Piaget's theory of cognitive development and list two key cognitive abilities that develop at each.	<input type="checkbox"/> High – I've got that! <input type="checkbox"/> Medium – I could use a bit more practice. <input type="checkbox"/> Low – I have some work to do!	Topic 2.4 Pages 94–100
the role of sensitive and critical periods in a person's psychological development	4 Distinguish between sensitive and critical periods for psychological development.	<input type="checkbox"/> High – I've got that! <input type="checkbox"/> Medium – I could use a bit more practice. <input type="checkbox"/> Low – I have some work to do!	Topic 2.4 Pages 107–109
the usefulness, and limitations, of psychological criteria to categorise behaviour as typical or atypical, including cultural perspectives, social norms, statistical rarity, personal distress and maladaptive behaviour	5 Using examples, explain the usefulness, and limitations, of psychological criteria to categorise behaviour as typical or atypical and typical behaviours.	<input type="checkbox"/> High – I've got that! <input type="checkbox"/> Medium – I could use a bit more practice. <input type="checkbox"/> Low – I have some work to do!	Topic 3.1 Pages 116–121
the concepts of continuity and discontinuity, including consideration of emotions, behaviours and cognitions that may be viewed as adaptive or maladaptive for an individual	6 a Describe the significance of having defined criteria for abnormality in developmental psychology. b Explain one limitation of this approach.	<input type="checkbox"/> High – I've got that! <input type="checkbox"/> Medium – I could use a bit more practice. <input type="checkbox"/> Low – I have some work to do!	Topic 3.2 Pages 122–126

**UNIT 1 REVIEW 249**

**Sample investigations**

Annotated examples of each AOS 3 investigation to support students create high quality assessments.

**Unit reviews**

At the end of each unit, students can:

- revisit and revise the content with questions mapped to each key knowledge dot point
- gain tips to succeed in exams and apply their skills in a Think like an examiner activity
- answer practice exam questions.

**Digital hotspots**

Digital icons or hotspots found throughout the student book link to digital resources accessible via the ebook pro.

- Video – Watch a video to support understanding of key concepts.
- Assessment – Access a digital quiz for the topic or chapter.
- Resource – Access a worksheet or additional resource.

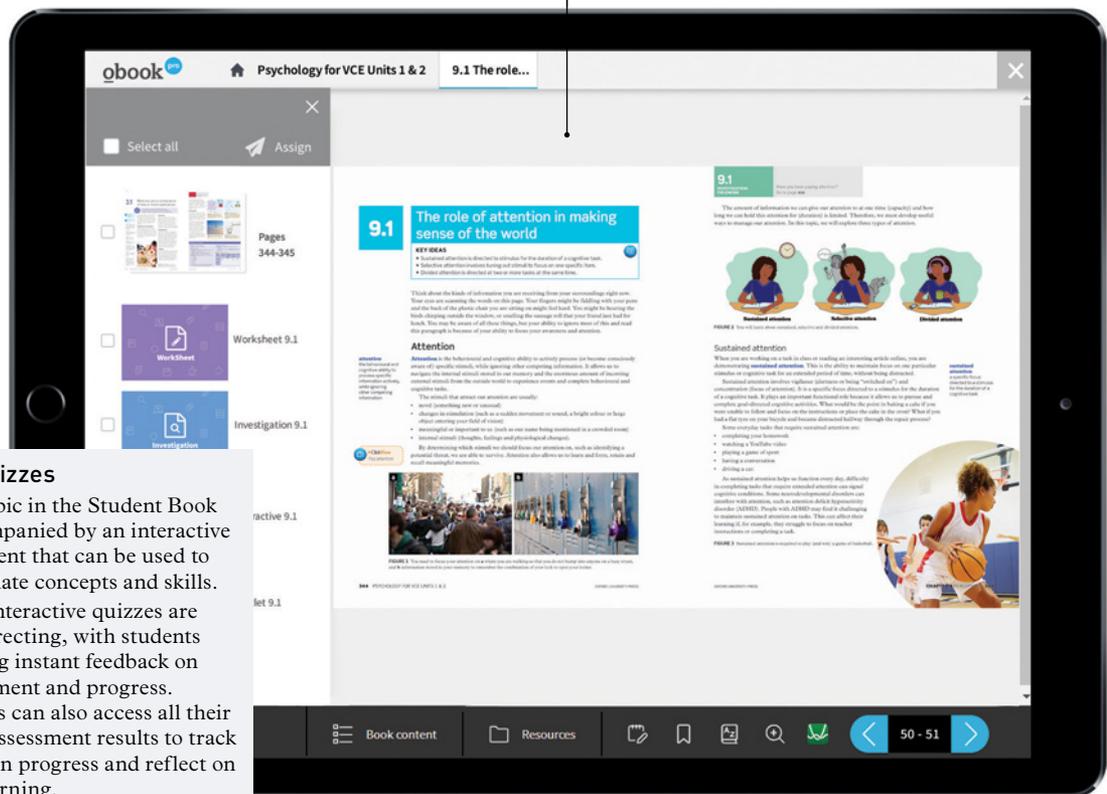
## Key features of Student obook pro

- > Student obook pro is a completely digital product delivered via Oxford's online learning platform, **Oxford Digital**.
- > It offers a complete digital version of the Student Book with interactive note-taking, highlighting and bookmarking functionality, allowing students to revisit points of learning.
- > A complete ePDF of the Student Book is also available for download for offline use and read-aloud functionality.

## Focus on eLearning

### Complete digital version of the Student Book

- This digital version of the Student Book is true to the print version, making it easy to navigate and transition between print and digital.



### Interactive quizzes

- Each topic in the Student Book is accompanied by an interactive assessment that can be used to consolidate concepts and skills.
- These interactive quizzes are autocorrecting, with students receiving instant feedback on achievement and progress. Students can also access all their online assessment results to track their own progress and reflect on their learning.
- Each chapter is supported by a multiple choice quiz to give students further practice with exam-style questions.

- > integrated Australian Concise Oxford Dictionary look up feature
- > videos to engage and strengthen understanding
- > interactive assessments to consolidate understanding
- > integrated Quizlet sets, including real-time online quizzes with live leaderboards
- > access to their online assessment results to track their own progress

**Benefits for students**

## Key features of Teacher obook pro

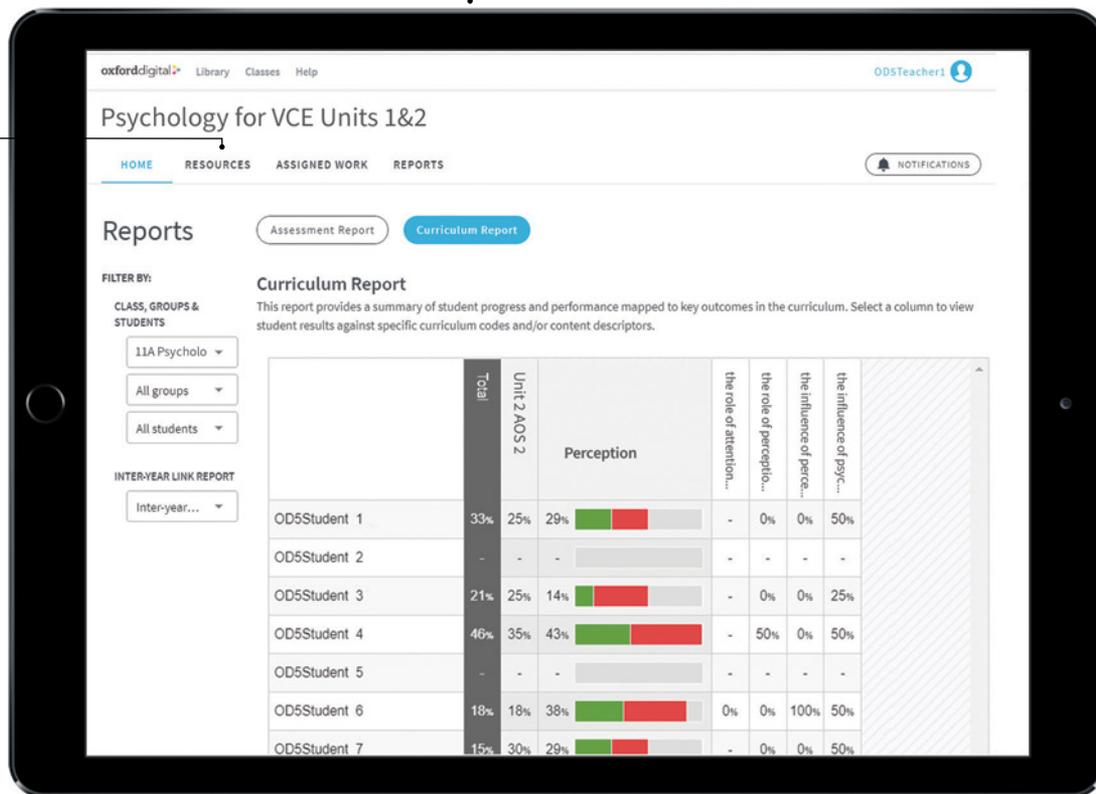
- > Teacher obook pro is a completely digital product delivered via **Oxford Digital**.
- > Each chapter and topic of the Student Book is accompanied by full teaching support. Lesson plans are provided that clearly direct learning pathways throughout each chapter, including ideas for differentiation and practical activities.
- > Teachers can use their Teacher obook pro to share notes and easily assign resources or assessments to students, including due dates and email notifications.

obook <sup>pro</sup>

## Focus on assessment and reporting

### Complete teaching support

- Teaching support includes full lesson and assessment planning, ensuring there is more time to focus on students.



### Additional resources

- Each chapter of the Student Book is accompanied by additional teaching and learning resources to help students progress.

- > In addition to online assessment, teachers have access to an editable practice exam that is provided at the end of Unit 2. This exam is formatted like the VCAA Psychology exam.
- > Teachers are provided with practice exams and guidance for internal assessments, detailed planning resources and reporting functionality that tracks student progress and success against assessments or key knowledge in the Study Design.

Benefits for teachers

# MEET THE AUTHORS & REVIEWERS



**Author: Paige Jessulat**

Paige Jessulat has taught VCE Psychology and VCE Legal Studies at Frankston High School since 2017. She is passionate about the field of Psychology and has a special interest in the mental health of adolescents which has underpinned her roles as Year Level Coordinator and Mental Health Week Coordinator. Paige has also been a VCAA Assessor for the Psychology exam since 2020.



**Author: Leo Hong**

Leo Hong is an experienced Psychology and Legal Studies teacher at Trinity Grammar School, Kew. Having taught in a range of schools over the past 16 years, Leo has a depth of knowledge and pedagogical experience through his involvement and implementation of problem-based learning programs and ICT training programs for teachers. He currently holds a Bachelor of Arts/Music, with a major in Psychology and Honours in Criminology, is an assessment writer for other private educational resource companies and VCAA assessor.



**Author: Jodie Allen**

Jodie Allen has been teaching VCE Psychology since 2001 and has been a VCAA exam assessor for more than 13 years. She has a Bachelor of Arts and Postgraduate Primary and Secondary Teaching degree and is currently teaching at Wellington Secondary College. Over her career she has held leading teacher and learning specialist roles in areas such as the senior school and student voice & agency. Jodie has worked for OUP in the past writing eBook resources. In her spare time, she likes to spend time with her family, which includes her husband and three daughters and she enjoys playing basketball.



**Author: Elizabeth Blaher-Lucas**

Elizabeth Blaher-Lucas is a passionate and experienced VCE Psychology teacher, VCE psychology assessor, and examination panel member. In addition to having worked in both government and independent school environments for the past 20 years, Elizabeth has also co-taught 3rd and 4th year preservice psychology teachers at Monash University since 2018.



**Author: Matthew Rock**

Matthew Rock started his career as a chemist working in energy production and pharmaceuticals whilst finishing studying at Monash University with a double degree in Bachelor of Science/Bachelor of Secondary Education. His passion in science led to a first teaching job at Trinity Grammar School for five years teaching VCE Chemistry and Psychology gaining skills as a subject coordinator, writer, assessor, and examiner. Matthew's current school, Camberwell Girls Grammar School, allows him to continue his passions in engaging with science, developing student wellbeing projects.



**Author: Kerri Morey**

Kerri is a passionate teacher of Psychology and Science, having taught at both government and independent schools in Victoria over the past 35 years. She is currently teaching and coordinating Psychology at Brauer College in Warrnambool. She has also enjoyed a variety of roles across different schools in pastoral care, with extensive experience and interest in fostering the wellbeing of students, and in teaching students to understand how to be effective learners through the application of psychology and neuroscience. Kerri has authored for a range of educational resources on the areas of psychology and student development and wellbeing and has been a VCAA exam assessor for Psychology over many years.

**Author: Roger Edwards**

Roger has been involved with the VCE Psychology course since its inception back in 1991. He taught VCE psychology for fifteen years and is currently the Supervising Psychologist at Monash University's Krongold Clinic – a university-based clinic that provides affordable psychological and counselling services.



**Reviewer: Elise Truong**

Elise Truong has taught in the education system since 2009. She worked as an integration aid for four years prior to becoming a teacher in 2013. Elise has taught across the public and private sectors of education including within an alternative setting

for disengaged youth. She holds a Bachelor of Psychology (Interpersonal and Organisational), a Graduate Diploma of Education (Secondary) with a major in English and Psychology and a Masters in Instructional Leadership. Elise has taught in the areas of English, Psychology and is a trained and practising IB Psychology (HL) teacher. Elise has taken up various roles in the educational setting including being a year 11 and 12 coordinator, and a lead teacher.



**Reviewer: Sayeeda Bawa-Savant**

Sayeeda Bawa-Savant is a professionally registered career practitioner and certified life coach with degrees and postgraduate studies in psychology, education, educational psychology, Neuro-Linguistic Programming (NLP), and

economics. She began her teaching journey almost two decades ago, in South Africa, with her commitment to her students promoting her to Head of Department roles and Head of a Science Saturday School Program. Sayeeda and her family moved to Australia, where her experience was swiftly recognised by educational institutions. She has held leading teacher roles in psychology and careers coaching, taught business studies, is an exam assessor, and is also a writer of psychology resources. Presently, she teaches in the areas of psychology, business studies, and humanities, while continuing to provide consultancy services in writing, and career and life coaching.



**Reviewer: Michelle Maxwell**

Michelle Maxwell is a proud Aboriginal woman who brings a self-determined Aboriginal voice and lens to her work, passion and drive for change, focusing on better outcomes for our Aboriginal communities. Michelle currently works as a

therapist for Violet Dreaming. She

was formerly the Manager of the Aboriginal Social and Emotional Wellbeing team at the Mental Health Reform Victoria, responsible for implementing the Aboriginal Social and Emotional Wellbeing recommendations from the Royal Commission into Victoria's mental health system. Michelle has years of experience working in and alongside Aboriginal Community Controlled organisations developing the delivery of therapeutic services.

CHAPTER

1

# Psychology toolkit

## KEY SCIENCE SKILLS

- develop aims and questions, formulate hypotheses and make predictions
- plan and conduct investigations
- comply with safety and ethical guidelines
- generate, collate and record data
- analyse and evaluate data and investigation methods
- construct evidence-based arguments and draw conclusions
- analyse, evaluate and communicate scientific ideas.

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## GROUNDWORK

This topic will build on concepts you may have come across in junior science. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



Groundwork quiz  
Chapter 1

**\* CONTENT WARNING:** Aboriginal and Torres Strait Islander peoples are advised that this chapter may include images of people now deceased.

**FIGURE 1** Psychology is the scientific study of the human brain and behaviour.



# 1.1

## Overview of VCE Psychology

### KEY IDEAS

- ✦ Studying psychology can lead to a diverse range of career pathways.
- ✦ VCE Psychology is divided into units and areas of study.
- ✦ The key science skills and their application are important for success in VCE Psychology.



### psychology

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

**Psychology** is the scientific study of the human brain, its functions and behaviour.

Psychologists use the scientific method to investigate relationships that exist between our brain and nervous system and to investigate and explore the experience of behaviours, thoughts and emotions.

Studying psychology can lead to many different career paths, and it provides a valuable understanding of what influences the way we think, feel and act. This understanding can be used to improve our learning, mindset, relationships and overall quality of life.



**FIGURE 1** Psychology is the scientific study of the human brain, its functions and behaviour.

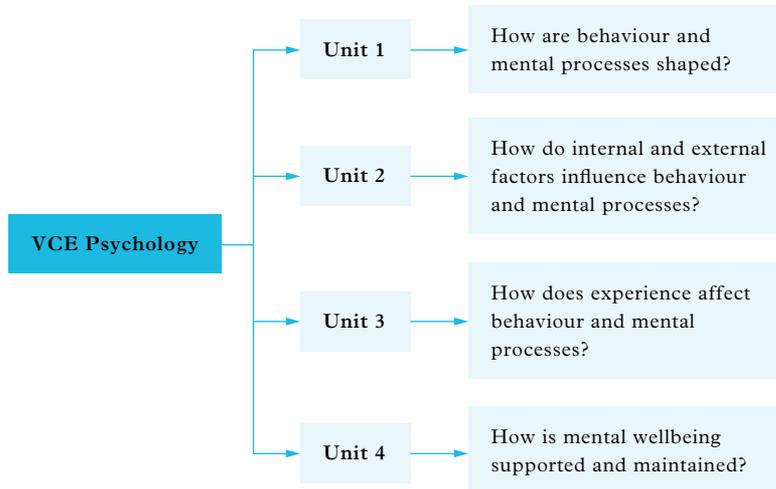
## Structure of the VCE Psychology course

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

The structure of the VCE Psychology course is laid out in the VCE Psychology Study Design. The course consists of four units. Units 1 and 2 are designed to be the first year of the VCE Psychology course as they form a strong foundation of psychological concepts for Units 3 and 4. However, Units 1 and 2 are not prerequisites for studying Units 3 and 4. An overview of the VCE Psychology units is shown in Figure 2 and Units 1 and 2 are summarised in Table 1.



**Resource**  
VCE Psychology  
Study Design



**FIGURE 2** The structure of the VCE Psychology course

**TABLE 1** Areas of Study in Units 1 and 2 Psychology

Unit 1 How are behaviour and mental processes shaped?	
Area of Study	Description
1 What influences psychological development?	In this area of study you will learn about: <ul style="list-style-type: none"> <li>the complex interactions between biological, psychological and social factors and how interactions relate to psychological development</li> <li>hereditary and environmental factors that influence a person’s development</li> <li>concepts of normality, neurotypicality and atypicality.</li> </ul>
2 How are mental processes and behaviour influenced by the brain?	In this area of study you will learn about: <ul style="list-style-type: none"> <li>brain structure and function</li> <li>different approaches and contributions to understanding the role of the brain</li> <li>how the brain changes with age and experience and how mental functions adapt.</li> </ul>
3 How does contemporary psychology conduct and validate psychological research?	In this area of study you will provide a response to an investigation into contemporary psychological research and how science can be used to explore and validate psychological research questions.
Unit 2 How do internal and external factors influence behaviour and mental processes?	
Area of Study	Description
1 How are people influenced to behave in particular ways?	In this area of study you will learn about: <ul style="list-style-type: none"> <li>how social cognition influences individuals to behave in specific ways</li> <li>factors that influence individual and group behaviour.</li> </ul>
2 What influences a person’s perception of the world?	In this area of study you will learn about: <ul style="list-style-type: none"> <li>the role of attention in making sense of the world</li> <li>the influence of biological, psychological and social factors on visual and gustatory perception</li> <li>the fallibility of perceptual systems.</li> </ul>
3 How do scientific investigations develop understanding of influences on perception and behaviour?	In this area of study you will conduct an investigation that you have designed or adapted yourself. The investigation will relate to concepts you have learnt about in Unit 2.

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## Assessment in VCE Psychology

In Units 1 and 2, you can be assessed in several ways across the different areas of study.

This is outlined in Table 2. The assessment in VCE Psychology is designed to test you against an outcome for each area of study. The outcome states what you should be able to do by the end of the area of study if you have completed it successfully.

**TABLE 2** Areas of Study 1 and 2 outcomes and assessment tasks

Area of Study	Outcome	Assessment
Unit 1 Area of Study 1: What influences psychological development?	The student should be able to discuss the complexity of psychological development over the lifespan, and evaluate ways of understanding and representing psychological development.	For each outcome in Area of Study 1 and 2, you could be asked to complete one or more of the following tasks: <ul style="list-style-type: none"> <li>analysis and evaluation of an experiment or case study</li> <li>a data analysis of generated primary and/or collated secondary data</li> <li>reflective annotations of a logbook of practical activities</li> <li>media analysis of one or more contemporary media texts</li> <li>a literature review</li> <li>response to a psychological issue or ethical dilemma</li> <li>a modelling or simulation activity</li> <li>problem-solving involving psychological concepts, skills and/or issues</li> <li>a report of a scientific investigation, including the generation, analysis and evaluation of primary data.</li> </ul>
Unit 1 Area of Study 2: How are mental processes and behaviour influenced by the brain?	The student should be able to analyse the role of the brain in mental processes and behaviour and evaluate how brain plasticity and brain injury can change biopsychosocial functioning.	
Unit 2 Area of Study 1: How are people influenced to behave in particular ways?	The student should be able to analyse how social cognition influences individuals to behave in specific ways and evaluate factors that influence individual and group behaviour.	
Unit 2 Area of Study 2: What influences a person's perception of the world?	The student should be able to explain the roles of attention and perception, compare gustatory and visual perception and analyse factors that may lead to perceptual disorders.	

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Area of Study 3 outcomes and assessment are slightly different.

You can use Chapter 6 Response to an investigation to guide you through Unit 1 Area of Study 3, and Chapter 11 Student-designed investigation to guide you through Unit 2 Area of Study 3.

**TABLE 3** Area of Study 3 outcomes and assessment tasks

Area of Study	Outcome	Assessment
Unit 1 Area of Study 3: How does contemporary psychology conduct and validate psychological research?	The student should be able to identify, analyse and evaluate the evidence available to answer a research question relating to contemporary psychology.	A response to an investigation into contemporary psychological research and how science can be used to explore and validate psychological research questions
Unit 2 Area of Study 3: How do scientific investigations develop understanding of influences on perception and behaviour?	The student should be able to adapt or design and then conduct a scientific investigation related to internal and external influences on perception and/or behaviour and draw an evidence-based conclusion from generated primary data.	A report of a student-adapted or student-designed scientific investigation using a selected format, such as a scientific poster, an article for a scientific publication, a practical report, an oral presentation, a multimedia presentation or a visual representation

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## Key science skills

In addition to key knowledge (which we will cover in Chapters 2 to 10), VCE Psychology also requires you to develop and apply a range of key science skills. These skills are specified in the VCE Psychology Study Design and are listed in Table 4. Chapters 1, 6 and 11 will help you develop each of these skills.

The key science skills are applicable to all areas of study in Units 1 to 4 of the VCE Psychology course. They are especially important for planning and conducting investigations for your assessment tasks.

**TABLE 4** Key science skills

Key science skill	VCE Psychology Units 1 to 4
Develop aims and questions, formulate hypotheses and make predictions	<ul style="list-style-type: none"> <li>identify, research and construct aims and questions for investigation</li> <li>identify independent, dependent and controlled variables in controlled experiments</li> <li>formulate hypotheses to focus investigations</li> <li>predict possible outcomes of investigations</li> </ul>
Plan and conduct investigations	<ul style="list-style-type: none"> <li>determine appropriate investigation methodology: case study; classification and identification; controlled experiment (within subjects, between subjects, mixed design); correlational study; fieldwork; literature review; modelling; product, process or system development; simulation</li> <li>design and conduct investigations; select and use methods appropriate to the investigation, including consideration of sampling technique (random and stratified) and size to achieve representativeness, and consideration of equipment and procedures, taking into account potential sources of error and uncertainty; determine the type and amount of qualitative and/or quantitative data to be generated or collated</li> <li>work independently and collaboratively as appropriate and within identified research constraints, adapting or extending processes as required and recording such modifications</li> </ul>
Comply with safety and ethical guidelines	<ul style="list-style-type: none"> <li>demonstrate ethical conduct and apply ethical guidelines when undertaking and reporting investigations</li> <li>demonstrate safe laboratory practices when planning and conducting investigations by using risk assessments that are informed by safety data sheets (SDS), and accounting for risks</li> <li>apply relevant occupational health and safety guidelines while undertaking practical investigations</li> </ul>
Generate, collate and record data	<ul style="list-style-type: none"> <li>systematically generate and record primary data, and collate secondary data, appropriate to the investigation</li> <li>record and summarise both qualitative and quantitative data, including use of a logbook as an authentication of generated or collated data</li> <li>organise and present data in useful and meaningful ways, including tables, bar charts and line graphs</li> </ul>
Analyse and evaluate data and investigation methods	<ul style="list-style-type: none"> <li>process quantitative data using appropriate mathematical relationships and units, including calculations of percentages, percentage change and measures of central tendencies (mean, median, mode), and demonstrate an understanding of standard deviation as a measure of variability</li> <li>identify and analyse experimental data qualitatively, applying where appropriate concepts of: accuracy, precision, repeatability, reproducibility and validity; errors; and certainty in data, including effects of sample size on the quality of data obtained</li> <li>identify outliers and contradictory or incomplete data</li> <li>repeat experiments to ensure findings are robust</li> <li>evaluate investigation methods and possible sources of error or uncertainty, and suggest improvements to increase validity and to reduce uncertainty</li> </ul>

(continued)

TABLE 4 continued

Key science skill	VCE Psychology Units 1 to 4
Construct evidence-based arguments and draw conclusions	<ul style="list-style-type: none"> <li>distinguish between opinion, anecdote and evidence, and scientific and non-scientific ideas</li> <li>evaluate data to determine the degree to which the evidence supports the aim of the investigation, and make recommendations, as appropriate, for modifying or extending the investigation</li> <li>evaluate data to determine the degree to which the evidence supports or refutes the initial prediction or hypothesis</li> <li>use reasoning to construct scientific arguments, and to draw and justify conclusions consistent with evidence base and relevant to the question under investigation</li> <li>identify, describe and explain the limitations of conclusions, including identification of further evidence required</li> <li>discuss the implications of research findings and proposals, including appropriateness and application of data to different cultural groups and cultural biases in data and conclusions</li> </ul>
Analyse, evaluate and communicate scientific ideas	<ul style="list-style-type: none"> <li>use appropriate psychological terminology, representations and conventions, including standard abbreviations, graphing conventions and units of measurement</li> <li>discuss relevant psychological information, ideas, concepts, theories and models and the connections between them</li> <li>analyse and explain how models and theories are used to organise and understand observed phenomena and concepts related to psychology, identifying limitations of selected models/theories</li> <li>critically evaluate and interpret a range of scientific and media texts (including journal articles, mass media communications, opinions, policy documents and reports in the public domain), processes, claims and conclusions related to psychology by considering the quality of available evidence</li> <li>analyse and evaluate psychological issues using relevant ethical concepts and guidelines, including the influence of social, economic, legal and political factors relevant to the selected issue</li> <li>use clear, coherent and concise expression to communicate to specific audiences and for specific purposes in appropriate scientific genres, including scientific reports and posters</li> <li>acknowledge sources of information and assistance, and use standard scientific referencing conventions</li> </ul>

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## 1.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Define the term “psychology”.
- 2 Identify all the different formats that can be used to present the Unit 2 Area of Study 3 student-designed investigation.
- 3 Reflect on the key science skills listed in Table 4 and identify three to five skills you need to practise most.

### Apply, analyse and compare

- 4 Summarise how your knowledge and skills will be assessed for Outcomes 1 and 2 in VCE Psychology Units 1 and 2.

- 5 Summarise how your knowledge and skills will be assessed for Outcome 3 in VCE Psychology Units 1 and 2.

### Design and discuss

- 6 Research a field of psychology that interests you and create an infographic that includes:
  - a description of what the field focuses on
  - the different career opportunities related to that field of study
  - a summary of the qualifications needed to work in the career opportunities identified above
  - a summary of how your chosen field of psychology has a positive impact on the world.

# 1.2

## Developing aims, questions and hypotheses

### KEY IDEAS

- ✦ A research question states the specific problem or issue on which your investigation will be based.
- ✦ An aim is a statement of what is to be investigated.
- ✦ A hypothesis is a testable statement that should include a prediction about the outcome of an investigation, based on scientific reasoning.



#### research question

a clear, focused and concise query that guides an investigation and forms the foundation of a research study

#### aim

the primary focus of the research that states the purpose of the research

#### scientific method

a standardised way of making observations, gathering data, testing hypotheses and interpreting results to establish theories to describe and measure behaviour

## The scientific method

Psychology is a science that uses research methods and experimental evidence to test theories and understand human nature. Psychologists use a variety of research methods to help answer **research questions** – these are the specific inquiries that researchers want to find more information about through investigations. The research **aim** is the overall purpose of conducting a specific research investigation.

To investigate research questions, psychologists use the **scientific method**, a process of problem-solving that is applied in all sciences. There are eight main stages of the scientific method as shown in Figure 1. You will notice that Figure 1 shows the scientific method as a cyclical process. This is because if the findings lead to more questions about a particular area, it may trigger the process again and a new investigation will begin.

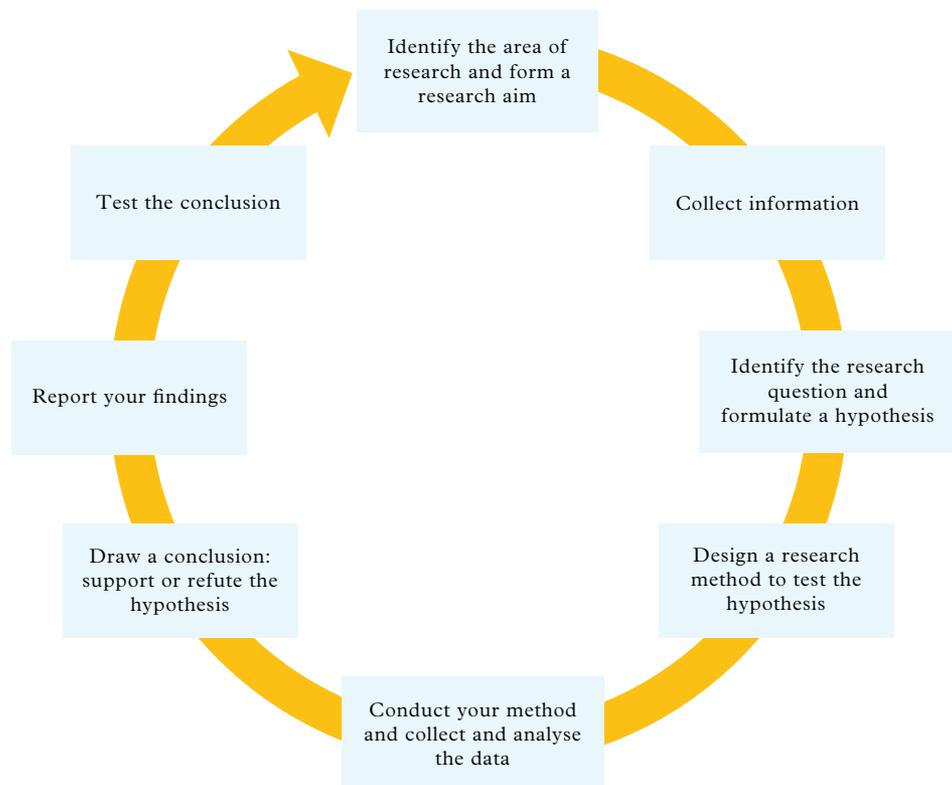


FIGURE 1 Steps in the scientific method

To see exactly how the scientific method works, consider the example of some interesting research by Thai et al. (2023).

### Study tip

Research questions can evolve from a psychology topic or phenomenon of your interest and can be based on your observations, experiences, thoughts or reading.

- 1 Identify the area of research and form a research aim.** Thai and colleagues wished to investigate whether a reduction in social media usage could result in improved appearance and weight esteem in young people with emotional distress.
- 2 Collect information.** From previous research, it appeared that heavy or frequent users of social media tended to have more body issue concerns. Studies also suggested that distressed youth appear to be more susceptible to the negative effects of social media use.
- 3 Identify the research question and formulate a hypothesis.** Thai and colleagues asked the question: “Can social media use reduction lead to improvements of weight and body esteem in youth who experience emotional distress?” They formed the hypothesis that participants who limited their social media usage (SMU) would exhibit greater improvement in both appearance and weight esteem after four weeks, compared to the control group who did not limit their SMU.
- 4 Design a research method to test the hypothesis.** Participants consisted of Canadian undergraduate psychology students aged between 17 and 25 who used social media at least two hours per day and displayed symptoms of depression and anxiety. A pre-test was conducted to assess each participant’s baseline weight and body esteem. Participants were randomly assigned to one of two groups: the control or intervention group. Participants in the intervention group were instructed to restrict their SMU to a maximum of one hour per day for four weeks; participants in the control group were given no restrictions on SMU. After four weeks a post-test was conducted to assess each participant’s baseline appearance and weight esteem.
- 5 Collect and analyse the data.** It was found that compared to the control group, the intervention group had significant increases in appearance and weight esteem.
- 6 Draw a conclusion – support or refute the hypothesis.** Based on results, the research hypothesis was supported.
- 7 Report findings.** This study was published in a journal called *Psychology of Popular Media*.
- 8 Test the conclusion.** Findings of the study can now be tested by other researchers or continue to be explored by Thai and colleagues.



**FIGURE 2** Thai et al. wanted to investigate whether reducing social media usage could result in improved appearance and weight esteem in young people with emotional distress.

# Variables

A **variable** is a quantity or quality that can change at different times or in different places. In psychology, we are mainly interested in properties that vary from person to person or within the same person at different times. These include:

- age
- race
- gender
- level of education
- aggression
- position in family
- income
- quality of life
- feelings of wellbeing.

In psychology and other sciences, we often look to find and assess the relationships between variables. To do this, scientists perform investigations that manipulate, measure and control variables to examine what sort of relationships exist between them.

## Independent and dependent variables

An **independent variable (IV)** is a variable that is deliberately manipulated or altered in some way by the experimenter. This is planned before the experiment begins. Simple experiments use one independent variable with two values (for example, male/female or yes/no). In Thai et al.'s research, it was social media usage (restricted or unrestricted). In a more complex experiment, the IV could be continuous – that is, it could have a range of values on a scale; for example, age, body mass or levels of optimism.

The **dependent variable (DV)** is the property that is measured in the research. Its value depends on the IV and that is why it is called “dependent”. The DV is therefore the property that the researcher believes will change as result of changes to the value of the IV. The DV is usually continuous (it has any value within a certain range) and should be stated through how it is measured (for example, in litres, seconds or bpm).

## Extraneous and confounding variables

An **extraneous variable** is any variable other than (“extra to”) the IV that may cause a change in the value of the DV. For example, when investigating how blood alcohol concentration (IV) affects driving performance (DV), the type of car being driven, traffic conditions and weather are all examples of extraneous variables that may affect driving performance. To ensure that any change in the DV is due to the IV, extraneous variables need to be removed or manipulated to be kept constant. For the example above, this would include making sure all driving performance tests use the same model car and occur under the same traffic and weather conditions. An extraneous variable that has been removed or manipulated so that it no longer influences the DV is called a **controlled variable**.

### **variable**

a factor, trait or condition that can exist in differing amounts or types

### **independent variable (IV)**

the variable that is changed or manipulated during an investigation

### **dependent variable (DV)**

the variable that is observed or measured when the independent variable is changed during an investigation

### **extraneous variable**

a variable other than the independent variable that may cause changes in the value of the dependent variable

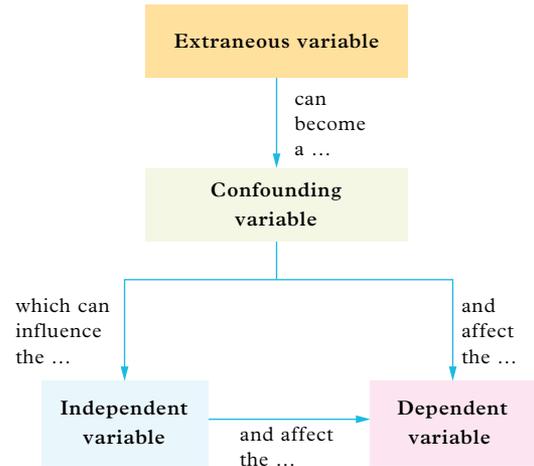
### **controlled variable**

a variable that a researcher keeps constant (controls) in an investigation

**confounding variable**

an unwanted variable that has a systematic effect on the value of the dependent variable. If a confounding variable exists, no valid conclusions about the research can be drawn

A **confounding variable** is a variable (other than the IV) that has directly or systematically affected the DV. A confounding variable could be an uncontrolled for extraneous variable, or a type of variable that cannot be controlled for. For example, if you were investigating how blood alcohol concentration (BAC) affects driving performance, a confounding variable could be if all participants were dehydrated. Dehydration can increase a person’s BAC (alters the IV) and can also cause loss of concentration (which can affect the DV). Therefore, if participants were dehydrated, the researcher would not be able to attribute any changes in driving performance to BAC levels. If a confounding variable exists, results are not internally valid because the DV cannot be attributed to the IV and the experiment has not accurately tested what it set out to test. Confounding variables are only able to be identified after an experiment is completed and after results have been analysed.



**FIGURE 3** Summary of how extraneous and confounding variables can affect the results (dependent variable). Remember that if a confounding variable occurs, it is impossible to determine whether the change in DV is due to the IV or a confound.

## Hypothesis

**hypothesis**

a testable statement that includes a prediction about the outcome of an investigation based on scientific reasoning

A **hypothesis** in psychological research is a clear statement predicting how changes in the independent variable(s) will affect the value of the dependent variable(s). A hypothesis should also clearly state the population about which the researcher intends to draw conclusions.

Variables do not need to include how they are measured in the statement of the hypothesis. However, you should clearly describe how variables are measured in the introductory part of the research report. One method to make sure you include everything in your hypothesis is to use a structure such as “If ... then” or “When ... the ... then ...”. Suggested phrases for formulating a hypothesis using this approach are listed in Figure 4.



**FIGURE 4** Constructing a hypothesis using suggested phrases

An example hypothesis might be: “**If** the blood alcohol concentration in drivers is greater than 0.05 **then** reaction speed will decrease.” Remember that different hypothesis writing styles can be equally effective. This hypothesis could also be written as: “It was hypothesised that drivers with a blood alcohol concentration greater than 0.05 would experience a decline in reaction speed.”

## 1.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify the steps of the scientific method.
- 2 Define:
  - a independent variable
  - b dependent variable.
- 3 Explain why the scientific method is a cyclical process.

### Apply, analyse and compare

- 4 In each situation below, determine what the independent and dependent variables are.
  - a Primary school children who watch violent cartoons on television have more nightmares than those who watch funny cartoons.
  - b By the age of six, children who were in daycare before the age of six months are socially better adjusted than those who stayed with a sole caregiver.
  - c Children who sleep more than nine hours each night have better concentration in school than those who sleep less than nine hours.

- 5 Distinguish between a research aim and research question.
- 6 Compare extraneous variables and confounding variables.

### Design and discuss

- 7 A researcher theorises that students who eat cereal in the morning will have lowered exam performance. Propose a research question and hypothesis for this theory.
- 8 A researcher had a theory that an increased intake of sugar improves people's problem-solving ability. They define "increased sugar intake" as a 10 per cent increase in sugar intake per day. The researcher also needs to decide how they could measure "problem-solving ability". Discuss one way the researcher could measure "problem-solving ability".

# 1.3

## Planning and conducting investigations

### KEY IDEAS

- + Different scientific methodologies can be used to conduct investigations.
- + Participants in a psychological investigation can be selected through random or stratified sampling techniques.
- + Within-subjects, between-subjects and mixed designs have specific advantages and disadvantages for different types of controlled experiments.



In VCE Psychology Units 1 and 2, you will complete at least 17 hours of practical work per unit. Scientific investigations are important to the VCE Psychology course and can be used to collect data. You can complete an investigation individually, in a small group or with the whole class; however, all the work required for assessment purposes must be your own work.

### Scientific investigation methodologies

**methodology**  
the approach used to plan and conduct a scientific investigation

A variety of **methodologies** can be used when planning and conducting scientific investigations. A methodology refers to the approach you take to answer your scientific question. There are many ways to investigate your research question and collect data. The different methodologies that you will encounter in VCE Psychology are outlined in Table 1. You can also find examples of each of these in Chapter 12 Investigations.



**FIGURE 1** Modelling can help us to investigate scientific concepts and phenomena; it is especially useful if we are unable to observe the real thing in the lab.



**FIGURE 2** Fieldwork allows us to investigate phenomena that occur at a specific location. For example, studying the behaviour of toddlers at an early learning centre.

**TABLE 1** Key scientific investigation methodologies in VCE Sciences

Investigation method	Investigation outline	Example	Strengths and weaknesses
<b>Case study</b>	A case study involves the investigation of a specific event, an activity or a problem that contains a real or hypothetical situation.	Read about people's different experiences of synaesthesia and use those experiences to answer questions.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>provides in-depth qualitative data about events or experiences</li> <li>allows the researcher to study experiences that may be unethical or impossible to replicate</li> <li>can lead to new research</li> <li>useful when participant selection is limited.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>often focuses on one person or a small group of participants so results may not be representative of a population or may be externally invalid.</li> </ul>
<b>Classification and identification</b>	Classification refers to the arrangement of phenomena, objects or events into smaller, more manageable groups. Identification is a process of recognising things as belonging to particular sets or possibly being part of a new set.	Classify thoughts, feelings and behaviours as adaptive or maladaptive.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>classification can be used to narrow down groups</li> <li>classification or identification of a disorder can help people access better treatment for conditions</li> <li>classification or identification of a disorder can be used to make predictions.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>grouping people using classification or identification may lead to labelling and subsequently stereotyping, prejudice, discrimination and stigma</li> <li>a lot of information is required to create classification and identification categories</li> <li>classification or identification groups may not be entirely representative, particularly when dealing with subjective or nuanced phenomena.</li> </ul>
<b>Controlled experiment</b>	A controlled experiment investigates the relationship between an independent variable and a dependent variable. All other variables are controlled so they do not affect the outcome of the investigation.	Test whether the presence of music affects memory recall.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can identify cause/effect relationships between variables</li> <li>internally and externally valid results can be generalised to the population.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>controlled conditions may be difficult to maintain and subject to extraneous and confounding variables</li> <li>artificial or lab settings may influence behaviour of participants</li> <li>if settings are too artificial this may render results as externally invalid.</li> </ul>

*(continued)*

TABLE 1 continued

Investigation method	Investigation outline	Example	Strengths and weaknesses
<b>Correlational study</b>	Planned observation and recording of events and behaviours that have not been manipulated or controlled to understand the relationships/associations that exist between variables, to identify which factors may be of greater importance and to make predictions.	Conduct a survey to determine if social media usage decreases with age.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can help determine how strong or weak the relationship between two variables is</li> <li>observation of behaviours is more natural since variables have not been manipulated</li> <li>established correlated relationships can be used to make predictions about variables.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>does not confirm if one variable causes a change in the other</li> <li>a large amount of data is needed</li> <li>since variables are unmanipulated, an extraneous variable could influence results, therefore causing low internal validity.</li> </ul>
<b>Fieldwork</b>	Fieldwork involves going to a specific location to investigate a phenomenon or problem that is unique to that site. When completing fieldwork, you should record site-specific data in your logbook, such as observations and data collected about the conditions of the environment.	Visit a primary school to observe different cognitive stages of development.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>able to provide site- or environment-specific data.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>can be expensive to run and conduct</li> <li>can be time-consuming to organise the logistics of fieldwork (such as travel, site permissions)</li> <li>limited control over extraneous variables</li> <li>if observing masses of people in public settings, there may be ethical concerns with lack of informed consent.</li> </ul>
<b>Literature review</b>	A literature review involves researching, gathering and interpreting secondary sources (also called “literature” by academics) to answer a research question. This may be used to answer questions that have already been asked by other scientists, or to develop a background understanding before you start your own investigation.	Gather secondary data on the gut microbiome to assess whether probiotics are worth adding to a balanced diet.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can shed light on how much knowledge has been established about a particular subject</li> <li>can help identify gaps of knowledge about a particular subject and inform direction of future research</li> <li>uses secondary data so can be more time- and cost-effective than conducting primary research.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>can be vulnerable to selection bias</li> <li>there may not be enough existing research to adequately respond to the research question.</li> </ul>
<b>Modelling</b>	A model physically, conceptually or mathematically simulates a concept or system to assist understanding.	Use modelling clay to build a brain.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can help consolidate complex ideas or subjects through more straightforward representations</li> <li>can allow for unobservable events to be visualised.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>some psychological theories may be difficult to represent through modelling.</li> </ul>

(continued)



FIGURE 3 You may use plasticine to model structures in psychology.

TABLE 1 continued

Investigation method	Investigation outline	Example	Strengths and weaknesses
<b>Product, process or system development</b>	Product, process or system development involves designing a thing, process or system to meet a need. This should link scientific knowledge to technological developments.	Design a piece of sporting equipment to prevent concussion and traumatic brain injuries.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>can help create new solutions to existing issues or problems</li> <li>can shed light on the strengths and weaknesses of existing products, processes and systems.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>can be time- and labour-intensive.</li> </ul>
<b>Simulation</b>	Simulations involve using an existing model to investigate a scientific phenomenon by manipulating variables in the simulation. Simulations are useful when variables cannot be manipulated in real life.	Use an application to simulate the experience of colour vision deficiency and how this condition affects perception.	<p>Strengths:</p> <ul style="list-style-type: none"> <li>allows for manipulation of variables that would otherwise be difficult to manipulate in real life</li> <li>can be a cost-effective alternative to conducting physical research</li> <li>can be used to make predictions.</li> </ul> <p>Weaknesses:</p> <ul style="list-style-type: none"> <li>complex simulation software may be expensive to purchase</li> <li>simulations are artificial and might not be able to be generalised to the broader population.</li> </ul>

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## Participant selection

In research, we are always interested in drawing conclusions that are valid for a particular group of people. The group about which we wish to draw conclusions is referred to as the **population**.

It is rarely possible to perform an experiment on every member of a population. As a result of this, psychologists select a smaller number of individuals from the population to be participants in their research and to represent the population. This group is referred to as the **sample** and the selection of participants for research is called “sampling”. Sampling procedures must ensure that the sample is representative of the population from which it is drawn. This means that personal characteristics of the sample should be distributed in the same proportions as in the population. Two procedures used to make sure that the sample is representative are random sampling and stratified sampling (or stratified random sampling).

### Random sampling

**Random sampling** is a sampling procedure in which every member of the population has an equal chance of being selected – just as lottery numbers do in each draw.

Imagine that we wish to draw conclusions about all 18,000 Psychology students in Victoria. The VCAA has allocated a number to each student, so all we need to do is put each number in a barrel, roll the barrel and pull out one number at a time until we have enough for our experiment.

This process would be very time-consuming, so luckily, we can use technology to help. Scientific calculators and computers have the capacity to generate a list of random numbers. If we instruct the computer to give (for example) 180 random numbers between 1 and 18,000, we can then get a list of the population from VCAA and select the students whose numbers appear in those 180 different positions shown in the random number list.

#### population

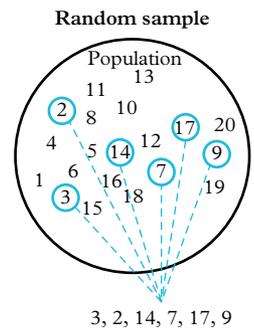
the group of people about whom scientists want to draw conclusions

#### sample

the members of the population who have been chosen to take part in the research

#### random sampling

a sampling procedure in which every member of the population has an equal chance of being selected



**FIGURE 4** Random sampling is a selection process where everyone in the population has an even chance of being selected for the sample.

## Stratified sampling

### stratified sampling

a sampling process by which the effects of a certain variable can be eliminated as a possible confound in an experiment

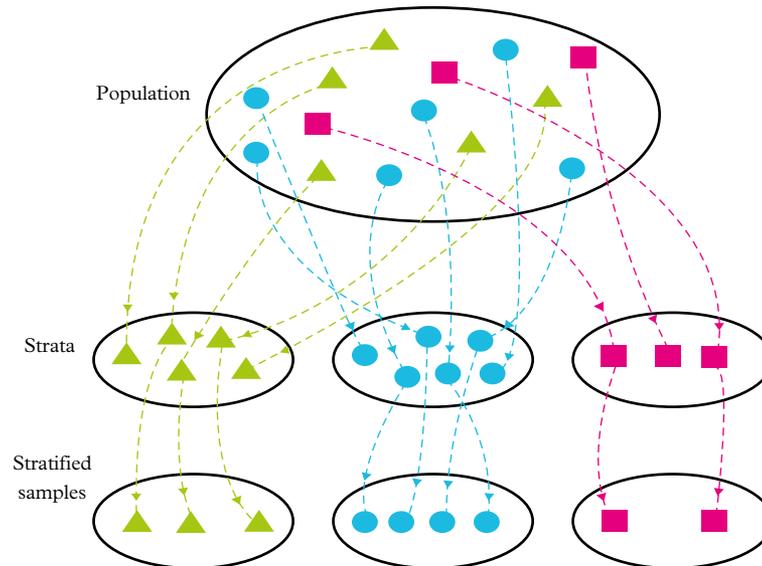
**Stratified sampling** (or stratified random sampling) is a process by which the effects of a certain variable can be removed as a possible confound in an experiment. This is done by ensuring that this variable is distributed within the sample in the same proportions as it is within the population. For example, if we wanted to draw conclusions about VCE Psychology students, we should first note that there might be 18,000 students in total, 13,000 who are female, 5000 who are male. If our sample had an equal number of males and females, the sample would not represent the population and our results could not be generalised to the population. In this case, stratification by sex would mean a sample of 180 students should consist of 130 females and 50 males to eliminate the possible confounding effects of sex.

Stratified sampling involves a number of procedures:

- 1 Identifying a property that we believe may interfere with the effects of the IV on the value of the DV.
- 2 Measuring that property for each member of the population.
- 3 Dividing the population into particular strata (groups) based on the value of that variable.
- 4 Deciding on the number of participants required for the experiment.
- 5 Selecting participants in the same proportions as exist in the population to make up the sample (a stratified sample).
- 6 Selecting a random sample from each stratum, in the same proportions as exist in the population (a stratified random sample).

The stratum could really be any personal variable, such as age, years of completed education, ethnicity, gender or body mass.

Stratified sampling is used in the creation of many high-quality psychological measuring instruments, such as the Wechsler Intelligence Scale. These scales are stratified according to ethnicity, age group and years of completed education.



**FIGURE 5** Stratified sampling involves dividing the population into distinct “subgroups” and then selecting a separate sample from each subgroup in the same proportions as they occur in the population.

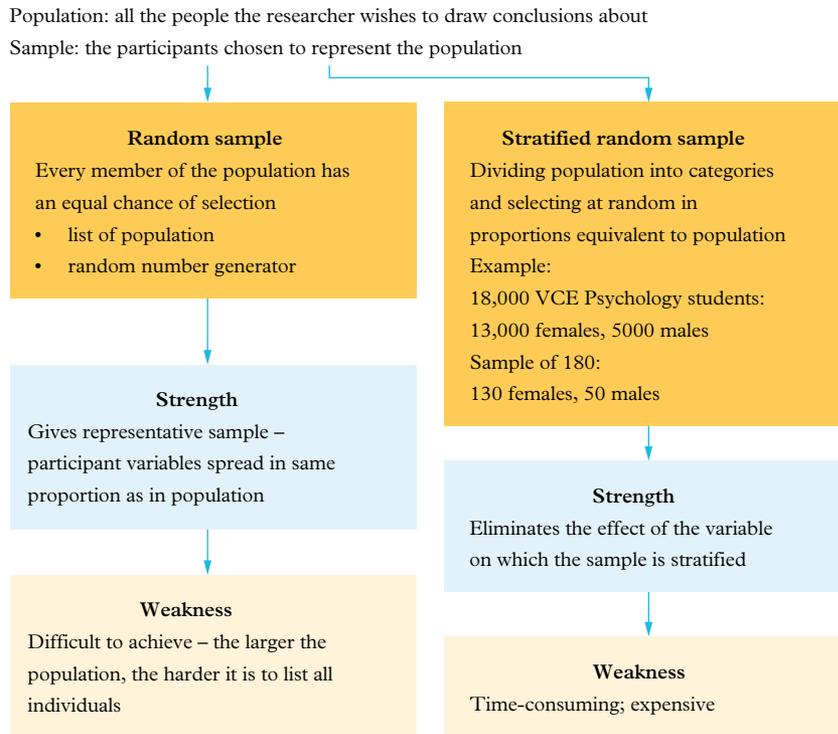


FIGURE 6 Summary of sampling techniques

## Experimental and control groups

In controlled experiments participants may be randomly allocated to different groups. The basic experimental method uses two different groups called the **experimental group (E-group)** and the **control group (C-group)**.

Members of the E-group are exposed to the IV. This is referred to as the condition that receives the treatment. The treatment is the variable that the experimental group participants receive and the members of the control group do not. The purpose of the E-group is to show the effects of the IV on the value of the DV.

The control group consists of the participants who are not exposed to the IV – they do not receive the treatment. The purpose of the C-group is to form a basis for comparison with the E-group.

After the experiment, the average value of the DV for the E-group is compared with the average value of the DV for the C-group. If there is a significant difference, it is concluded that the independent variable (the treatment) has caused this difference.

It is important that the experimental group and the control group are as similar as possible in relevant **participant characteristics**, and that they are treated as similarly as possible throughout the experiment.

**experimental group (E-group)**  
 the group of research participants exposed to the independent variable; the results are compared with the control group so that the effects of the independent variable can be determined

**control group (C-group)**  
 the group of research participants not exposed to variations in the independent variable; the results are compared with the experimental group so that the effects of the independent variable can be determined

**participant characteristic**  
 individual factor such as age, sex, health levels, education and socioeconomic status

## Random allocation

### random allocation

a subject-selection procedure where all participants who have been selected for an experiment have an equal chance of being in either the E-group or C-group

**Random allocation** is when all participants who have been selected for an experiment have an equal chance of being in the E-group or the C-group.

When the sample is large enough, this means that the E-group and the C-group will be equal on all participant characteristics, and the presence or absence of the IV will be the only difference between them – meaning that it is entirely responsible for any difference in the measured DV.

For example, suppose we performed an experiment to test the theory that “sleep deprivation adversely affects performance on a problem-solving task”, and we allocated all males to the E-group and all females to the C-group. No conclusions could be drawn from this research because the difference in results between the two groups may be due to differences in the sex of the participants, rather than (or as well as) the effects of the sleep deprivation. We would say that these results were confounded by sex.

## Investigation designs

### investigation design

the framework of research methods and techniques used by a researcher to conduct an investigation

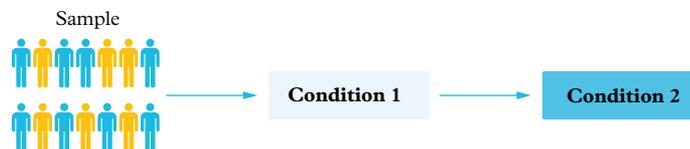
Another method of controlling extraneous and confounding variables is through **investigation design**, which is how you allocate participants into groups and set up your experimental conditions in controlled experiments. In VCE Psychology you need to understand three investigation designs: within subjects, between subjects and mixed design. Each design can have advantages and disadvantages depending on the aim of the study. A researcher must be able to choose the design that best suits the population and variables to be investigated.

## Within-subjects design

### within-subjects design

a subject-selection procedure where each participant is part of both the E-group and the C-group

In a **within-subjects design**, each participant in the sample is tested under all conditions of the experiment. For example, in the research previously mentioned that looks at the effects of sleep deprivation on problem-solving ability, all participants would be tested for problem-solving on two occasions. They would be tested once in a normally rested state (the control condition) and once in a sleep-deprived state (the experimental condition). The results from each condition would then be compared.



**FIGURE 7** In a within-subjects design, all participants are tested in each condition of the experiment.

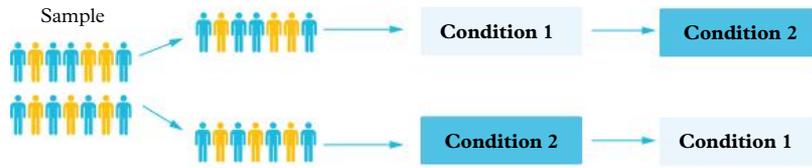
### order effect

effect on results that occurs due to the order or sequence in which the treatments in an experiment are given

If participants in this type of design need to perform the same task twice, they would be more likely to perform better the second time due to practice. This is due to the influence of **order effects** – when the order of treatments influences results. One method of overcoming order effects is **counterbalancing**. To counterbalance, half the participants should first perform the experimental condition and then perform the control condition. The other half of the participants should experience the conditions in the reverse order, the control first and the experimental second. Random selection should be used to decide which participants perform the tasks in which order.

### counterbalancing

a method for controlling order effects in a repeated measures design

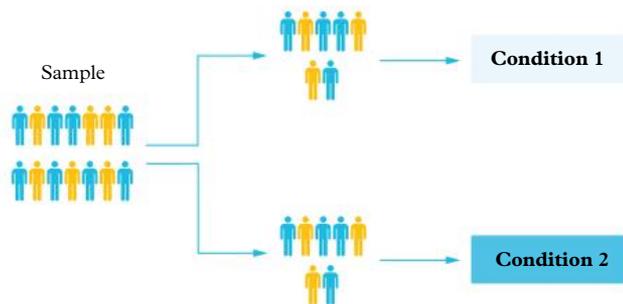


**FIGURE 8** Counterbalancing can be applied to within-subjects designs to overcome potential order effects.

Order effects can also be limited by increasing the time that passes between the two measurements being taken. This lessens the chance of either practice or boredom affecting results. A setback of this strategy is that by increasing the interval between the two events, you also increase the likelihood of participant withdrawal.

## Between-subjects design

In a **between-subjects design** the population is randomly allocated into groups and each group only experiences one condition of the experiment. The results from each group are then compared. For example, a researcher testing whether a new drug is more effective at treating depression than psychotherapy splits their sample so that half receive the new drug and the other half receive psychotherapy. Results from each condition are then compared.



**FIGURE 9** In between-subjects designs the sample is randomly allocated into groups and each group will experience one condition of the experiment.

Because different people experience different experimental conditions, subjects in each group might need to be matched based on similar characteristics to eliminate any confounding variables. Once a confounding variable has been identified, participants can be ranked in accordance with their scores on this variable and then allocated into respective groups. For example, an educational psychologist designed a program that she believed would increase the rate at which Foundation children learnt to read. She decided to test this by giving the E-group of children instructions using her program. The C-group consisted of children taught by traditional methods without her instructions.

She believed that the reading ability of each child could be a confounding variable, so she measured the reading ability of each child through a test. The two children with the highest reading ability scores were randomly allocated so one would join the E-group and one the C-group. The two children with the third and fourth highest scores were also randomly allocated, one to the E-group and one to the C-group. This procedure continued until all the children were allocated and the mean reading ability of the E-group and the C-group were the same.

### Study tip

Order effects and counterbalancing are not terms that will come up on your assessments, however they are useful to consider when planning a within-subjects design.

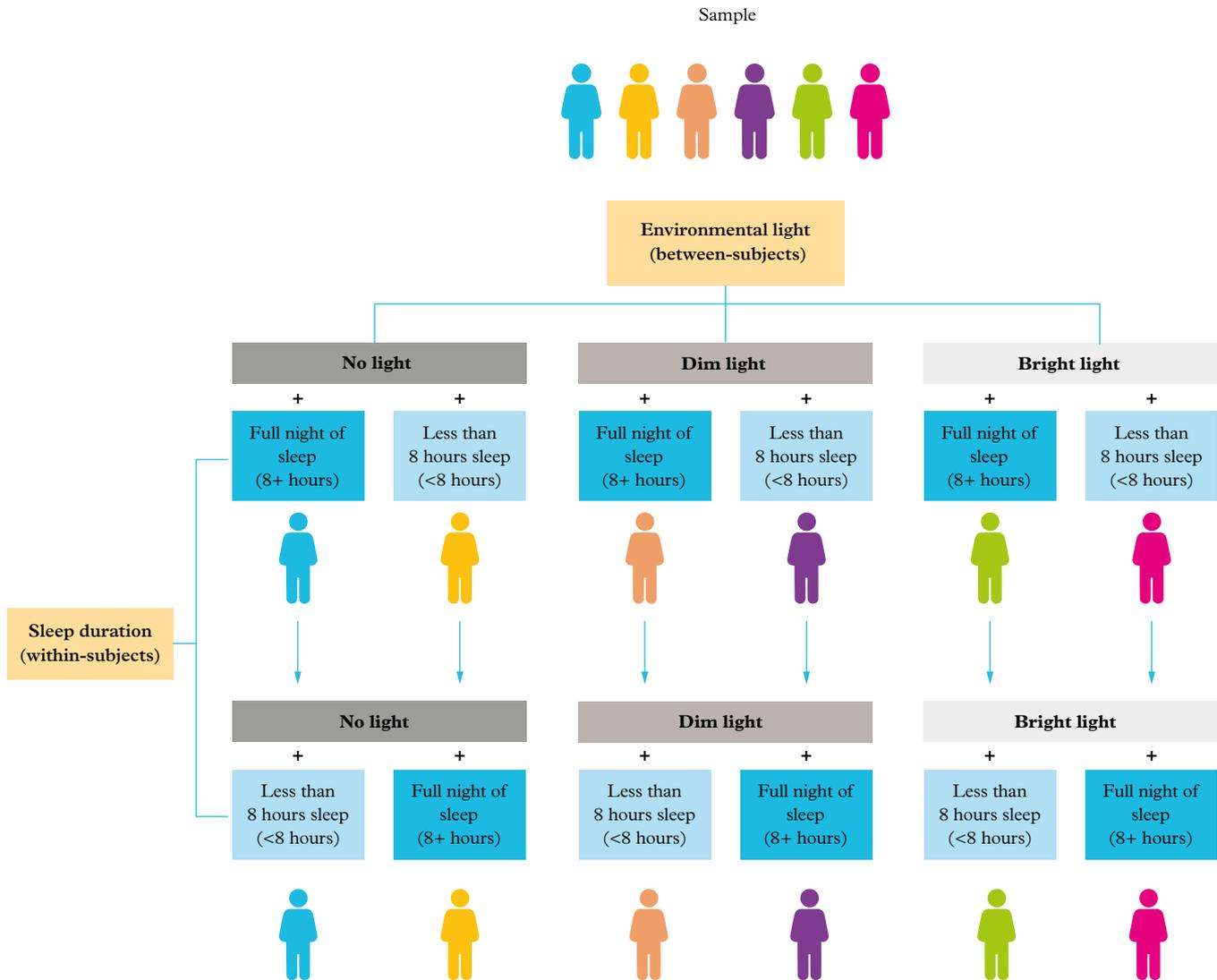
### between-subjects design

a subject-selection procedure where participants are allocated at random to either E-group(s) or the C-group

## Mixed design

**mixed design**  
a study that combines features of both a between-subjects design and a within-subjects design

A **mixed design** is an experimental design that combines elements of within-subjects and between-subjects designs. This design is often used when there is more than one independent variable that can affect the dependent variable. For example, a researcher wants to investigate how environmental light affects sleep quality. They may have three conditions of environmental light: no light, dim light and bright light. The researcher suspects that sleep duration (the second IV) could also affect sleep quality, so the researcher sets up two conditions for sleep duration: a full night of sleep (8+ hours) and an incomplete night of sleep (<8 hours) (Figure 10).



**FIGURE 10** Mixed designs incorporate elements from both within-subjects and between-subjects designs.

In this case the two independent variables affecting sleep quality are environmental light and sleep duration. Each participant only experiences one condition of environmental light (either no light, dim light or bright light), so in this study, the first IV of environmental light is investigated through a between-subjects design. Since every participant in the sample experiences both sleep duration conditions (<8 hours and 8+ hours), the second IV of sleep time is investigated through a within-subjects design. The combination of both between- and within-subjects investigation elements makes this study an example of a mixed design.

Mixed designs are often used in research when it is not possible or ethical to use a fully between-subjects or fully within-subjects design. They can also reduce error variance (the difference between the observed data and the predicted values of the dependent variable based on the independent variables) and increase efficiency by allowing researchers to test multiple hypotheses with the same set of participants.

## Twin and adoption studies

One way of eliminating interpersonal variables as potential confounds is to use participants who are as similar to each other as possible. The nature-versus-nurture debate is a major theme in psychology. Twin studies – especially with identical twins – and adoption studies provide the strongest evidence for the balance between the contributions of genetics and the environment to personal variables.

## Advantages and disadvantages of design types

Advantages and disadvantages of within-subjects, between-subjects and mixed designs are described in Table 2.

**TABLE 2** Advantages and disadvantages of some experimental designs

Experimental design	Advantages	Disadvantages
Within-subjects	<ul style="list-style-type: none"> <li>Using the same participants in experimental conditions means that confounds caused by “participant variables” will be eliminated.</li> <li>Uses fewer participants than other designs.</li> </ul>	<ul style="list-style-type: none"> <li>Within-subjects designs take a long amount of time to complete.</li> <li>Participants must take part in all conditions, so “drop-outs” are likely.</li> <li>Procedures can suffer from confounding variables known as order effects: participants may perform better on the task when doing it a second time because of the effect of practice, or participants may do worse the second time because of fatigue or boredom.</li> </ul>
Between-subjects	<ul style="list-style-type: none"> <li>The procedure can all be done at once and drop-outs are unlikely, which can therefore make it more time-efficient.</li> </ul>	<ul style="list-style-type: none"> <li>Procedure needs many participants to ensure that the spread of participant variables in the sample will match the spread in the population; this can also lead to less control of participant variables.</li> <li>If matching is required it can be time-consuming (and therefore expensive) to find out the value of variables for each participant.</li> </ul>
Mixed design	<ul style="list-style-type: none"> <li>Can investigate the effects of more than one independent variable on the dependent variable, which can also make the study more time- and cost-effective.</li> </ul>	<ul style="list-style-type: none"> <li>Findings can be difficult to interpret.</li> <li>Research design can be very complex; discrepancies can be unclear and hard to correct.</li> </ul>

### 1.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Explain why extraneous variables need to be controlled and provide an example.
- 2 Identify two differences between a within-subjects and a between-subjects design.
- 3 Describe what a control group is.
- 4 Explain the purpose of an experimental group.
- 5 Define the term “random allocation”.
- 6 Identify at least one variable on which the sample should be stratified in the following research questions:
  - a Does the Acme Reading Instruction Method increase the rate at which early primary school students learn to read?
  - b Does consumption of one standard alcoholic drink interfere with an adult’s problem-solving ability?
  - c Do teachers who use PowerPoint presentations get better results than those who dictate notes?

#### Apply, analyse and compare

- 7 Consider why random allocation is a necessary part of the experiment process.

- 8 Determine how a psychologist could obtain a random sample for all the adult population of Geelong.

#### Design and discuss

- 9 For each of the scenarios below, evaluate whether a within-subjects design, between-subjects design or mixed design would be most appropriate.
  - a A researcher wants to investigate the impact of sleep on cognitive performance using two conditions (after a full night of sleep and after a night of sleep deprivation).
  - b A researcher wants to study the effectiveness of two different teaching methods (rote learning and hands-on learning) on student performance in a maths class.
  - c A researcher wants to study the effects of a new medical treatment on anxiety levels in two different age groups (young adults and older adults).
- 10 Evaluate the benefits of a twin study against a between-subjects design. Justify why a twin study may yield better results.

**FIGURE 11** Which experimental design would be most appropriate for an investigation on sleep deprivation and cognitive performance?



# 1.4

## Complying with ethics and safety requirements

### KEY IDEAS

- ✦ Ethical understanding should be applied when undertaking research.
- ✦ Ethical concepts guide discussion and decision-making in psychological research.
- ✦ Laboratory safety practices minimise risks and protect investigation participants' safety.



## Ethical understanding

Ethics are moral principles that govern how a person behaves or how an activity is conducted. When undertaking student-designed investigations or evaluating research, you must apply an ethical understanding.

Applying an ethical understanding means applying ethical concepts when collecting and analysing data. Psychological investigations often involve humans as subjects. In such situations, it is important to ensure that ethical concepts are adhered to. You need to consider how the investigation may affect the subject's life. Decisions based on science-related ethical issues take into consideration scientific knowledge, current and future needs, and sociocultural, economic, political and legal factors.



**FIGURE 1** Have you ever decided on something based on your “moral compass”? Ethical concepts help researchers determine what is right and what is wrong.

### ethical concept

idea that helps explore ethical conduct in investigations; can be used to decide whether an action or course of action is ethically acceptable

### integrity

the ethical principle about the commitment to search for knowledge and be honest in the approach

## Ethical concepts

When exploring ethical issues and dilemmas, you need to consider **ethical concepts** to determine the acceptability of effects and research (Figure 2). There are five ethical concepts.

- **Integrity** is the commitment to searching for knowledge and being honest. When researching, it is important to honestly communicate results and research, whether favourable or unfavourable.

**justice**

the ethical principle of ensuring fair and equal consideration of all factors

**beneficence**

the ethical principle of a commitment to minimising risk and doing good

**non-maleficence**

the ethical principle of avoiding harm or decreasing the amount of harm inflicted

**respect**

the ethical principle that considers the value of living things and the ability for living things to make their own decisions where possible

- **Justice** is the moral rightness and commitment to fairly assessing claims, means and actions. It means that all are treated equally to make sure moral obligation stands.
- **Beneficence** is the idea that the purpose of a person’s action should be to do well and minimise the risks of harm while maximising benefits.
- **Non-maleficence** is avoiding the causations of harm. As scientific research can sometimes unavoidably involve harm, any benefits of the course of action must outweigh the resulting harm. If not, the investigation is not worth undertaking.
- **Respect** refers to the intrinsic value of all living things, which considers the religious beliefs, cultural heritage, views and opinions, customs, health and safety of an individual or group. This ethical principle makes sure that living things can make their own decisions and when that capacity is diminished, decisions should be based on empowerment and protection.



**FIGURE 2** A summary of questions you can ask to assess whether ethical concepts apply to research.

## Ethical guidelines

In psychological research, there are ethical considerations involved when working with both animals and humans.

- **Research with animals:** Animals have been used in research for centuries, however research today has stringent guidelines in place to protect them. Animals must be protected, well-cared for and pain must be minimised.
- **Research with humans:** Psychological research most commonly involves human beings as participants. It is vital that the wellbeing of participants is safeguarded. The overriding principle is that there must be no physical or psychological harm to participants.

## The ethics committee

To ensure the wellbeing of participants, before beginning a study researchers must submit detailed plans of their proposal to the human research ethics committee (HREC) of their university or other research institution (such as a hospital or medical research body).



**Resource**

Ethical guideline checklist



**Resource**

Informed consent form

The HREC will study the proposal and indicate any changes that must be made or additional procedures that are required before it will give approval for the study to proceed.

The Australian Psychological Society publishes a “Code of Ethics” for psychologists. This includes a section on the conduct of psychological researchers and draws together regulations and guidelines from bodies such as the National Health and Medical Research Council and guidelines such as the National Privacy Principles.

An HREC will take account of each of the following ethical guidelines before giving approval.

- **The role of the researcher:** The researcher must always act in a professional manner, making sure that the best interests of the participants, and of society in general, are met.
- **Participants’ rights (respect for participants):** Researchers must always maintain respect for the participants. Participants’ rights include those listed below.
  - **Confidentiality** (privacy): Participants must not be identified in any way in terms of test results, their involvement in the study or any other confidential data. Data needs to be stored and disposed of using secure procedures. The means by which confidentiality is to be established and maintained should be described to the participants at the beginning of the study.
  - **Voluntary participation:** Participants have the right to refuse to take part in a study. There must not be any pressure to take part in a study, nor should the participants be tricked into taking part. Participants must also not be at a disadvantage if they choose not to participate.
  - **Withdrawal rights:** Participants have the right to leave a study at any stage, regardless of the possible effects on the results. They also have the right to withdraw their results after the study has been completed. This must be explained to the participants before beginning the study.
  - **Informed consent:** Participants must be given information about a study and understand the nature of the study before they agree to take part. For participants who are either too young or too intellectually disabled to give their consent, their guardian must be given the information before giving consent on their behalf.
  - Use of **deception in research:** Deception is the provision of false or incomplete information for the purpose of misleading research participants. This is only permitted if the results would be confounded if the participants had too much information before taking part in the study. The researcher must ensure that participants do not unexpectedly suffer distress; the study must be stopped immediately if this occurs. Participants must be debriefed when the study is complete.
  - **Debriefing:** Debriefing occurs after completion of the study, when participants are told the aim, results and conclusions of the study. Any erroneous beliefs about the study are corrected, especially if there was any deception involved. Participants are informed of the availability of, and how to obtain, counselling if they feel they need it.



**FIGURE 3** Animal ethics help ensure that animals used in research do not suffer through unnecessary pain.

**confidentiality**  
participants must not be identified in any way in terms of test results, their involvement in the study or any other confidential data

**voluntary participation**  
participants have the right 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

**withdrawal right**  
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

**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, before they agree to participate

**deception in research**  
the provision of false or incomplete information for the purpose of misleading research participants

**debriefing**  
the experimental process during which, 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

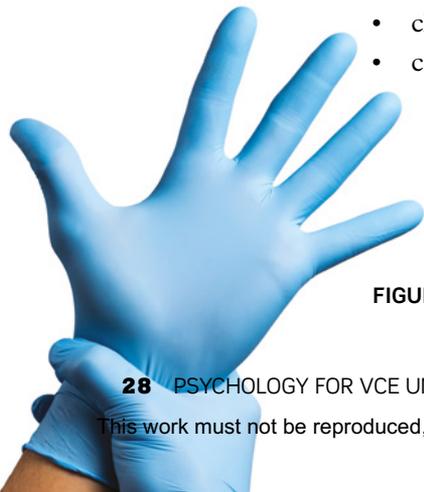


**FIGURE 4** All universities that conduct scientific research have a human rights ethics committee and an animal ethics committee.

## Safe laboratory practices

Psychological investigations can often involve work in the laboratory. Laboratories implement several safe practices to ensure that procedures or investigations conducted in a lab are done so in a way that minimises risks and protects the safety of others. Common safe laboratory practices include:

- keeping long hair tied back
- listening to instructions from teachers or supervisors
- not eating or drinking in the lab
- being aware of your peers and surroundings
- acting appropriately in a way that does not cause harm
- wearing personal protective equipment (PPE), such as lab coats, safety glasses, gloves and closed-toe shoes when required (Figure 5)
- knowing the safety procedures and locations of eye wash stations, showers, spill kits, first-aid kits and fire alarms
- handling chemicals with care
- keeping flammable materials (such as alcohols or aerosols) away from open flames
- checking equipment for damage before using it
- considering ethical concepts before conducting experiments.



**FIGURE 5** Wearing PPE is an important part of laboratory safety, particularly when working with chemicals.

## Risk assessments

A **risk assessment** is a document that identifies any materials or procedures related to an investigation that may potentially cause risk or harm. Risk assessments are created prior to conducting an investigation so that the researcher is aware of any risks involved before starting. This minimises the chances of risks occurring because the researcher can modify and control the experiment to reduce potential risks. It also ensures that the researcher has time to check whether they have the necessary equipment or resources needed to manage risks if they do occur. You can access an example of a risk assessment and a risk assessment template using the hotspot links.



### risk assessment

a system or document that evaluates any potential risks involved with a particular activity



### Resource

Risk assessment template

**FIGURE 6** Risk assessments help researchers minimise and prepare for potential risks prior to running investigations (for example, checking fire extinguishers before working with flammable materials).

## Safety data sheets

A **safety data sheet (SDS)** is a document that provides information on a specific chemical or substance and identifies whether a substance is considered hazardous. SDSs also provide instructions for handling substances safely and instructions on how to respond to any risks (for example, eye contact, skin contact and ingestion) related to hazardous and non-hazardous substances. SDSs are most often used to inform risk assessments for investigations that use chemicals, but you may need to use them when working with common foods and drinks.

### safety data sheet (SDS)

a document that lists information related to hazardous and non-hazardous materials

## 1.4 CHECK YOUR LEARNING

### Describe and explain

- 1 Define the ethical concept of “respect”.
- 2 Describe how the role of the researcher could influence research.
- 3 Explain the role of an ethics committee.
- 4 Define each of the following terms and provide an example of how each could be applied in a psychological investigation:
  - a informed consent
  - b withdrawal rights
  - c confidentiality.

### Apply, analyse and compare

- 5 Compare the ethical concepts of beneficence and non-maleficence, providing examples of both.
- 6 Infer why a risk assessment should be completed before conducting an investigation rather than after.

### Design and discuss

- 7 Determine which ethical concepts are being applied to each of the following situations. Justify each of your answers.
  - a A researcher conducts a study to determine which classroom strategies improve engagement in schools in the hope of improving outcomes for students and teachers.
  - b A researcher finds that results of their latest study contradict the large body of work they have established over the past few years. The researcher still submits the work for publication.
  - c A researcher writing a literature review includes papers from a diverse range of published material rather than only including their colleague’s work.
- 8 Researchers want to use a group of 10-year-olds in a study. Consider the ethical implications of using this group and explain how these implications could affect the study.

# 1.5

## Generating, collating and recording data

### KEY IDEAS

- ✦ Data can be classified as either qualitative or quantitative.
- ✦ Observations, interviews and questionnaires can be used in research investigations to collect data.



## Types of data

Our knowledge of psychological concepts and theories has come from the collection, interpretation and analysis of different forms of data. In VCE Psychology you will need to practise generating, collating and recording data. There are two types of data you will work with:

### primary data

data collected by the investigator from firsthand sources

### secondary data

data collected by another person, not the investigator, which is relevant to the scientific investigation

### qualitative data

descriptive characteristics of what is being studied

- **primary data** – data that you have gathered firsthand through your own research, such as responses from a questionnaire you have conducted
- **secondary data** – data that has come from a secondary source, such as data you have found in a scientific journal or database.

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

**Qualitative data** refers to descriptions of the characteristics of what is being studied.

For example, when asking a participant what their favourite food is, the response “apple” is a form of qualitative data. Common sources of qualitative data include:

- open-ended survey responses
- interviews
- focus groups
- observations.

Qualitative data offers in-depth insights useful for exploring context. This type of data can be effective for gathering subjective data (such as feelings or preferences). Analysis of qualitative data involves identifying, examining and interpreting patterns and themes in the data.



**FIGURE 1** Self-report surveys collect qualitative data.

**Quantitative data** refers to measurements or numerical values of the variables being studied. For example, a heart rate of 120 bpm (beats per minute) is an example of quantitative data. Most psychological research aims to gather quantitative data because statistical procedures can be performed on these and, provided the data are accurate and precise, psychologists can determine whether the results are significant and the hypotheses can be supported.

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

## Collecting and recording data

There are many different sources and ways of collecting data. Depending on the sort of data you want to collect, some data collection methods may have benefits over others. Observations, interviews, focus groups and yarning circles are all methods of obtaining data.

### Observations

Psychological research often uses observations to gather data on subjects. **Direct observation** is a type of data collection that involves a researcher simply watching or listening to subjects without asking specific questions or manipulating variables. Direct observation can be used to collect qualitative data (for example, writing a description of a person’s facial expressions) or quantitative data (for example, counting the number of times a person claps their hands). **Controlled observations** are when voluntary behaviours are monitored within a structured environment such as a laboratory.

**direct observation** a research method in which the researcher watches and records behaviour as it occurs naturally without intervention or interference

**controlled observation** observation of voluntary behaviours within a structured environment such as a laboratory

**TABLE 1** Comparing direct and controlled observation

Observation type	Strength	Weakness
Direct observation	Highly realistic, especially if the observer is not visible.	There is a lack of ability to control the independent variable.
Controlled observation	Control over the environment enables more accurate observations.	Participant behaviour may be changed by the environment.

**participant observation** a data collection method where the researcher immerses themselves or “participates” in a specific setting or group to make observations of the target of their research

**Participant observation** is a method of data collection where a researcher immerses themselves in a particular social setting or group to observe the behaviours, interactions and practices of subjects. In participant observation, the researcher may disguise themselves or go “undercover” to observe the behaviours or actions of subjects (for example, they may join an online forum as an anonymous user to observe the responses of others without posting anything). Alternatively, a researcher may choose to share their identity and intentions with the participants in the group they are observing (for example, a researcher may join a fitness class and inform the class that they will also be observing participant behaviour for research purposes).

**structured interview** a research technique that involves an interviewer asking a participant a set of pre-determined questions

### Interviews

All interviews involve 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 questions with a fixed choice of responses such as yes/no, or never/sometimes/often/always. In a **clinical interview** there are guidelines, but the interviewer may choose to add additional or unscripted questions for clarification.

**clinical interview** a qualitative research technique where an interviewer has a dialogue or conversation with the participant that is not structured or contains unstructured questions

The strengths of structured interviews include that they make it easy to compare participants and that they are easy to replicate, but data may be missed because of limited response choices. Strengths of clinical interviews are flexibility, and that they are usually high in validity. However, clinical interviews rely on the objectivity of the interviewer.

**focus group**

a research technique that involves collecting data from a small group of people as they discuss or respond to different ideas or products

A **focus group** is a data collection technique that involves a researcher conducting a group interview with specific groups or subjects (Figure 2). During focus group interviews participants are often given questions or prompts to freely discuss as a group (for example, a tech start-up company might interview a group of teenagers about the features they find most engaging on social media applications). Focus group interviews can help identify and explore people’s collective opinions and how they might think and behave.



FIGURE 2 People discussing ideas in a focus group

**questionnaire**

a list of questions used for data collection

**survey**

the collection and analysis of the experiences and/or opinions of participants who have been asked questions

**Likert-type scale**

questions that use a scale for responses, ranging from one extreme to another

**psychological test**

assessment used to evaluate various aspects of emotions, cognitions or behaviours (such as personality tests or intelligence assessments)

## Questionnaires

A **questionnaire** is a research tool that consists of a series of questions that help collect information from respondents. Questionnaires can take various forms, such as surveys and psychological tests. A **survey** can combine question-and-answer responses and **Likert-type scales** (rating scales). A benefit of using surveys is that they are easy to replicate and to score. Likert-type scales can provide a means of quantifying data (Figure 3). Surveys may be open to bias if participants are trying to appear in a particular way.

<b>I complete my Psychology homework on time.</b>	Never	Sometimes	Often	Always
	1	2	3	4
	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

FIGURE 3 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** are written, visual or verbal evaluations given to assess the cognitive and emotional functioning of participants. Personality and multiple-choice intelligence tests are examples of psychological tests. The strengths of psychological tests include being standardised, easy to replicate, and easy to score. Weaknesses include that they are difficult to construct and validate.

## Yarning circles

A **yarning circle** is an informal speaking and listening space where members of a group are free to share, discuss, receive and question information openly and without judgment from others. Yarning circles or “yarning” has been practised in Aboriginal and Torres Strait Islander communities for thousands of years and is a tradition with high significance in many Aboriginal and Torres Strait Islander communities. Yarning can help strengthen the bonds between people and allow people to pass on and preserve cultural knowledges, histories and perspectives. Some of the benefits of yarning circles include that they:

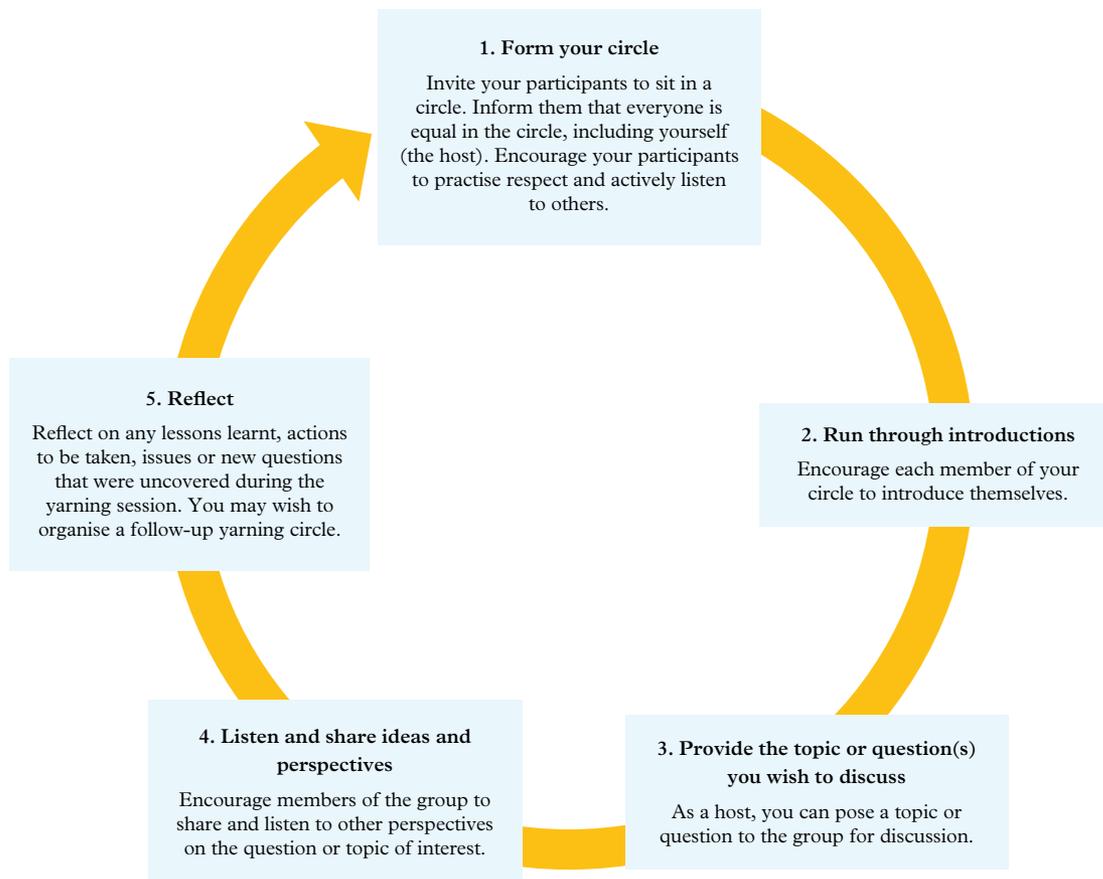
- provide a safe, respectful and trustworthy environment to share experience, perspectives and knowledge
- build relationships between people
- encourage honesty and sharing
- foster a sense of community connection.

In VCE Psychology you may engage with yarning circles to build relationships with your peers, learn new information, or provide a safe space for information sharing. Yarning can also inform psychological research investigations. For example, a student may run a yarning circle to share perspectives on factors that can influence social and emotional wellbeing and then, with the consent of all members involved, use the knowledge they have obtained as inspiration for a research question about factors influencing social and emotional wellbeing. A guideline for running a yarning circle is outlined in Figure 4.

**yarning circle**  
a harmonious, creative and collaborative way of communicating to encourage responsible, respectful and honest interactions

### Study tip

Consulting with Aboriginal and Torres Strait Islander community groups or individuals for guidance on yarning can help you determine the best approach to take.



**FIGURE 4** Outline of how you could run a yarning circle

# Logbook

## logbook

a record of investigation ideas, events, results and interpretations

You will need a **logbook** in hard copy or digital form to record primary and secondary data from all types of scientific investigations undertaken in Units 1 to 4. You will need to submit your logbook to your teacher for some assessment tasks so they can check that the work you have submitted is your own.

Each entry must include:

- the date and entries sequenced in chronological order
- acknowledgment of secondary resources, expert advice and teacher assistance when this information is referred to.

Your logbook could also include the following information as you complete your investigation:

- planning notes for experiments
- a description of the activities you have carried out
- the results or data from guided activities or investigations (including outliers and/or risk identification and management)
- personal reflections made during or at the conclusion of demonstrations, activities or investigations
- any links to spreadsheet calculations or other digital records and presentations you might use
- any notes and electronic (or other) images taken on excursions, or any database extracts
- notes of any additional work completed outside of class time.

A well-organised logbook that contains all of this information will make it much easier to complete your scientific investigation in Unit 2 Area of Study 3.



**FIGURE 5** If your logbook is hard copy, use a bound notebook to make sure you do not lose any pages.

## 1.5 CHECK YOUR LEARNING

### Describe and explain

- 1 Define the terms “primary data” and “secondary data”.
- 2 Identify three benefits of using yarning circles.
- 3 Explain one method you could use to change qualitative data into quantitative data.

### Apply, analyse and compare

- 4 Compare qualitative and quantitative data.
- 5 Contrast the strengths and weaknesses of direct and controlled observations.

### Design and discuss

- 6 Discuss a research scenario where using a structured interview for data collection would be more appropriate than using a clinical interview.
- 7 Marion is conducting a research investigation to observe how often teachers in the staffroom complain about students. Marion is contemplating whether she should observe the teachers by openly revealing her identity and research purpose or whether she should go undercover as a student teacher. Discuss which approach you believe Marion should take. Justify your answer.



## 1.6

# Organising, presenting and processing data

## KEY IDEAS

- ✦ Organising and presenting data in the correct format can help us determine what the data means.
- ✦ Descriptive statistics can be calculated or used to help us process what our data means.



## Organising and presenting data

**raw data**  
unprocessed data

**Raw data** is the unprocessed data collected during an investigation. For example, look at the data below, collected by a student who has rolled a die 80 times and recorded the number shown on each throw:

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.

Looking at raw data like that shown above can be confusing and make it hard to determine what your data means or shows. Luckily, there are many ways we can organise and present data to make it easier to analyse and interpret.

### Tables

**table**  
a format of presenting data using rows (horizontal) and columns (vertical)

Placing the above data into a **table** can make it much easier to perform simple calculations with the data. Compare the data set from rolling a die 80 times above with Table 1. Which would you prefer to work with? Tables can summarise information and be used to present both qualitative and quantitative data. Tables should also include a heading or caption that summarises what the table is showing. The first column in the table can be used to list your variables. If you are working with numerical data, you should also include the relevant specific measurement units of any variables in the heading cells of the table.



**FIGURE 1** Placing data from rolling a die into a table makes calculations easier.

**TABLE 1** Results recorded from rolling a die 80 times

Number on die face	Number of times rolled
1	12
2	11
3	17
4	12
5	15
6	13

## Graphs

Tables can help to organise data, but they do not always reveal much about what the data means. Presenting data in the right format can help us make sense of the data and identify any patterns or trends that exist within our data. **Graphs** are visual representations that show the relationship between two or more variables measured along a pair of axes. All graphs should include the following:

- a graph title that succinctly describes what the graph is showing (this statement often includes the independent and dependent variable)
- clearly labelled axes that include units of measurement (the independent variable placed on the horizontal “x” axis; the dependent variable placed on the vertical “y” axis)
- equally spaced units of measurement along the axes (scaling)
- axes that start at zero (when possible)
- data plotted within the confines of each axis
- distinguishing symbols, colours or keys when more than one set of data is plotted on a single graph.

### graph

a pictorial representation that displays values and data in an organised way

### bar chart

a pictorial representation of data where the numeric values of variables are represented by height or lengths of bars

### discrete categories

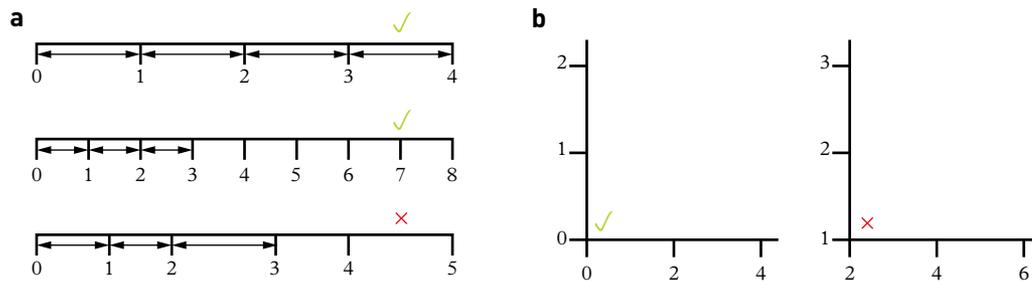
groups of data that have gaps or spaces between values (are not continuous)

### 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

### correlation

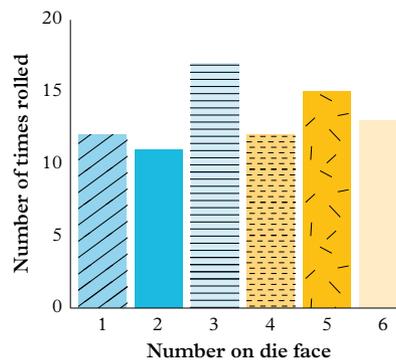
a statistical measure of the strength and direction of the relationship between two variables; does not show a cause-and-effect relationship, but describes the way in which the variables are different in relation to each other



**FIGURE 2** When drawing your graph, remember to **a** scale your axes correctly, and **b** start your axes at zero.

## Bar charts

**Bar charts** are graphical representations of data with **discrete** (countable) **categories**. The height or length of a rectangle (or bar) is used to show the value of one category of data. We can use bar charts to get a much clearer picture of the numbers rolled on the die. Looking at Figure 3, we can quickly see that a three was rolled most frequently.



**FIGURE 3** This bar chart shows the number of occasions each number was thrown in 80 rolls of one die.

## Line graphs

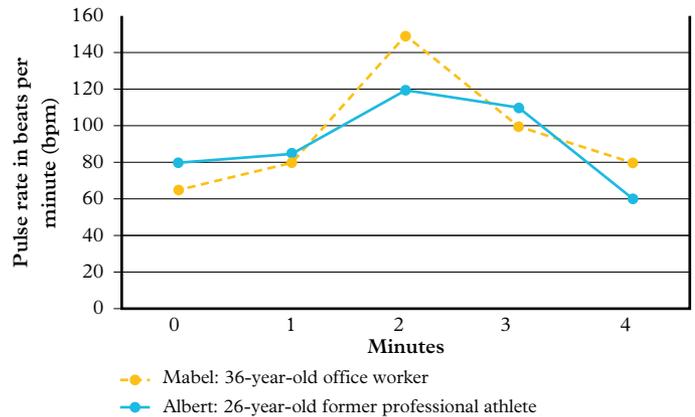
When one variable is continuous (meaning that it can have any value within a certain range) – such as body mass, or age in months – we can showcase it using a **line graph**. Line graphs are graphical representations that can show the relationship between two variables (**correlation**) or show how a variable might change over time. Line graphs can also be used to show more than one data set on the same axis, as long as both data sets have the same defined relationship (Figure 4).

## Scatterplots

A **scatterplot** is a graph of unconnected plotted data points that is used to determine whether a relationship exists between two variables that have no defined relationship (that is, there is no clear or apparent connection between the two variables). For example, imagine you have a data set that includes the number of hours people exercise and the number of pairs of shoes they own. There is no logical or expected relationship between these two variables, so you could say that there is “no defined relationship”.

Scatterplots are often used to graph data collected in correlational studies as they help to identify and describe the relationship between two variables. After data is plotted onto the scatterplot, a **line of best fit** can be generated to indicate the closeness of two variables. If the trend of the data is linear, then the line of best fit should be drawn as a straight line; if the trend is curved, then the line of best fit should be drawn as a smooth curved line.

Change in pulse rate during exercise



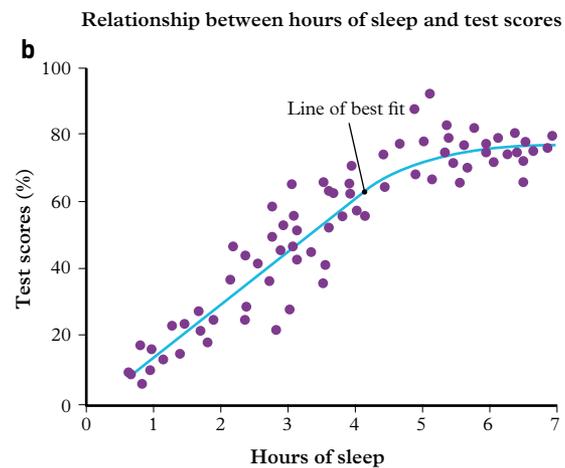
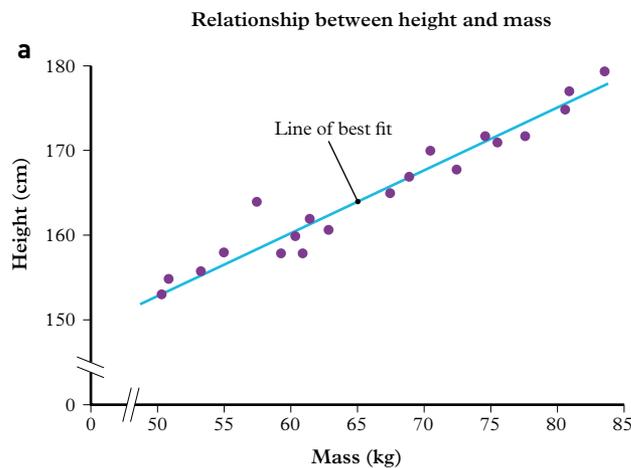
**FIGURE 4** A line graph that shows how one variable (pulse rate) changes over time during exercise

### scatterplot

a diagram showing the values of the two variables for each result in the sample by representing the intersection of those two values with a dot on a graph

### line of best fit

a trendline that gives an approximation of the linear relationship between two variables on a graph



**FIGURE 5** Two scatterplots depicting a line of best fit

If the line of best fit slopes upwards (Figure 5a) it means that the independent variable and dependent variable increase together. This is called a **positive correlation** and describes when two variables change in the same direction – that is, as one increases, so does the other; or alternatively, as one decreases, so does the other.

### positive correlation

a relationship in which the two variables change in the same direction – that is, as one increases (or decreases), so does the other

**negative correlation**

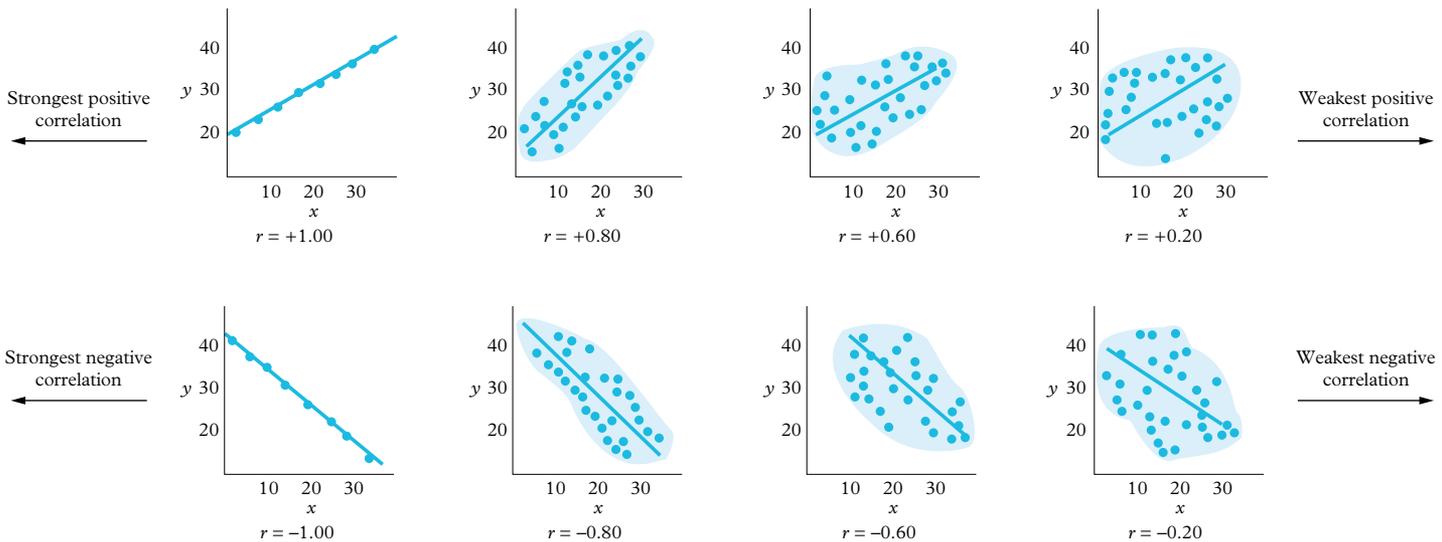
a relationship in which the two variables change in the opposite direction – that is, as one increases, the other decreases

**Pearson correlation coefficient ( $r$ )**

a measure of the strength of the linear relationship between two continuous variables

For example, we might expect to find a positive correlation between hours spent sleeping each night and test results in VCE Psychology – meaning that as the number of hours spent sleeping each night increases, the average results increase. If the line of best fit slopes downwards, it indicates a **negative correlation** – where the two variables change in opposite directions (as one increases, the other decreases). Using our sleep and test results example, a negative correlation would be as the number of hours spent sleeping each night increases, the average test results decrease.

A **Pearson correlation coefficient ( $r$ )** is a measure of the strength of the correlation expressed as a decimal number in the range of  $-1.0 < r < +1.0$ . The (+) or (–) sign in front of the number shows whether it is a positive or negative correlation. The number following the positive or negative sign indicates the strength of the correlation. The higher the number, the stronger the correlation, whether positive or negative. Correlation coefficients of  $+1.0$  or  $-1.0$  show perfect positive or perfect negative correlations respectively. This would mean that as one variable increased by one unit, the other variable would increase by one unit (perfect positive correlation) or decrease by one unit (perfect negative correlation). A correlation coefficient of  $r = .00$  indicates that the two variables are not related in any way. A correlation of  $r = +.80$  indicates that the two variables have a strong, positive correlation, while a correlation of  $r = -.14$  indicates that the two variables have a weak, negative correlation.



**FIGURE 6** Scatterplots showing direction and strength of correlations

**causation**

a cause-and-effect relationship, where changes in one variable lead directly to changes in another variable

It is important to remember that correlation does not equal **causation**. This means if two variables happen to show a statistical relationship (correlation), it does not confirm that changes in one variable will cause changes in the other variable. To establish if a cause-effect relationship exists between variables, researchers need to conduct controlled experiments or use advanced statistical techniques to rule out alternative explanations. Simply observing a correlation is not enough evidence to conclude that one variable is causing the changes in another.

## Processing data

Presenting or organising raw data in the correct format is only one way to help make sense of it. **Descriptive statistics**, which are statistics that analyse and summarise key features of a data set, can also be calculated or used to help us understand what our data means. In VCE Psychology there are three main descriptive statistics you need to understand:

- percentages
- measures of central tendency
- standard deviation.

### descriptive statistic

measure or point of information that describes the characteristics of a data set

## Calculating percentages and percentage change

A **percentage** is a number or ratio expressed as a fraction of 100. Percentage is a very useful and commonly used descriptive statistic. Psychologists often need to calculate what percentage of a data set is represented by a certain score. Percentage can be calculated using the following formula:

$$\text{Percentage (\%)} = \frac{\text{Value}}{\text{Total value}} \times 100$$

For example, consider the data set of the die rolled 80 times from Table 1. To discover what percentage of the data was a six, our “value” would be the number of times the die rolled six (13), and our “total value” would be the total number of times the die was rolled (80). Therefore, our calculation would be:

$$\frac{13}{80} \times 100 = 16.25\%$$

**Percentage change** is another useful descriptive statistic that assesses the difference (the increase or decrease) between two percentages. Percentage change can be calculated using the following formula:

$$\text{Percentage change (\%)} = 100 \times \frac{\text{New percentage} - \text{initial percentage}}{(\text{initial})}$$

If the number generated from the formula above is positive, it means the percentage has increased; if the number is negative, it means the percentage has decreased. For example, imagine you were conducting a study to determine how effective a revision program was at improving test scores. If a student scored 12/30 on the test before the program and 27/30 after the program, to figure out percentage change you would need to:

- 1 convert both scores to percentages (the initial score is 40% and the post-program score is 90%)
- 2 use the formula to calculate the percentage change ( $100 \times \frac{90 - 40}{40}$ ). Since the percentage change is positive, you could say that the program resulted in a 125% increase in test score.

### percentage

a number or ratio expressed as a fraction of 100

### Study tip

The word percentage comes from the Latin “*per centum*” which translates to “by the hundred”.

### percentage change

the factor by which an initial data percentage changes after time or an event

## Measures of central tendency

### measure of central tendency

summary statistic that represents the central point of a data set

### mean

the calculated central number or “average” of a set of numbers

**Measures of central tendency** are descriptive statistics used to describe a whole set of data with a single value that represents the middle or “centre” of the distribution of data. There are three main measures of central tendency: mean, median and mode.

### Mean

The **mean** or “average” is calculated by adding up all the values in a data set and then dividing that figure by the number of values in the data set. For example, consider the data in Table 2. The mean test score for this data set would be calculated as follows:

$$\begin{aligned} \text{Mean} &= \frac{57 + 70 + 81 + 25 + 50 + 92 + 70 + 63}{8} \\ &= 63.5\% \end{aligned}$$

**TABLE 2** Test scores of 12 students in a Grade 6 class

Student	Test score (%)
John	57
Robert	70
Kiet	81
Luke	25
Hanna	50
Jacob	92
Adelina	70
Ahmed	63



ClickView

Measures of central tendency

The mean is a useful statistic to describe data when most values of the data set fall close to the mean. It is less useful to use when there are extreme or irregular scores that might influence the mean. For example, if the class scores were 6%, 4%, 2%, 7%, 87%, 100%, 97% and 93%, the mean test score for this data set would be 49.5%; however, none of the students in the class got a score close to this mean – they were all either well over or well under it.

### Median

The **median** is the middle number (or the mean of the two middle numbers) of a data set that has been listed in numerical order. For example, consider the data from Table 2. The scores in numerical order would be as follows: 25, 50, 57, **63**, **70**, 70, 81, 92.

Because the data set has an even number of scores (eight), there are two middle numbers: 63 and 70. Our median is therefore the mean of these two values:  $\frac{63 + 70}{2}$ .

### Mode

The **mode** is the most commonly occurring score in the data set. Looking at the test score data from Table 2 (25, 50, 57, 63, **70**, **70**, 81, 92), the mode would be 70 as it is the only number that occurs more than once. The mode is the least used measure of central tendency; however, it can help researchers find a central point of the data when mean or median are not able to be calculated or are not representative.

## Measures of variability

**Measures of variability** are descriptive statistics that inform us about the spread of scores around a central point in a data set. When used alongside measures of central tendency, they can tell us a great deal about the features of the data set. The closer the scores of a data set are to the mean, the lower the variability of data. The more widely dispersed that scores are from the mean, the higher the variability. There are three measures of variability: range, variance and standard deviation.

### median

the middle number in a set of numbers that are listed in an ascending or descending order

### mode

the number that occurs most frequently in a data set

### measure of variability

summary statistic describing how spread out the data is in a data set

**Range** is the simplest measure of variability; it is calculated by subtracting the lowest value in a data set from the highest value in a data set. For example, if the lowest test score in a class is 25 and the highest score is 90, the range of the test scores would be 65 ( $90 - 25 = 65$ ). **Variance** is a measure of how spread out the data is from the mean. You will not be required to calculate variance in VCE Psychology.

One of the most useful measures of variability is **standard deviation**, which is a measure of how far, on average, scores in the data set differ from the mean. The higher the value of the standard deviation, the higher the variability of the data set or the more the data “deviates” from the mean. The lower the value of the standard deviation, the lower the variability of the data set and the less the data “deviates” from the mean.

## Normal distribution

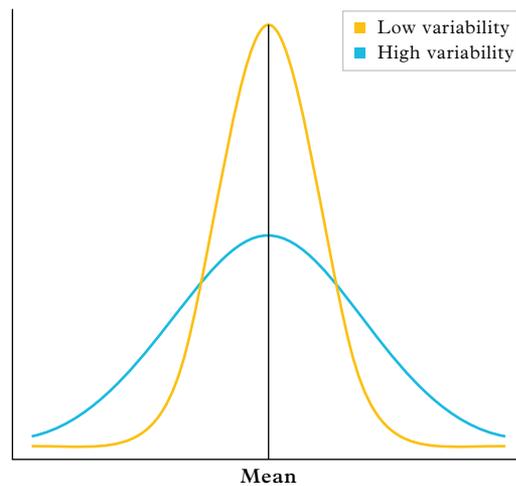
A **normal distribution** is a continuous probability distribution often used to model things that happen in the real world. The distribution of data looks like a bell-shaped curve, where most data falls near the centre and fewer data points are located away from the centre. A normal distribution is described by two parameters: the mean and the standard deviation. The mean represents the centre of the distribution curve and is also the point of highest frequency (the most number of times something occurs). The standard deviation measures the spread of the data around the mean. A normal distribution is a symmetrical shape, which means the frequency of data points to the left of the mean is equal to the frequency of data points to the right of the mean.

One of the most important properties of the normal distribution is that it is characterised by data falling into a consistent pattern. This is known as the 68–95–99.7 rule, which states that:

- approximately 68% of the data falls within one standard deviation of the mean
- approximately 95% of the data falls within two standard deviations of the mean
- approximately 99.7% of the data falls within three standard deviations of the mean.

The normal distribution is important in research because many real-world phenomena can be estimated by a normal distribution. This allows researchers to use models to make predictions and draw conclusions about data that follow this type of distribution.

High variability vs low variability



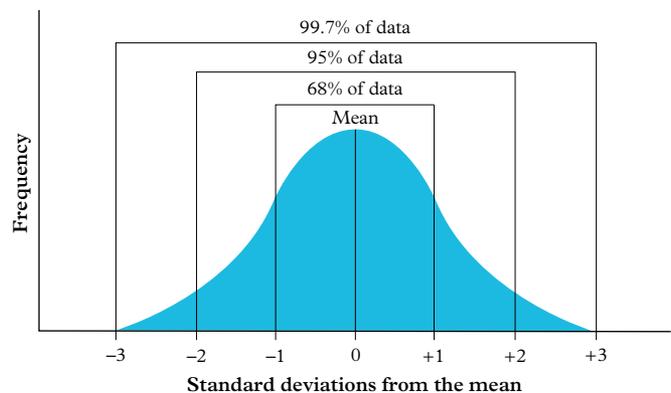
**FIGURE 7** A high-variability distribution versus a low-variability distribution

**range**  
the difference between the lowest and highest value in a data set

**variance**  
a measure of how spread out data is from the mean

**standard deviation**  
a measure that tells us how far, on average, scores are different from the mean

**normal distribution**  
a statistical distribution where data is symmetrically distributed around the mean



**FIGURE 8** A normal distribution curve

## 1.6 CHECK YOUR LEARNING



### Describe and explain

- Identify on which axis of a graph you would place:
  - the independent variable
  - the dependent variable.
- In your own words, define the term “range”.

### Apply, analyse and compare

- Consider the following data set, which includes the ages of people who go to a small rock-climbing gym: 20, 23, 23, 25, 25, 26, 29, 33, 35, 31, 29, 22, 27, 28
  - Identify the median and mode from the data.
  - Calculate the mean.
  - Calculate the percentage of gym members older than 30.
- Lossalia completes an online topic quiz just after learning about the brain in Psychology. She scores 8/10 on the quiz. Four weeks later when revising, she completes the same quiz and scores 3/10. Calculate the percentage change in Lossalia’s score.
- Compare the terms “positive correlation” and “negative correlation”.

### Design and discuss

- Consider the graph in Figure 9, which shows the distribution of data related to the average minutes spent on social media for three groups.

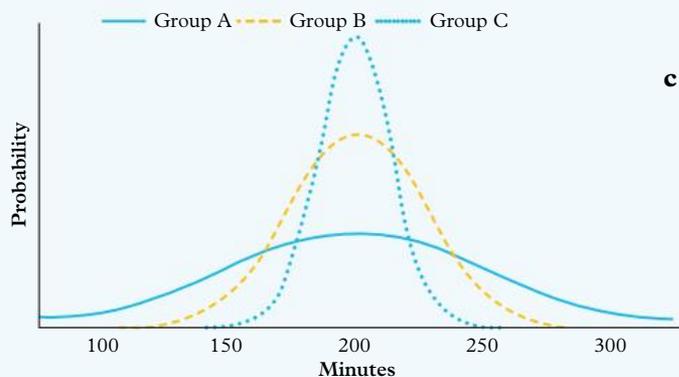


FIGURE 9 Distribution of average minutes spent on social media

- Identify which group has the highest standard deviation and justify your answer.
  - Identify which group has the lowest standard deviation and justify your answer.
- A researcher is investigating whether a relationship exists between meditation and stress levels. They conduct a pre-test survey on seven participants that asks participants to rate their general stress levels from 1 to 5 (where 1 = not stressed at all and 5 = extremely stressed). Following the meditation session, the researcher conducts a post-test survey. The results are shown in Table 3.

TABLE 3 Pre-meditation and post-meditation stress levels

Participant	Pre-test stress level	Post-test stress level
A	5	2
B	4	2
C	4	3
D	3	2
E	5	2
F	3	1
G	2	1

- Calculate the mean pre-test and post-test stress level of participants.
- Graph the data from the investigation in a format of your choosing. Justify your selection of graph format.
- Describe what your graph suggests about the relationship between the meditation and stress levels.

## 1.7

# Analysing and evaluating data and investigation methods

## KEY IDEAS

- ✦ Investigations that generate raw data must be valid, repeatable and reproducible.
- ✦ Errors and outliers must be included and accounted for in data evaluations.



## Analysing and evaluating data and measurements

Once data has been generated and processed, scientists must analyse and evaluate its quality and the investigation methods that were used to obtain it. This helps to ensure that any results or findings from the investigation can effectively address the research question. This topic will explain some of the key concepts that you should apply when analysing and evaluating data and investigation methods in VCE Psychology.

### True value

**true value**  
the value that accurately represents the measurement if the experiment ran perfectly

**True value** is the value or range of values you would expect to find if a quantity was measured perfectly without error. A true value cannot always be determined because the nature of some measurements and quantities can be hard to define or quantify. However, scientists can take steps to minimise the level of uncertainty around a value.

Imagine a researcher who is interested in measuring the reaction time of participants in response to a stimulus. The true value of reaction time would be the time it takes for a participant to react to the stimulus, measured perfectly without any error. However, due to various factors, such as measurement error, individual differences and extraneous variables, the researcher cannot obtain a true value with certainty. Instead, the researcher can obtain an estimate of the true value by using reliable and valid measurement tools, controlling for extraneous variables, and collecting data from a large and diverse sample. These actions make it more likely that the obtained value reflects the true value as closely as possible.

### Accuracy and precision

**accuracy**  
how close experimental data is to the true value

**precision**  
how close a set of data values are to each other



▶ ClickView  
Accuracy



▶ ClickView  
Precision

**Accuracy** describes how close a measurement is to its true value. Measurements can be described as “more accurate” or “less accurate” when compared to their true or expected value. Alternatively, **precision** is a measure of how close the values in a data set are to each other. If the values in a data set are all close (or the same), they can be described as precise. Precision does not indicate how close measurements are to the true value and should not be confused with accuracy.



**FIGURE 1** Data that is both accurate and precise falls close together and close to the true value (the target).

Consider the image of the dartboards in Figure 2. If the true value or “target” is the bullseye (centre of the dartboard), then the closer a dart lands to the bullseye, the higher the accuracy. The closer that all darts thrown are to each other, the higher the precision. It is crucial that data is both accurate and precise in scientific research because inaccurate or imprecise data can lead to incorrect conclusions and misleading interpretations. Inaccurate data may introduce bias or systematic errors, while imprecise data may introduce random errors.

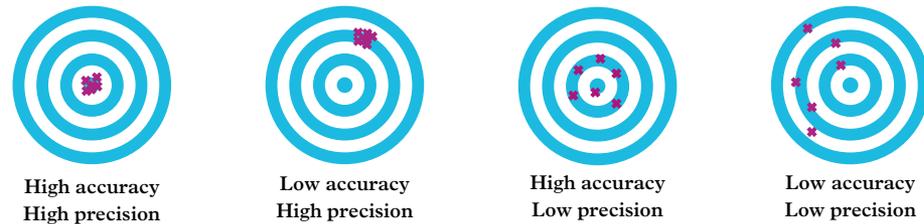


FIGURE 2 Accuracy and precision are different concepts.

**repeatability**

the degree to which an experiment can produce the same results when repeated under the same conditions

**robust**

the degree to which a result is consistent across different studies, methods and/or samples

**reproducibility**

the degree to which results can be independently confirmed by other researchers using different methods, techniques or instruments than the original conditions of the experiment

**validity**

a measure of whether the investigation is sound

**internal validity**

the extent to which the investigation results truly measured what was intended to be measured

**external validity**

the extent to which the investigation results are applicable to other settings outside of the experiment

## Repeatability

**Repeatability** refers to the ability to obtain the same data values again under the same experimental and laboratory conditions by the same observer. To determine repeatability, the same experiment should be conducted at least three times. Repeatability can be used to assess the precision and quality of measurement results and to ensure that findings are **robust**.

## Reproducibility

**Reproducibility** refers to the ability to obtain the same data values again under slightly different experimental conditions, such as with a different measuring instrument, in a different laboratory, or with different experimenters. Reproducibility requires clear experimental methods and well-defined variables. Reproducibility is closely linked to the accuracy of an experiment and can also be used to evaluate the precision and quality of measurement results.

## Validity

The **validity** of a measurement is how well it measures what it is supposed to be measuring. The validity of a psychological investigation refers to how well the results among participants represent true findings among similar individuals outside of a study. To assess the validity of an investigation we usually consider two types of validity: internal and external.

**Internal validity** assesses whether the investigation truly measured what it was designed to measure, accounting for factors such as the appropriateness of the investigation design, the sampling and allocation techniques used, and the potential impact of confounding and extraneous variables. A lack of internal validity suggests that the results may not accurately reflect the truth, and conclusions cannot be drawn from those results.

**External validity** assesses whether the results of the investigation can be applied to similar individuals in a different setting. A lack of external validity suggests that the results may not apply to individuals from a different population than the one studied. External validity can be increased by using broad inclusion criteria and sampling techniques that result in a study population representative of the overall general human population.

# Analysing and evaluating errors, uncertainty and outliers

Although we may aim to produce data that is close to the true value when researching, this is not always possible due to errors and other factors including uncertainty and outliers.

## Errors

An **error** is the difference between the measured value and the true value of what is being measured. Table 1 outlines different kinds of errors that can occur during investigations and affect the integrity of results.

### error

the difference between the measured value and the true value

### random error

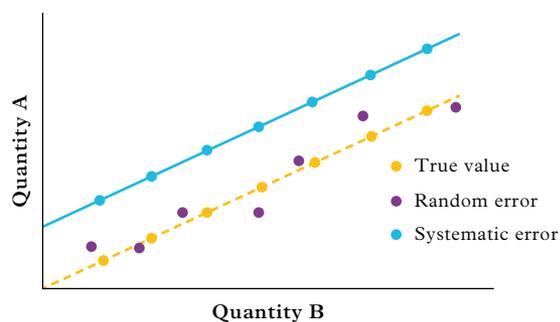
an error that affects the precision of the data set due to an unknown and unpredictable error in the experimental process

**TABLE 1** Types of errors and their possible causes

Type of error	Definition and example	Possible causes	Can be reduced by
<b>Random errors</b>	Unpredictable variations in the measurement process that affect the <b>precision</b> of results. For example, a participant drops their pencil on the ground during a memory test, which distracts them and impacts their recall ability.	<ul style="list-style-type: none"> <li>• Limitations of instruments</li> <li>• Environmental factors</li> <li>• Slight variations in procedures</li> </ul>	<ul style="list-style-type: none"> <li>• Conducting multiple trials</li> <li>• Taking repeated measurements and calculating a new mean</li> <li>• Increasing sample size</li> <li>• Refining measurement method or technique</li> </ul>
<b>Systematic errors</b>	Errors that cause readings of a measurement to differ from the true value by a consistent amount or proportion each time, thus affecting the <b>accuracy</b> of results. For example, if a researcher used a weighing scale that was off calibration by 0.5 grams.	<ul style="list-style-type: none"> <li>• Observation error</li> <li>• Imperfect instrument calibration</li> <li>• Environmental interference</li> </ul>	<ul style="list-style-type: none"> <li>• Becoming familiar with the limitations of instruments and experienced with their correct use</li> </ul>
<b>Personal errors</b>	Mistakes, miscalculations and biases introduced by the observer or researcher. For example, if a student miscalculates the average.	<ul style="list-style-type: none"> <li>• Confirmation bias</li> <li>• Rushing through experiments</li> <li>• Observer bias</li> <li>• Misconduct</li> <li>• Unstructured investigation designs</li> </ul>	<ul style="list-style-type: none"> <li>• Using rigorous investigation designs</li> <li>• Carefully following instructions</li> <li>• Double checking calculations</li> <li>• Developing standards of conduct</li> <li>• Having peers review work or interpretations</li> </ul>

## Uncertainty

**Uncertainty** occurs when you are unsure of the exact value of the quantity you are measuring. In psychology, many of the variables of interest are psychological constructs, which are abstract concepts that cannot be directly observed or measured (for example, emotions, attitudes and personality traits). As psychological constructs are inherently subjective and can vary from person to person, there is often a degree of uncertainty surrounding their measurement.



**FIGURE 3** Representation of how random error and systematic error affect results. Random error affects the precision of results and systematic error affects the accuracy of results in a consistent way.

### systematic error

an error that affects the accuracy of the data by causing the reading to differ from the true value

### personal error

mistakes, miscalculations and observer errors that occur when conducting research

### uncertainty

the degree to which the result of a measurement does not reflect the exact value of what is being measured

**contradictory data**

incorrect data

**incomplete data**

data that is missing or unfinished in some way due to errors in data collection, processing or limitations in the data itself

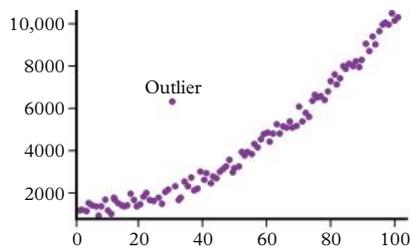
**outlier**

value that lies outside the expected data set

In VCE Psychology, uncertainty is treated qualitatively (without calculations). This means that when you are evaluating data to check whether it is uncertain, you should look out for **contradictory data** (incorrect data) or **incomplete data** (missing responses or observations). Qualitative evaluation of uncertainty in research may involve looking at patterns in the data, considering alternative explanations for the results, and considering contextual factors that may influence the interpretation of the data. For example, a study participant's emotional state on the day of testing could be part of a qualitative evaluation of uncertainty.

## Outliers

**Outliers** are data points or observations that lie a long way from, or are significantly different to, other points in the data set. Outliers can occur for many reasons, including measurement errors, data entry errors, a skewed distribution, or data points from a different underlying distribution. A small number of outliers is expected when there is a larger sample. It is important to explain outliers when analysing data in the discussion of a scientific report, because they can have a significant impact on the results and conclusions of a study.



**FIGURE 4** An outlier is a data point or observation that is significantly different to other points in the data set.

Plotting outliers on a graph can be a useful way to visualise their impact on the data and assess their significance. Outliers can also be excluded from the calculation of a line of best fit if they are believed to be non-representative of the underlying data. Repeating measurements is another useful way to examine outliers and assess the validity of the data. If a measurement is found to be an outlier on multiple occasions, it may be an indication of a genuine phenomenon that requires further investigation. In VCE Psychology you must be able to recognise when outliers are present in visual data and reflect on how an outlier could affect the data.

### 1.7 CHECK YOUR LEARNING



**Describe and explain**

- 1 Which types of errors would affect the accuracy of data collected in a scientific investigation?
- 2 Explain why implementing multiple trials in scientific investigations improves the reliability of data obtained.

**Apply, analyse and compare**

- 3 Compare the following sets of terms:
  - a accuracy and precision

- b repeatability and reproducibility
- c random error and personal error.

**Design and discuss**

- 4 Design a revision summary tool to help you remember how to determine whether an investigation is internally or externally valid. Include steps you can take to improve the external and internal validity of an investigation.

# 1.8

## Constructing evidence-based arguments and conclusions

### KEY IDEAS

- ✦ Analysis of raw data generated in a scientific investigation is important for constructing evidence-based arguments and conclusions.
- ✦ Sentence structure and paragraph structure are important when constructing evidence-based arguments and conclusions.



#### evidence

data, observations or facts obtained from valid research

#### anecdote

a personal account or story that is often used to illustrate a point or make an argument

#### opinion

a personal view or belief about a particular topic or issue

#### scientific idea

idea or theory based on empirical evidence that has been rigorously tested through observation or scientific investigation; supported by the scientific method

#### non-scientific idea

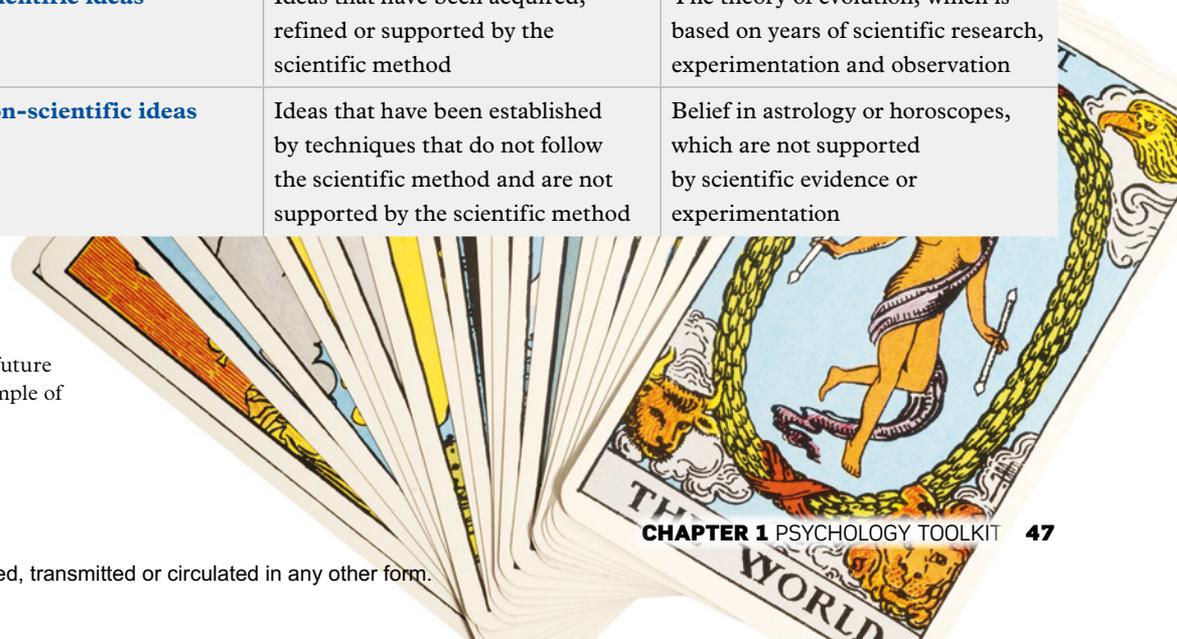
idea or theory that is not based on empirical evidence and has not been rigorously tested or supported through observation or scientific investigation; not supported by the scientific method

Constructing evidence-based arguments and conclusions is an important key science skill required for VCE Psychology. It is primarily used in the analysis, discussion and conclusion sections of a scientific investigation report. The type of information and ideas you source and use to help build your arguments and draw conclusions can vary. In VCE Psychology, it is important that you can tell the difference between opinion, anecdote, evidence, scientific and non-scientific ideas. Table 1 summarises different sources of information and idea types with examples.

TABLE 1 Summary of different sources of information and ideas

Term	Definition	Example
<b>Evidence</b>	Information or data on a topic that has been systematically collected; this information can help form conclusions	Data on the effects of exercise on mental health collected from participants using a standardised questionnaire
<b>Anecdote</b>	A personal observation collected in a casual non-systematic manner, used to support a view or judgment; this information is often biased	"My friend tried that diet and it didn't work for her, so I don't think it's worth trying."
<b>Opinion</b>	A person's or organisation's judgments or views about a topic; opinions may not always be based on evidence, experience or fact	"I think that social media is harmful to young people's mental health."
<b>Scientific ideas</b>	Ideas that have been acquired, refined or supported by the scientific method	The theory of evolution, which is based on years of scientific research, experimentation and observation
<b>Non-scientific ideas</b>	Ideas that have been established by techniques that do not follow the scientific method and are not supported by the scientific method	Belief in astrology or horoscopes, which are not supported by scientific evidence or experimentation

FIGURE 1 Predicting the future using tarot cards is an example of a non-scientific idea.



## How to construct evidence-based arguments and conclusions

Some broad questions that may be answered when constructing evidence-based arguments are:

- What is the origin or who was responsible for the experimental results, findings, evidence or raw data collected?
- Are the experimental results, findings, evidence or raw data accurate, precise, repeatable, reproducible and/or valid?
- What kinds of errors, inconsistencies and outliers may have affected the experimental results, findings, evidence or raw data collected?
- What kinds of background information (such as psychological concepts, scientific understandings or other researched information sources) were used to link or connect the experimental results, findings, evidence or raw data to the investigation question and to the aim?
- What series of steps or procedures could be used to improve the experimental design or methodology for future trials of this scientific investigation?

### Evaluating evidence

Any data or evidence you have produced or sourced to help answer your investigation question needs to be evaluated before you can use it to form an argument. When evaluating data or evidence you should consider whether the evidence supports the aim of the investigation.

Evidence that supports the aim of an investigation is any information, data or observations that help to answer the research question or hypothesis being investigated. This evidence is directly useful to support the goal of the investigation. For example, if the aim was to “investigate the effects of sleep duration on academic performance in high school students”, evidence that supports this aim would be data on academic performance in response to different sleep times or conditions. This could include results from trials, questionnaires or case studies.

If evidence does not support the investigation aim or could be improved, you should offer recommendations or modifications that could improve or extend the investigation.

### Constructing an argument

Argument structure usually follows a pattern, the length of which is determined by the number of arguments addressed. One argument usually corresponds to one paragraph.

**Introduction (what is your argument/point of view?):**

- Position statement (what is your hypothesis or summary of the scientific investigation?)
- List the arguments that you will make.

**Explain your supporting arguments:**

- Supporting argument 1:
  - Point – identified in topic sentence
  - Explanation – support with evidence, scientific finding, result or data



**FIGURE 2** How would a lack of sleep affect a high school student’s academic performance?

- Supporting argument 2:
  - Point – identified in topic sentence
  - Explanation – support with evidence, scientific finding, result or data
- Supporting argument 3:
  - Point – identified in topic sentence
  - Explanation – support with evidence, scientific finding, result or data

**Reinforce your main point – “To sum up ...”**

## Language features

When writing an argument, use the following language features to enhance your writing:

- connectives to show cause and effect; for example, “As an outcome of ...”, “As a result of ...”, “because ...”, “consequently ...”
- scientific terminology and/or supporting figures
- supporting facts and/or quotes from experts or other researched external sources of information; for example, “A study conducted by XX found that ...”
- making evaluative statements; for example, “The data shows a clear trend ...”, “Evidence contradicts the argument that ...”
- formal language and avoiding personal language (such as I, you, he, she, we, they, me, him, her, us and them); for example, “the hypothesis was supported”, not “I proved my hypothesis”.

## Drawing conclusions

Once you have evaluated your evidence and used this to construct your arguments, you can then start to form an evidence-based conclusion. A **conclusion** is a statement or a few statements that summarise the findings of an investigation in response to the investigation hypothesis. Psychologists never say that a hypothesis has been “proven” or “disproven”. After all, there may be another hypothesis that explains the relationship even more accurately than the one that was tested. Instead, the conclusion assesses whether the findings either **support** or **refute** the hypothesis.

If the results or investigation methods had low validity or did not address the research aim, then you should not draw a conclusion. Most conclusions from an investigation only apply to the population of that specific study. Conclusions can only be drawn for wider populations if the investigation is externally valid.

## Limitations

**Limitations** refer to factors or constraints that can potentially affect the reliability or validity of research. Limitations are generally related to the study design or the external environment in which the study is conducted (for example, methods used, limited funding, time constraints, sampling constraints or ethical considerations) and are often outside the control of the researcher. Limitations are not the same as extraneous or confounding variables; they may instead result in extraneous or confounding variables existing within a study. For example, in a study examining the relationship between exercise and mood, a limitation could be inability to control for participants’ dietary habits, which could introduce an extraneous variable that affects their mood independently of exercise. If any limitations in the research are identified, then recommendations should be made to negate the limitation in future. This might include suggesting improvements to the method or way the research was conducted or identifying if further research needs to be conducted.

### Study tip

Remember, a hypothesis cannot be “proved”; rather, findings are assessed on whether they support (agree with) or refute (do not agree with) the hypothesis.

### conclusion

a summary of the findings and results obtained from the study or investigation

### support

agrees with (in relation to the hypothesis)

### refute

contradicts or does not support (in relation to the hypothesis)

### limitation

factor or condition that may affect the accuracy or validity of results

## Implications

### implication

potential consequence or effect of scientific results or conclusions

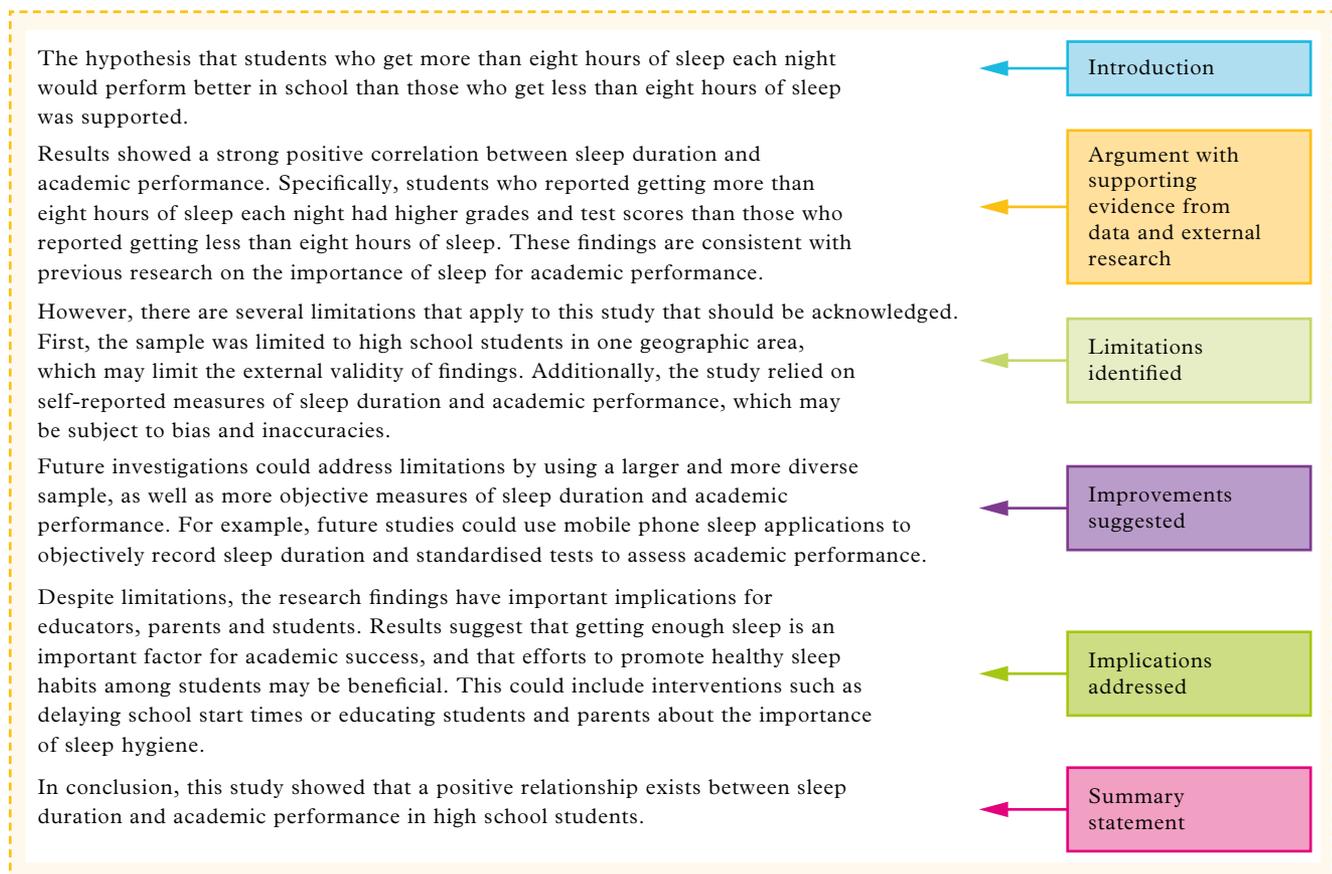
**Implications** are the potential impacts that research results may have on a population, field of study, related fields or on society. For example, if results showed that students who reported getting more than eight hours of sleep each night had higher grades and test scores than those who reported getting less than eight hours of sleep, then implications of this research may include:

- the need for schools to promote healthy sleep habits among students
- government interventions (for example, delaying school start times, including sleep education as part of health curriculums)
- the need for more research to determine the cognitive impacts sleep deprivation may have on adolescents.

When discussing the implications of an investigation, it is important to consider how appropriate and applicable findings are to different cultural groups and to assess whether any cultural bias might exist within the research. For example, the implications of research conducted on Australian students might differ for Finnish or Japanese student populations due to cultural differences and norms. **Generalisability** is the degree to which findings of research can be applied to other situations. In VCE Psychology you should consider generalisability where evaluating the appropriateness and application of data to different cultural groups and when reviewing the external validity of research.

### generalisability

the extent to which findings of research can be applied to other situations or populations



**FIGURE 3** Example of using evidence to structure arguments and form a conclusion

## 1.8 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain why it is important to construct and understand evidence-based arguments and conclusions in science.
- 2 Identify three things you should (or should not) do when writing an evidence-based argument.

### Apply, analyse and compare

- 3 Distinguish between a limitation and an implication.
- 4 Classify the following examples as one of evidence, anecdote, opinion, scientific ideas or non-scientific ideas:
  - a Results of a study that used a large sample of participants and systematic data collection that show how smoking increases the risk of lung cancer
  - b A person's belief that vaccinations are harmful and should not be given to children
  - c The belief that certain gemstones have healing powers
  - d Charles Darwin's theory of evolution

- e A story shared by a friend about how their aunt who only ate junk food lived until 95 years old without any health problems.

### Design and discuss

- 5 A study was conducted to investigate the relationship between caffeine consumption and anxiety levels. Researchers recruited 200 participants and asked them to report their average daily caffeine intake and anxiety levels over the past week. Results found a significant positive correlation between caffeine consumption and anxiety levels.
  - a If the original hypothesis was that “the greater the amount of caffeine consumed, the higher the level of anxiety experienced”, do results support or refute the hypothesis? Justify your response.
  - b Discuss two potential limitations of this study and provide recommendations to improve the study in future based on the limitations you have discussed.
  - c Identify two potential implications of the study.

**FIGURE 4** Research suggesting that one in six Australians aged 14–17 years has tried vaping has had implications for Australian anti-vaping reforms.



## 1.9

# Analysing and evaluating scientific ideas

## KEY IDEAS

- ✦ Ideas, concepts, models and theories are different forms of scientific information.
- ✦ Sources of scientific information such as journal articles, mass media communications, opinions, policy documents and reports in the public domain have strengths and limitations and can vary in levels of credibility.
- ✦ Psychological issues can be influenced by social, economic, political and legal factors.



## Types and sources of scientific information

Scientific information is not only found in your science subjects at school. It is found across everyday life in journalism, advertising, government policy and online (such as on websites, blogs, videos and social media). In VCE Psychology, you must be able to analyse and evaluate scientific information. To do this, you need to be familiar with different types and sources of information about psychology.

### Types of scientific information

In VCE Psychology, you will need to be able to discuss different types of scientific information and draw links between many ideas. Table 1 outlines the differences between ideas, concepts, models and theories.

**TABLE 1** Summary of different types of scientific information

Type of information	Definition	Example
<b>Idea</b>	A mental representation of a thought or concept, often without a specific structure or framework. An idea is typically an initial thought that has yet to be fully formed or developed.	A psychologist may have an idea that a certain type of therapy may be effective for treating depression.
<b>Concept</b>	A mental construct that organises linked ideas and observations into a clear framework. It is a more structured way of thinking about a particular subject or phenomenon. Concepts can be used to define, categorise and explain various aspects of the world around us.	The concept of self-esteem refers to a person's overall evaluation of themselves and their worthiness as an individual.
<b>Model</b>	A simplified representation or summary of a complex system or phenomenon that is used to help explain or predict behaviour	The Information Processing Model is a cognitive model used to describe how people perceive, process and store information.
<b>Theory</b>	A well-substantiated explanation of a phenomenon that has been developed through scientific observation, experimentation and reasoning. It is typically supported by a large body of evidence and can be used to make predictions about future observations or experiments.	The theory of social learning, as developed by Albert Bandura, provides a well-substantiated explanation for how individuals learn new behaviours through observation and imitation of others. It has been extensively studied and supported by empirical (experimental) evidence.

#### idea

a mental construct representing a vague thought or notion that lacks a specific structure or framework

#### concept

a mental representation that organises ideas and observations into a clear structure or framework

#### model

a simplified version of a complex system that helps inform, make predictions, or provide explanations about different phenomena

#### theory

a well-supported reason or descriptive account of a phenomenon that has been established through rigorous scientific investigation

## Sources of scientific information

Scientific information can come from many different sources. Understanding the strengths and weaknesses of different sources of scientific information can help you evaluate the credibility of scientific information, assess claims, make informed decisions and communicate effectively. Table 2 outlines common sources of scientific information and their strengths and weaknesses.



**FIGURE 1** Mass media communications can reach a large audience.

**TABLE 2** A summary of different sources of scientific information

Source of information	Description	Example	Strengths	Weaknesses
Journal articles	Scholarly papers published in academic journals that present original research findings, theories, or reviews	A paper published in the journal <i>Psychiatry Research</i> that provides an overview of the mental health of Australians during the COVID-19 pandemic	<ul style="list-style-type: none"> <li>Provides detailed information about research methods, result, and conclusions.</li> <li>Undergoes peer review by experts in the field.</li> </ul>	<ul style="list-style-type: none"> <li>Can be highly technical and difficult for non-experts to understand.</li> <li>Can take a long time to publish.</li> <li>May not be accessible to the public.</li> </ul>
Mass media communications	News articles or broadcasts that present information to a wide audience	A news segment on the ABC about a study on the impact of bushfires on the mental health of Australians	<ul style="list-style-type: none"> <li>Reaches a large audience.</li> <li>Can raise awareness about scientific issues.</li> </ul>	<ul style="list-style-type: none"> <li>May oversimplify complex scientific concepts or exaggerate findings for dramatic effect.</li> <li>May not provide sufficient context or detail.</li> </ul>
Opinions	Personal views or beliefs on topics	A blog post by a mental health advocate discussing the importance of early intervention for children with anxiety	<ul style="list-style-type: none"> <li>Can provide different perspectives on scientific issues.</li> <li>Can be accessible to the public.</li> </ul>	<ul style="list-style-type: none"> <li>May not be based on evidence or scientific consensus.</li> <li>Can be biased or influenced by personal beliefs or interests.</li> </ul>
Policy documents	Documents created by governments or organisations that outline plans or guidelines related to an issue	The Australian Psychological Society's Code of Ethics	<ul style="list-style-type: none"> <li>Can influence public policy and decision-making.</li> <li>Can provide a framework for addressing scientific issues.</li> </ul>	<ul style="list-style-type: none"> <li>May not be based on the most up-to-date scientific research.</li> <li>Can be influenced by political or economic interests.</li> </ul>
Reports in the public domain	Documents created by researchers or organisations that are publicly available and provide information about issues	Suicide Prevention Australia's annual report	<ul style="list-style-type: none"> <li>Can provide accessible information about scientific issues to the public.</li> <li>Can highlight areas for further research or action.</li> </ul>	<ul style="list-style-type: none"> <li>May not undergo the same level of scrutiny as peer-reviewed journal articles.</li> <li>May be biased or influenced by the interests of the organisation that produced them.</li> </ul>

## Factors influencing psychological issues

In addition to the ethical concepts and guidelines outlined in Topic 1.4, there are several additional factors that may influence information on psychology, including social, economic, legal and political factors. Understanding how these factors influence psychological research and issues is important for developing effective research strategies and interventions. Table 3 summarises how social, economic, legal and political factors can influence psychological research or issues.

**TABLE 3** Summary of factors that can influence psychological issues and research

Factor	Description	Example
Social	Refers to the ways in which society and culture shape psychological research and issues.	A study on the impact of social media use on mental health may be influenced by differences in social norms around technology use, as well as cultural values regarding privacy and self-disclosure.
Economic	Refers to the financial resources available for psychological research and issues, as well as the economic factors that influence them.	Access to medication may be influenced by its cost.
Legal	Refers to the laws and regulations that impact psychological research and issues, including ethical guidelines and regulations regarding data collection and privacy.	Researchers conducting a study on sensitive psychological topics, such as trauma or addiction, may be subject to data and privacy laws.
Political	Refers to the influence of politics and government on psychological research and issues, including policies related to mental health care and funding for research.	Mental health policies and the allocation of funding for research may be influenced by political factors, such as the priorities of the current government or the influence of interest groups.



**FIGURE 2** The financial resources available for psychological research and issues are economic factors.

## 1.9 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify two benefits of being able to understand the strengths and weaknesses of different sources of psychological information.
- 2 Explain one strength and one weakness for each of the following sources of information:
  - a journal articles
  - b policy documents
  - c mass media communications.

### Apply, analyse and compare

- 3 Distinguish between a model and a theory.

### Design and discuss

- 4 Pierre is conducting a study on how the media's coverage of bushfires affects the mental health of Australians. Discuss how two factors (social, economic, legal or political) could affect his research.
- 5 Tory is the host of a popular podcast that discusses pop culture and daily life. In one episode, Tory shares

her experience of being diagnosed with attention deficit hyperactivity disorder as an adult and how symptoms have presented in her life. Following the episode, many listeners wrote in to say the episode was eye-opening and helped them recognise symptoms in themselves.

- a Identify the type of information Tory is providing. Justify your answer.
- b Identify what source of information Tory's podcast is. Justify your answer.
- c Discuss the positive and negative impacts that this information could have on listeners.
- d The money from her podcast has allowed Tory to access and pay for top-quality psychologists and expensive medications. Explain how economic factors could influence some of Tory's lower-socioeconomic listeners' access to psychological assessment and costly medications.

# 1.10

## Communicating scientific ideas

### KEY IDEAS

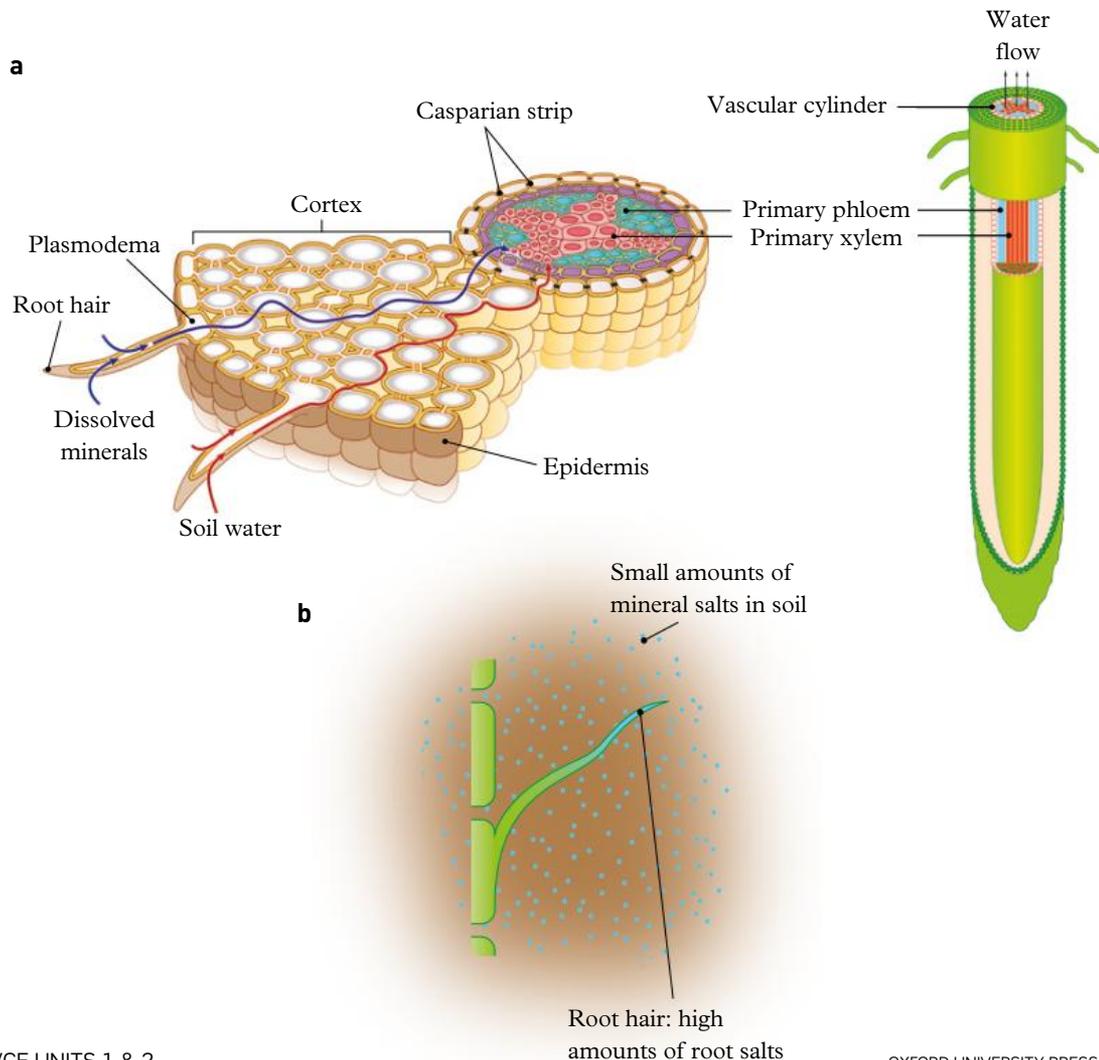
- ✦ Effective science communication depends on knowing your audience and prioritising important information.



### Communicating scientifically

Science can often be difficult to understand, especially for those outside the scientific community. Effective science communication can help bridge this gap by translating scientific findings and concepts into language that a variety of audiences can understand. Some actions you can take to improve the effectiveness of your scientific communication include:

- **Identifying and understanding your target audience.** Presenting work for teachers or external examiners will be different from presenting to your peers. You want to ensure the language and methods you use to communicate ideas are appropriate for your audience and encourage them to engage. Consider the two diagrams in Figure 1. They are focused on the same concept, but the style, details and labels included are specific to two different audiences.



**FIGURE 1** Two diagrams both showing how plant root hairs take in water; **a** is appropriate for a VCE Biology class, while **b** is appropriate for a Year 8 science class.

- **Using language that is appropriate for your target audience.** If you are speaking to the public, then limit the use of **jargon** wherever possible. If you need to incorporate acronyms, make sure in your visual presentation that the full words are written in brackets next to the abbreviation on one occasion.
- **Being concise and only including essential content.** Your communication should contain essential facts that enhance your target audience’s understanding of the science involved.
- **Using appropriate stylistic elements relevant to your target audience.** This might include (but is not limited to) the use of a specific presentation format (poster, report, infographic or digital media platform), diagrams, photographs, graphs, tables or other text elements (such as similes, metaphors or analogies). They should convey clear content and messages, appeal to your audience and enhance the information so that the science is simple, easily understood and relatable without too much information or confusion.
- **Using appropriate psychological terminology and conventions.** This might include (but is not limited to) the use of coherent, concise, objective and formal use of scientific language; the consistent use of tense and/or active or passive voice; definition of key psychological terms and accurate scientific representations (such as diagrams, flowcharts or graphs) and a bibliography or reference list for citation of text and/or diagrams that are not of your own creation. You can learn more about referencing correctly in Chapter 6, Topic 6.3.

**jargon**  
specific terminology or language relevant to a field of study that might be difficult for others to understand

### Study tip

Spell check on your digital device is not always 100 per cent reliable. Read, re-read or ask another person to review your work before final submission(s) so that the points of effective science communication have been covered.

## Formats for communication

Science is not all about practical reports. There are many ways to communicate scientific concepts that you might like to try in VCE Psychology. For example, you could present information as:

- an oral presentation
- a report
- an infographic
- a video or animation
- a multimodal presentation
- a scientific poster.

### Scientific poster

In VCE Psychology, you will produce a scientific poster as part of a major piece of assessment in Units 3 and 4. For this reason, some teachers will have you practise this skill in Units 1 and 2.

The poster may be produced electronically or in hard copy and should not exceed 600 words, to meet criteria of conciseness, clarity and legibility. Note that tables, graphs and references and/or acknowledgments are not included in the word count.

Table 1 shows the required scientific poster format as specified by the VCE Psychology Study Design. The centre of the poster should take up 20–25 per cent of the poster space and contain a one-sentence summary of the major finding or outcome of the investigation that answers the investigation question.

**TABLE 1** The format for the scientific poster

Title Student name		
Introduction	Communication statement reporting the key finding of the investigation as a one-sentence summary	Discussion
Methodology and methods		Conclusion
Results		
References and acknowledgments		

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

## 1.10 CHECK YOUR LEARNING



### Describe and explain

- 1 Define the term “jargon” and explain why it is important to minimise the use of jargon when presenting ideas to the public.
- 2 Rewrite each of the following statements to express the same idea to an audience of eight-year-old children.
  - a “It is important to include all sources of information used in a reference list at the end of an assessment to ensure you are correctly acknowledging the work of others.”
  - b “When communicating scientific concepts, it is better to be concise than to include irrelevant or unnecessary information.”

### Apply, analyse and compare

- 3 Compare the elements of science communication used in a TikTok video against a media article of your choice. In what ways are they similar and different?

### Design and discuss

- 4 Ezra is writing a report that examines the effects of sleep deprivation on academic performance at school.

Ezra wants to include the following features and points in their report:

- an explanation of sleep deprivation and the effects of sleep deprivation
  - an explanation of how academic results are collated in VCE
  - summarised findings of published studies that have examined or tested how sleep deprivation impacts performance on cognitive and academic tasks
  - a graph based on the results of a study that shows a correlation between lack of sleep and poor academic performance
  - the average VCE study scores in their school
  - a conclusion that summarises what Ezra has learnt about the effects of sleep deprivation on academic performance.
- a Discuss which of the listed features Ezra should focus on, including the features they should not include within their report. Justify your reasoning.
  - b Suggest any features, points or advice Ezra could use or include in their report to enhance how well it is communicated.



**FIGURE 2** When creating a scientific poster remember to use colour to engage your audience!

# 1.11

## Aboriginal and Torres Strait Islander knowledges, cultures and histories

### KEY IDEAS



- ✦ Aboriginal and Torres Strait Islander peoples – the traditional owners of Australia – hold Indigenous knowledges developed by their ancestors and passed down through generations. These knowledges are broad in topics and have facilitated the continuing survival of Aboriginal and Torres Strait Islander cultures to make them 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 Aboriginal and Torres Strait Islander knowledges, cultures and histories in VCE Psychology.

### Aboriginal and Torres Strait Islander peoples

past and current descendants of the original inhabitants and custodians of the land we know today as Australia

### Indigenous knowledge system

Aboriginal and Torres Strait Islander traditional system of knowledge, that include understandings, practices, skills, spirituality and innovations

### Country

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

### Place

a space confined by physical or intangible boundaries occupied and regarded as belonging to individuals or groups of Torres Strait Islander peoples; spaces have varying spiritual meaning to different peoples

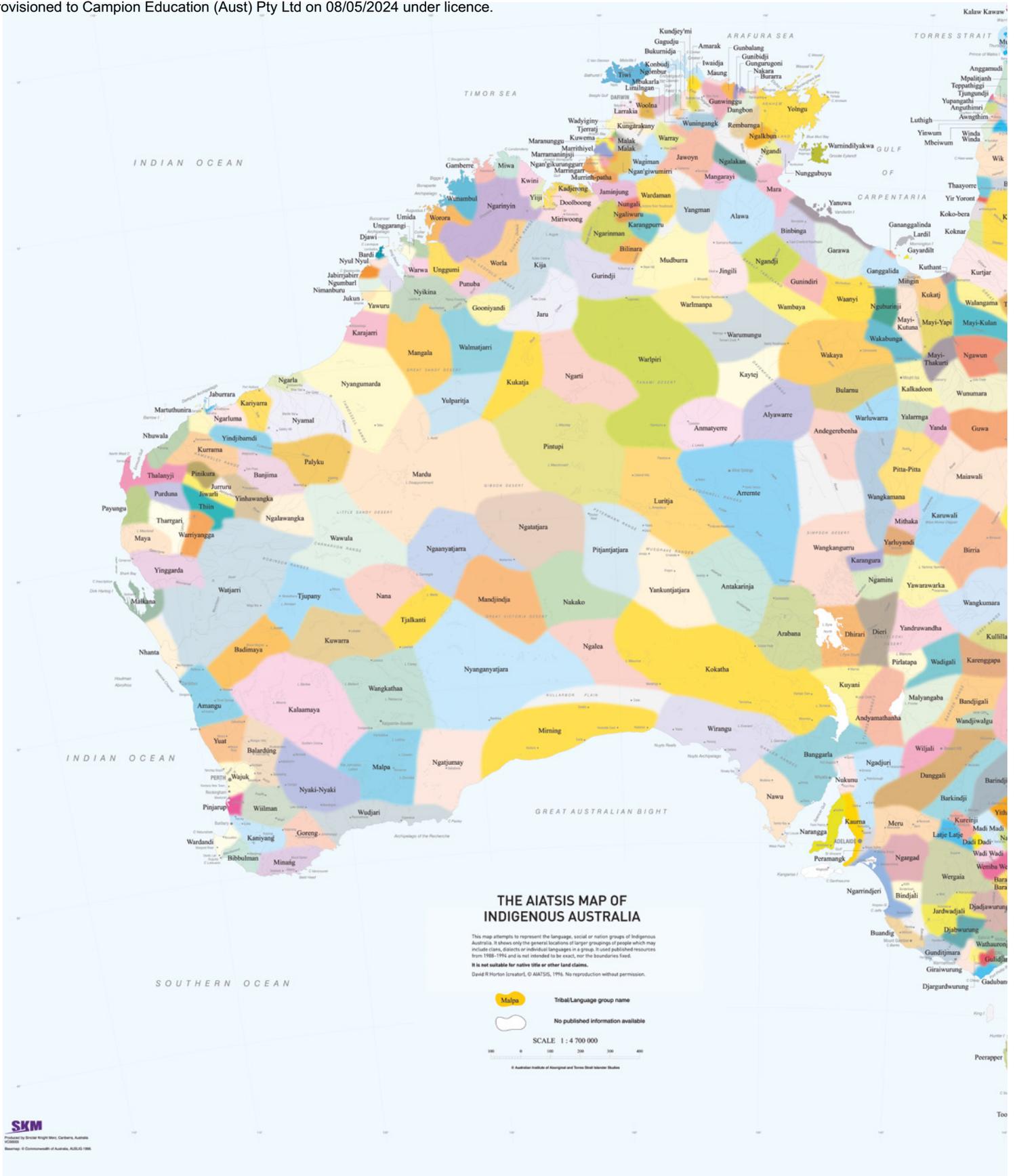
**Aboriginal and Torres Strait Islander peoples** are the first peoples and traditional owners of Australia. For more than 65,000 years, Aboriginal and Torres Strait Islander peoples have developed, and continue to refine, understandings of the world through a variety of different practices. Aboriginal and Torres Strait Islander ways of knowing, being and doing are complex and promote sustainable lifestyles that foster peaceful relationships between cultural groups, kinship, land, waterways, skies, plants, animals and ancestry. These **Indigenous knowledge systems** allow Aboriginal and Torres Strait Islander peoples to thrive.

Aboriginal and Torres Strait Islander peoples are not a homogeneous group; there are approximately 250 different language groups within Australia including 800 dialects (Figure 1). Throughout VCE Psychology, you will have the opportunity to learn about some Aboriginal and Torres Strait Islander knowledges, cultures, histories and experiences.

In Unit 2 Area of Study 1, your class may explore the impact of stereotypes, prejudice, discrimination and stigma on Aboriginal and Torres Strait Islander peoples. In Unit 2 Area of Study 2, you may also consider Aboriginal and Torres Strait Islander experiences of sensory connection to **Country** and/or **Place**, ancestors and spirituality. As you learn about Aboriginal and Torres Strait Islander knowledges, cultures and histories it is important that you:

- recognise the significance of how Aboriginal and Torres Strait Islander knowledges, cultures and histories, along with Indigenous psychology, have contributed to the overall field of psychology
- consider and understand the unique history and cultural diversity of Aboriginal and Torres Strait Islander peoples and diverse ways of being, knowing, thinking and doing
- recognise that what is experienced, observed or felt by one Nation, Mob or individual can differ greatly to what is experienced, observed or felt by another.

In this topic we will explore some practices and considerations you can apply to help you best engage with Aboriginal and Torres Strait Islander knowledges, cultures and histories in VCE Psychology. Please note that the content in this topic has been written by a non-Indigenous individual in consultation with First Nations peoples from the Australian Psychology community and may not represent the views and perspectives of all Aboriginal and Torres Strait Islander peoples.



**FIGURE 1** The Australian Institute of Aboriginal and Torres Strait Islander Studies map of Indigenous Australia

This map attempts to represent the language, social or nation groups of Aboriginal Australia. It shows only the general locations of larger groupings of people which may include clans, dialects or individual languages in a group. It used published resources from the eighteenth century-1994 and is not intended to be exact, nor the boundaries fixed. It is not suitable for native title or other land claims. David R Horton (creator), © AIATSIS, 1996. No reproduction without permission. To purchase a print version visit: <https://shop.aiatsis.gov.au/>



## Engaging with Aboriginal and Torres Strait Islander knowledges

Engagement with Aboriginal and Torres Strait Islander knowledges can enrich your understanding of and interaction with the world. However, there are certain protocols that must be applied to ensure that the sharing and acquisition of such knowledges is done respectfully, acknowledging Aboriginal and Torres Strait Islander peoples. The 8 Ways of Learning is a framework that was designed to help teachers incorporate Aboriginal perspectives in classrooms by using Aboriginal learning techniques. The framework, which describes eight Aboriginal learning practices (that you will learn more about in Units 3 and 4) was developed by James Cook University's School of Indigenous Studies and the Western New South Wales Regional Aboriginal Education Team. The 8 Ways framework also outlines ten cultural interface protocols to apply when engaging with Aboriginal knowledge:

- 1 Use Aboriginal processes to engage with Aboriginal knowledge.
- 2 Approach Aboriginal knowledge in gradual stages, not all at once.
- 3 Be grounded in your own cultural identity (not “colour”) with integrity.
- 4 Bring your highest self to the knowledge and settle your fears and issues.
- 5 Share your own stories of relatedness and deepest knowledge.
- 6 See the shape of the knowledge and express it with images and objects.
- 7 Build your knowledge around real relationships with Aboriginal people.
- 8 Use this knowledge for the benefit of the Aboriginal community.
- 9 Bring your familiar understandings but be willing to grow beyond these.
- 10 Respect the aspects of spirit and place that the knowledge is grounded in.



**FIGURE 2** Seeing the shape of knowledge and expressing it with images and objects is one cultural interface protocol to apply when engaging with Aboriginal knowledges.

In addition to these protocols, there are other actions you can take throughout your learning journey to best engage with both Aboriginal peoples’ knowledges and Torres Strait Islander peoples’ knowledges, cultures or histories. These include:

- knowing and correctly acknowledging cultural or language groups of the land you are a visitor on
- rejecting deficit discourse in preference to a strengths-based approach
- avoiding Eurocentrism
- critically evaluating sources of information through a cultural lens.

## Correctly acknowledging culture

Whenever writing or referring to Aboriginal or Torres Strait Islander peoples, it is important to use correct and respectful language. Using “Aboriginal and Torres Strait Islander peoples” is generally seen as best practice as it encompasses all diverse Aboriginal and Torres Strait Islander cultures. The words “peoples”, “First Nations” and “First Peoples” can also be used to respectfully refer to all diverse Aboriginal and Torres Strait Islander cultures. You should avoid abbreviating “Aboriginal and Torres Strait Islander” as this can be seen as lacking respect for different identities. Including capitalisation is a sign of respect and should be used for the following terms:

- **A**boriginal and **T**orres **S**trait **I**slander peoples
- **F**irst **N**ations/**F**irst **P**eoples/**F**irst **A**ustralians
- **I**ndigenous (if used)
- **E**lders
- **T**raditional **O**wners/**C**ustodians
- **C**ountry.

## Country, Nation and Mob

When referring to specific cultures or language groups it is important to understand the difference between Country, **Nation** and **Mob**. Having this understanding will help you to correctly acknowledge the sources of knowledges and more specifically understand who and where histories and cultures apply to or originate from.

**TABLE 1** Summary of the terms Country, Nation and Mob

Term	Description
Country	The traditional lands connected to a particular language or cultural group. “Country” is a term often used by Aboriginal peoples to describe the lands, waterways and seas to which they are connected. This also includes complex ideas about lore, place, custom, language, spiritual belief, cultural practice, material sustenance, family and identity. For example, Wurundjeri Country is connected to the Wurundjeri people.
Nation	A larger grouping or federation of language groups that may be linked geographically, socially, politically and/or linguistically. For example, the Kulin Nation (see Figure 3) is an alliance of five Aboriginal nations in south-central Victoria (Boonwurrung, Dja Dja Wurrung, Taungurung, Wathaurong and Woiewurrung).
Mob	May refer to an ethno-linguistic group or be used to refer to one’s family or community. For example, “My Mob are the Taungurung from my dad’s side and Yuin from my mum’s side.” Use of the term “Mob” can be debated among Aboriginal and Torres Strait Islander communities and individuals. Some communities and individuals prefer use of the term, others may prefer to use alternative terms and some others may find the term offensive.

### Nation

a collective of language groups linked through geographic, social, political and or linguistic ties

### Mob

a family unit, language group, Nation or wider community group that a First Nations person identifies with



**FIGURE 3** The Kulin Nation is a federation that consists of five language groups.

## Rejecting deficit discourse

The European colonisation of Australia has had a lasting impact on Aboriginal and Torres Strait Islander peoples, communities, identities and cultures. Colonisation displaced many First Peoples from their Country and/or Place, families and ways of life. Post-colonisation governing bodies continually failed to acknowledge the rights and cultures of Aboriginal and Torres Strait Islander peoples. This suppression and denial of Aboriginal and Torres Strait Islander cultures has contributed to an increased prevalence of **intergenerational trauma** and decreased health outcomes in Aboriginal and Torres Strait Islander communities. Despite the long-lasting impacts of colonisation, the **resilience** and strength of Aboriginal and Torres Strait Islander peoples have allowed Aboriginal and Torres Strait Islander systems, customs and understandings to continue to thrive.

### **intergenerational trauma**

trauma that is passed down from those who have directly experienced an incident to their future generations

### **resilience**

the ability to mentally cope with or adapt to uncertainty, challenges and adversity



**FIGURE 4** Torres Strait Islander dancers performing at the Cairns Indigenous Art Fair in 2016

**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

**deficit discourse**

a mode of thinking that frames and represents people through a negative or lacking perspective

**strengths-based approach**

a mode of thinking that frames and represents people through their resilience and strengths

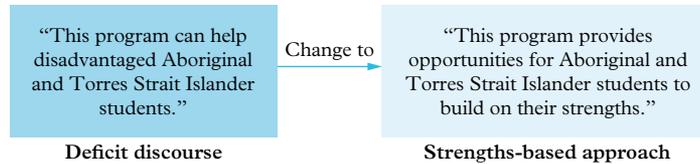
**self-determination**

the ability for Aboriginal and Torres Strait Islander peoples to freely decide and govern their own political, social, cultural and economic needs and rights

**Eurocentrism**

a worldview that focuses on or favours Western or European histories and thinking

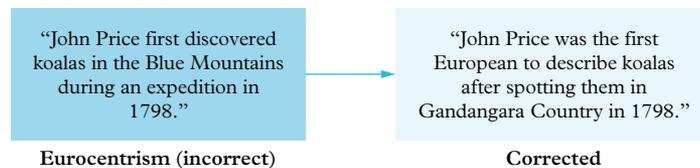
It is important to acknowledge how colonisation has impacted and continues to affect the **social and emotional wellbeing** of many Aboriginal and Torres Strait Islander peoples. However, Aboriginal and Torres Strait Islander peoples should not be viewed solely through the lens of any struggles or challenges faced. Doing so can result in **deficit discourse**, which characterises people or groups in terms of deficiency, absence, lack or failure and reinforces negative stereotypes. Deficit discourse can be countered by taking a **strengths-based approach**, a perspective that focuses attention on the **self-determination**, resilience and strengths of a person or group rather than the adversity faced by that person or group (Figure 5).



**FIGURE 5** Example of changing deficit discourse to a strengths-based approach

**Avoiding Eurocentrism**

**Eurocentrism** is the tendency to view things from a European or Western perspective while denying the perspectives and experiences of non-European cultures. Eurocentrism should be avoided as it can disregard important First Peoples understandings that have existed for thousands of years prior to European settlement in Australia. For example, many scientific discoveries of animals, plants and locations have been credited to Europeans, despite the same animals, plants and locations having been discovered and characterised by First Peoples well before European settlement. The way that you present or describe information when researching can help dismantle Eurocentric statements and beliefs (Figure 6).



**FIGURE 6** Example of correcting a Eurocentric statement

**Evaluating sources of information**

Not all sources of information are equal. In fact, some sources of information that appear to be educational or helpful can contain language or elements that may misrepresent other cultures and perspectives. Much of the information accessed when researching can come from Western perspectives and may contain Eurocentric or incorrect interpretations or a deficit discourse narrative, and may lack First Peoples voices or consultation. Therefore, when researching Aboriginal and Torres Strait Islander knowledges, cultures and histories it is important to evaluate the credibility of sources. Madsen, Perkins and Shay (2021) created the YARNS (Year, Author, Representations, Nouns, Sensitivity) tool to help evaluate resources containing information related to Aboriginal and Torres Strait Islander peoples. The YARNS tool poses a range of questions that can be asked to help assess whether a resource is fit for use (Table 2).



**FIGURE 7** The discovery and characterisation of many native Australian animals, plants and locations are often falsely credited to European colonisers.

**TABLE 2** The YARNS tool to evaluate resources

Aspect of YARNS	Questions to ask about the resource
Year	<ul style="list-style-type: none"> <li>• When was the resource made?</li> <li>• Is it up to date?</li> <li>• Does the year reflect contemporary (modern) Indigenous Australia?</li> <li>• Is additional context needed to understand the resource?</li> </ul>
Author	<ul style="list-style-type: none"> <li>• Does the author identify themselves as Aboriginal and/or Torres Strait Islander?</li> <li>• Were Aboriginal and/or Torres Strait Islander peoples consulted in the creation of the resource and were they recognised for their contribution?</li> <li>• Does the author identify the Traditional Owners of the Country on which the resource was produced?</li> <li>• Does the author (if non-Indigenous) clearly name the cultural standpoint and position they are writing from?</li> </ul>
Representations	<ul style="list-style-type: none"> <li>• Are Aboriginal and/or Torres Strait Islander peoples presented in a balanced way showing both historical and contemporary cultural practices?</li> <li>• Does the resource use racist terms (for example, “primitive” or “uncivilised”) for Aboriginal and/or Torres Strait Islander peoples?</li> <li>• Are there diverse representations of Aboriginal and/or Torres Strait Islander peoples through images?</li> </ul>
Nouns	<ul style="list-style-type: none"> <li>• Are accepted descriptions or names for Aboriginal and/or Torres Strait Islander peoples used in the resource?</li> <li>• Are capitals used correctly in the resource?</li> <li>• Is the language contemporary and does it reflect contemporary guidelines?</li> </ul>
Sensitivity	<ul style="list-style-type: none"> <li>• Does the source name all Aboriginal and/or Torres Strait Islander peoples pictured or group them into one homogeneous group?</li> <li>• Is there cultural information that may not be appropriate to represent?</li> <li>• Does the resource have images of Aboriginal and/or Torres Strait Islander peoples who have died and is there a warning about this?</li> </ul>

Source: Adapted from Madsen, Perkins and Shay (2021)

## 1.11 CHECK YOUR LEARNING



### Describe and explain

- 1 Define each of the following terms:
 

<b>a</b> Country	<b>c</b> Nation
<b>b</b> Mob	<b>d</b> Place.
- 2 Describe what Eurocentrism is and explain why it is important to avoid writing Eurocentric statements or relying on information that is written in a Eurocentric way.
- 3 Identify three questions you could ask to evaluate whether a resource is worth using based on its representations of Aboriginal and Torres Strait Islander peoples.
- 4 Explain why shortening Aboriginal and Torres Strait Islander peoples to an acronym is disrespectful.

### Apply, analyse and compare

- 5 Distinguish between deficit discourse and a strengths-based approach.
- 6 Rewrite the following Eurocentric statements so that they are corrected.
 

<b>a</b> Sydney Parkinson was the first person to draw the kangaroo.
<b>b</b> The first major use for eucalyptus leaves was discovered by Baron Ferdinand von Mueller, who suggested eucalyptus oil could be used as an antiseptic.

### Design and discuss

- 7 Research and discuss one example of Aboriginal and/or Torres Strait Islander peoples' knowledge that has made a significant contribution to the world of psychology.

# 1.12

## Preparing for assessment

### KEY IDEAS

- ✦ Organisational skills are important for revision.
- ✦ Understanding the meaning of command terms (such as describe, discuss or identify) will help you to answer questions well in assessments.



Preparing for any assessment in VCE Psychology requires organisational skills that can be practised throughout the year. Throughout Units 1 and 2 it is a good idea to practise and build your revision skills, as such skills become increasingly important in Units 3 and 4.

### Organisational skills

Organisational skills that are useful for VCE studies include:

- creating a timetable for your studies, homework and other commitments
- setting SMART goals
- incorporating reflection or evaluation of strategies for continuous improvement.

### Creating a timetable

It is important to maintain a balance between all your activities and commitments when you are in VCE. You need to make sure you have time to study, continue your extracurricular activities (such as hobbies or a part-time job) and have time to rest properly.

A template that you could use to create a study timetable can be found in your [ebook pro](#). You can also use different resources on your phone or computer to create your own version. Make sure that you block out the time spent at school (including travel), playing sport, family commitments, having meals or snacks and at part-time work. Be realistic – look at the amount of time you have left available; you may have to make some sacrifices to succeed in your VCE studies without sacrificing your mental health.

For the remaining time, allocate homework and/or study time for each subject, making sure that you are actively applying the skills learnt in class rather than only trying to remember the content.

### Setting SMART goals

Setting and achieving goals in VCE studies improves your motivation to succeed. Goals are most effective when they are SMART:

- **s**pecific – clear and explicit
- **m**easurable – can be measured or is a measure of success
- **a**ttainable – can be challenging but within reach
- **r**elevant – are meaningful and worthwhile
- **t**ime-based – are committed to deadlines or set times.

When setting your SMART goals, consider your strengths and weaknesses, as well as your thoughts and feelings about subject(s). An example of a SMART goal could be “By the end of Term 1, I would like to achieve an average of B+ or higher for my assessment tasks in VCE Psychology”, rather than the less specific “I want to improve in Psychology.”

## Reflection

Every few weeks, pause to reflect on your progress and the effectiveness of your organisational approach. Aim for continuous improvement – if something isn't working, then change to a more reliable (and repeatable) strategy. Celebrate small successes and continue to challenge yourself by setting new goals.

The advantages of having good organisational skills include improving your marks in assessment (Units 1 and 2) and school-assessed coursework (Units 3 and 4) and reducing your stress, worry, procrastination and uncertainty levels. It will allow you to work smarter (not harder), avoid last-minute panics and gain a sense of accomplishment in the knowledge that you did your best.

## Assessment tips

Before sitting an assessment in Units 1 and 2, there are a few strategies that could help you prepare.

- Start revising early. Cramming is stressful!
- Eat a healthy diet and cut back on processed or junk food and sugar-laden drinks.
- Try to keep the area where you revise or study separate from where you sleep.
- On the day of the assessment, eat breakfast so that you are not distracted by hunger or the noise of your rumbling stomach.
- Take a bottle of water to maintain hydration.
- Allow time for a bathroom visit before sitting the assessment.



**FIGURE 1** A healthy diet can provide you with the energy and nutrients your body needs to perform well on assessment tasks.

## Understanding command terms

**command term**  
verb that relates to performing a particular task, sets of tasks or mental processes

Assessments often contain **command terms** (instructive words). By understanding what different command terms mean and require, you can provide succinct and appropriate responses. Table 1 lists examples of command terms that are often used in assessment tasks and exams.

**TABLE 1** List of command terms and what they mean

Term	Explanation
account of	Describe a series of events or transactions.
account for	State reasons for; report on.
analyse	Identify components/elements and the significance of the relationship between them; draw out and relate implications; determine logic and reasonableness of information.
apply	Use; employ in a particular situation or context.
assess	Make a judgment about, or measure, determine or estimate, the value, quality, outcomes, results, size, significance, nature or extent of something.
calculate	Determine from given facts, figures or information; obtain a numerical answer showing the relevant stages in the working; determine or find (e.g. a number, answer) by using mathematical processes.
clarify	Make a statement or situation more comprehensible.
compare	Recognise similarities and differences and the significance of these similarities and differences.
construct	Make, build, create or put together by arranging ideas or items (e.g. an argument, artefact or solution); display information in a diagrammatic or logical form.
contrast	Show how things are different or opposite.
deduce	Draw a conclusion from given information, data, a narrative, an argument, an opinion, a design and/or a plan.
define	Give the precise meaning and identify essential qualities of a word, phrase, concept or physical quantity.
demonstrate	Show ideas, how something can be done or that something is true by using examples or practical applications, or by applying algorithms or formulas.
describe	Provide characteristics, features and qualities of a given concept, opinion, situation, event, process, effect, argument, narrative, text, experiment, artwork, performance piece or other artefact in an accurate way.
discuss	Present a clear, considered and balanced argument or prose that identifies issues and shows the strengths and weaknesses of, or points for and against, one or more arguments, concepts, factors, hypotheses, narratives and/or opinions.
distinguish	Make clear the differences between two or more arguments, concepts, opinions, narratives, artefacts, data points, trends and/or items.
evaluate	Ascertain the value or amount of; make a judgment using the information supplied, criteria and/or own knowledge and understanding to consider a logical argument and/or supporting evidence for and against different points, arguments, concepts, processes, opinions or other information.
examine	Consider an argument, concept, debate, data point, trend or artefact in a way that identifies assumptions, possibilities and interrelationships.
explain	Give a detailed account of why and/or how with reference to causes, effects, continuity, change, reasons or mechanisms; make the relationships between things evident.
extract	Select relevant and/or appropriate detail from an argument, issue or artefact.
extrapolate	Infer and/or extend information that may not be clearly stated from a narrative, opinion, graph or image by assuming existing trends will continue.
identify	Recognise and name and/or select an event, feature, ingredient, element, speaker and/or part from a list or extended narrative or argument, or within a diagram, structure, artwork or experiment.
infer	Derive conclusions from available information or evidence, or through reasoning, rather than through explicit statements.

(continued)

TABLE 1 continued

Term	Explanation
interpret	Draw meaning from an argument, point of view, description or diagram, text, image or artwork and determine significance within context.
investigate	Observe, study or carry out an examination in order to establish facts and reach new conclusions.
justify	Show, prove or defend, with reasoning and evidence, an argument, decision and/or point of view using given data and/or other information.
list	Provide a series of related words, names, numbers or items that are arranged consecutively.
name	Provide a word or term (something that is known and distinguished from other people or things) used to identify an object, person, thing, place etc.
outline	Provide an overview or the main features of an argument, point of view, text, narrative, diagram or image.
persuade	Induce (someone) to do something through reasoning or argument; convince.
predict	Give an expected result of an upcoming action or event; suggest what may happen based on available information.
propose	Suggest or put forward a point of view, idea, argument, diagram, plan and/or suggestion based on given data or stimulus material for consideration or action.
recall	Present remembered ideas, facts and/or experiences.
recommend	Put forward and/or approve (someone or something) as being suitable for a particular purpose or role.
recount	Retell a series of events or steps in a process, usually in order.
state	Give a specific name or value or other brief answer without explanation or calculation.
suggest	Put forward for consideration a solution, hypothesis, idea or other possible answer.
summarise	Retell concisely the relevant and major details of one or more arguments, text, narratives, methodologies, processes, outcomes and/or sequences of events.
synthesise	Combine various elements to make a whole or an overall point.

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## 1.12 CHECK YOUR LEARNING

### Describe and explain

- 1 Describe at least two strategies that can be useful as you prepare for assessment tasks.
- 2 Explain why having good organisational skills is important for VCE studies.

### Apply, analyse and compare

- 3 Analyse the revision strategies that you currently use and develop a SMART goal for improvement in this area.
- 4 Compare the following task words:
  - a list and identify
  - b propose and predict
  - c contrast and compare.

### Design and discuss

- 5 Use ICT resources to create and print a personal study timetable.
- 6 Design a lotus diagram for one of the topics in VCE Psychology that you find challenging and ask a classmate to peer review it for additions and/or improvements. (Use the internet to find about lotus diagrams if you need to.)



### Study tip

Studying for your VCE exams should begin during the first week of the first topic, as smaller and consistent study sessions create better student outcomes (higher marks) than longer and irregular study sessions.

## Chapter summary

- 1.1** • VCE Psychology is divided into units and areas of study.
- The key science skills and their application are important for success in VCE Psychology.
- 1.2** • A research question states the specific problem or issue on which your investigation will be based.
- An aim is a statement of what is to be investigated.
- A hypothesis is a testable statement that should include a prediction about the outcome of an investigation, based on scientific reasoning.
- 1.3** • Different methodologies can be used to conduct scientific investigations.
- Participants in a psychological investigation can be selected through random or stratified sampling techniques.
- Within-subjects, between-subjects and mixed designs have specific advantages and disadvantages for different controlled experiments.
- 1.4** • Ethical understanding should be applied when undertaking research.
- Ethical concepts guide discussion and decision-making in psychological research.
- Laboratory safety practices minimise risks and protect investigation participants' safety.
- 1.5** • Data can be classified as either qualitative or quantitative.
- Observations, interviews and questionnaires can be used in research investigations to collect data.
- 1.6** • Organising and presenting data in the correct format can help us determine what the data means.
- Descriptive statistics can be calculated or used to help us process what our data means.
- 1.7** • Investigations that generate raw data must be valid, repeatable and reproducible.
- Errors and outliers must be included and accounted for in data evaluations.
- 1.8** • Analysis of raw data generated in a scientific investigation is important for constructing evidence-based arguments and conclusions.
- Sentence structure and paragraph structure are important when constructing evidence-based arguments and conclusions.
- 1.9** • Ideas, concepts, models and theories are different forms of scientific information.
- Sources of scientific information such as journal articles, mass media communications, opinions, policy documents and reports in the public domain have strengths and limitations and can vary in levels of credibility.
- Psychological issues can be influenced by social, economic, political and legal factors.
- 1.10** • Effective science communication depends on knowing your audience and prioritising important information.
- 1.11** • Aboriginal and Torres Strait Islander peoples – the traditional owners of Australia – hold Indigenous knowledges developed by their ancestors and passed down through generations.
- 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 Aboriginal and Torres Strait Islander knowledges, cultures and histories in VCE Psychology.
- 1.12** • Organisational skills are important for assessment preparation.
- Understanding command terms can help you to answer questions properly on assessment tasks.

## Revision questions

### Multiple choice

Use the following information to answer questions 1 and 2.

A researcher has been investigating whether excessive time (more than five hours per week) spent playing online games causes a reduction in academic success at school. He compares the memory skills of students who spend more than five hours per week playing games with the memory skills of students who spend less than five hours per week playing games when both groups learnt a list of 40 botanical names of plants.

- 1 In this research, what is the independent variable?
  - A Whether participants spent more or less than five hours per week playing online games
  - B Students who played online games or students who did not play online games
  - C Academic success or academic failure
  - D Academic success; hours students spent playing online games
- 2 In this research the dependent variable is \_\_\_\_\_ measured as \_\_\_\_\_.
  - A excessive time spent playing online games; number of hours per week spent playing online games
  - B students who play online games; more than five hours per week spent playing online games
  - C academic success; average percentage score in school examinations
  - D academic success; score on test of memory of 40 botanical names of plants
- 3 A student completes a maths test and scores 34/40. What was the student's score as a percentage?
  - A 85%
  - B 34%
  - C 90%
  - D 40%
- 4 Research is the process by which psychologists and other scientists collect and analyse data. They can then make informed statements about properties of the population. In this sense, what does the word population refer to?
  - A All the people who live in a certain area
  - B All the people of a certain age
  - C All the people about whom the researcher wishes to draw conclusions
  - D All the people who took part in the experiment or research
- 5 The purpose of using different experimental designs is to try to reduce the influence of confounding variables, but each design may have its own problems. The problem of the sample becoming biased because of a change in the characteristics of the sample during the research is greatest in which design?
  - A Within-subjects
  - B Between-subjects
  - C Mixed design
  - D Twin studies
- 6 Which option is the best definition of a random sample?
  - A A group of participants selected from the population by picking names at random from the electoral roll
  - B A group of participants selected from the population by putting all the names in a hat and drawing them out at random
  - C A group of participants selected from the population in such a way that each member of the population has an equal chance of selection
  - D A group of participants selected from the population by means of a random number generator on a computer
- 7 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 puzzles on a computer, but in reality the computer would
 

“crash” near the end of the test and their emotional response would be measured.

This research:

- A** 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** would be ethical if the research aim was considered sufficiently important and the ethics committee of the researcher’s university had approved it as long as debriefing procedures were carried out.
- C** would be ethical if the subjects gave informed consent about the deceit and debriefing procedures were carried out.
- D** would be unethical since deceit in research can never be ethical and is not permitted even if debriefing procedures are carried out.

*Use the following information to answer questions 8 and 9.*

Professor Dembele is conducting some research to investigate how the human brain changes its responses when a person has been without sleep for 14 hours, compared with its responses one hour after awakening from a full night’s sleep. She gives each of her first-year university psychology students a card and instructs them to attend the experimental session and submit the card. She tells her students that if they do not do this, they will lose 5 per cent of their semester mark.

- 8** Which ethical guideline is Professor Dembele violating for the rights of participants in research?
- A** Voluntary participation in research
  - B** Informed consent from participants
  - C** Confidentiality of participant information
  - D** No physiological or psychological harm to participants
- 9** Another researcher wishes to do further research and thinks that Professor Dembele’s data will be useful. The professor gives her a list of the student names and data collected. Which ethical guideline has this action breached?

- A** Voluntary participation in research
- B** Informed consent from participants
- C** Confidentiality of participant information
- D** Both informed consent and confidentiality of participant information

- 10** Professor Chen is researching the effects of increased vitamin A intake on the rod function in the eye. He gives his experimental group 125 mL of carrot juice each day and gives the control group water. What is the purpose of the control group in this experiment?
- A** To show the effects of the IV
  - B** To control or eliminate the effects of participant variables
  - C** To form a basis for comparison with the experimental group
  - D** To show the effects of the DV

### **Short answer**

#### **Describe and explain**

- 11** Explain why valid research is important.
- 12** Describe the importance of debriefing.
- 13** Define the following terms:
- a** independent variable
  - b** dependent variable
  - c** confounding variable
  - d** extraneous variable.

#### **Apply, analyse and compare**

- 14** Identify the independent variable and population in the following hypotheses.
- a** Primary school students will find it easier to learn two languages when they have a bilingual parent.
  - b** Football players are more likely to score goals when they train.
  - c** Teenagers are more likely to adopt a stereotype if their in-group also adopts this stereotype.
- 15** Distinguish between informed consent and the right to withdraw.
- 16** Provide an example of research that applies the ethical concept of beneficence.
- 17** Compare variance and standard deviation.

- 18 Analyse why it is important to gain parental or guardian consent when a participant is underage.
- 19 Determine the mean, median and mode of the following data set:  
8, 9, 10, 16, 17, 19, 19, 20
- 20 It is thought that adolescents will sleep for longer periods after they have spent the day studying or engaged in intense physical activity compared to a normal day's activity. A researcher wished to study this.
- Explain why a between-subjects design would be less appropriate than a within-subjects design.
  - Outline two extraneous variables that may affect the research.
  - Suggest how the variables identified in part b could be controlled.
- 21 Compare the use of journal articles versus mass media communication as a source of scientific information.
- 22 Distinguish between the ethical concepts of respect and integrity.

*Use the following information to answer questions 23 to 28.*

Richard wished to compare the mood of Year 6 children 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). He decided to measure mood on a scale of 1 to 10, with 1 being "depressed" and 10 being "elated".

He took his measurements with the first 30 children on the school's alphabetical roll. The role-plays took place on Monday afternoons, one week apart. He made sure that half the children role-played Condition 1 the first week and

Condition 2 the second, with the other half role-playing the conditions in the opposite sequence.

Richard's results showed that the mean mood score for Condition 1 was 3.4 and the mean mood score for Condition 2 was 7.2.

- 23 Identify the population in this research.
- 24 Was Richard's sampling procedure appropriate? Explain your answer.
- 25 Identify the IV in this research.
- 26 Identify the DV in this research.
- 27 Describe how the DV was measured.
- 28 Create an appropriate experimental hypothesis for this research.
- Identify the experimental design used in this research. Justify your answer.
  - Discuss why Richard made sure that half the children role-played Condition 1 the first week and Condition 2 the second, with the other half role-playing the conditions in the opposite sequence.

### Design and discuss

- 29 A researcher wants to investigate the effects of a new anti-anxiety medication on anxiety levels in participants with generalised anxiety disorder. They recruit 40 participants and randomly assign them to two groups: a treatment group that receives the new medication, and a control group that receives a placebo (sugar pill). The anxiety levels of each participant are measured at four different time points: before the treatment (baseline), immediately after the treatment, one week after the treatment, and four weeks after the treatment. Discuss the type of investigation design the researcher has used and suggest the benefits of using this design type over others.

You can find the following resources for this section in your **obook pro**:

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key science skills.



#### Chapter checklist

Rate your understanding of key science skills.

**UNIT**

**1**

# **How are behaviour and mental processes shaped?**

**FIGURE 1** In Unit 1 you will look at the role of the brain in mental processes and behaviour.

## Unit 1 Overview

In Unit 1 of VCE Psychology, you will examine the complex nature of psychological development, including situations where psychological development may not occur as expected. You will investigate the structure and functioning of the human brain and the role it plays in mental processes and behaviour and explore brain plasticity and the influence that brain damage may have on a person's psychological functioning. You will also undertake a student-directed research investigation into contemporary psychological research.

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## Unit 1 Areas of Study

The learning for this unit has been divided into three areas of study. The table below shows how each area of study aligns with the chapters in this book and lists the page numbers for each chapter.

Area of Study	Chapter	Pages
<b>Area of Study 1</b> What influences psychological development?	<b>Chapter 2</b> The complexity of psychological development	76–113
	<b>Chapter 3</b> Defining and supporting psychological development	114–149
	<b>Unit 1 Area of Study 1</b> Checkpoint	150–157
<b>Area of Study 2</b> How are mental processes and behaviour influenced by the brain?	<b>Chapter 4</b> The role of the brain in mental processes and behaviour	158–187
	<b>Chapter 5</b> Brain plasticity and brain injury	188–221
	<b>Unit 1 Area of Study 2</b> Checkpoint	222–229
<b>Area of Study 3</b> How does contemporary psychology conduct and validate psychological research?	<b>Chapter 6</b> Response to an investigation	230–245
	<b>Unit 1 Area of Study 3</b> Sample response	246–247

## Unit 1 Outcomes

By the end of this unit, you should be able to:

- discuss complexity of psychological development over the life span, and evaluate ways of understanding and representing psychological development
- analyse the role of the brain in mental processes and behaviour and evaluate how brain plasticity and brain injury can change biopsychosocial functioning
- identify, analyse and evaluate the evidence available to answer a research question relating to contemporary psychology.

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CHAPTER

# 2

# The complexity of psychological development

## KEY KNOWLEDGE

- the interactive influences of hereditary and environmental factors on a person's psychological development
- the biopsychosocial approach as a model for considering psychological development and mental wellbeing
- the process of psychological development (emotional, cognitive and social development) over the course of the life span
- the role of sensitive and critical periods in a person's psychological development.

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## GROUNDWORK

This chapter will build on concepts you may have come across in Year 10. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



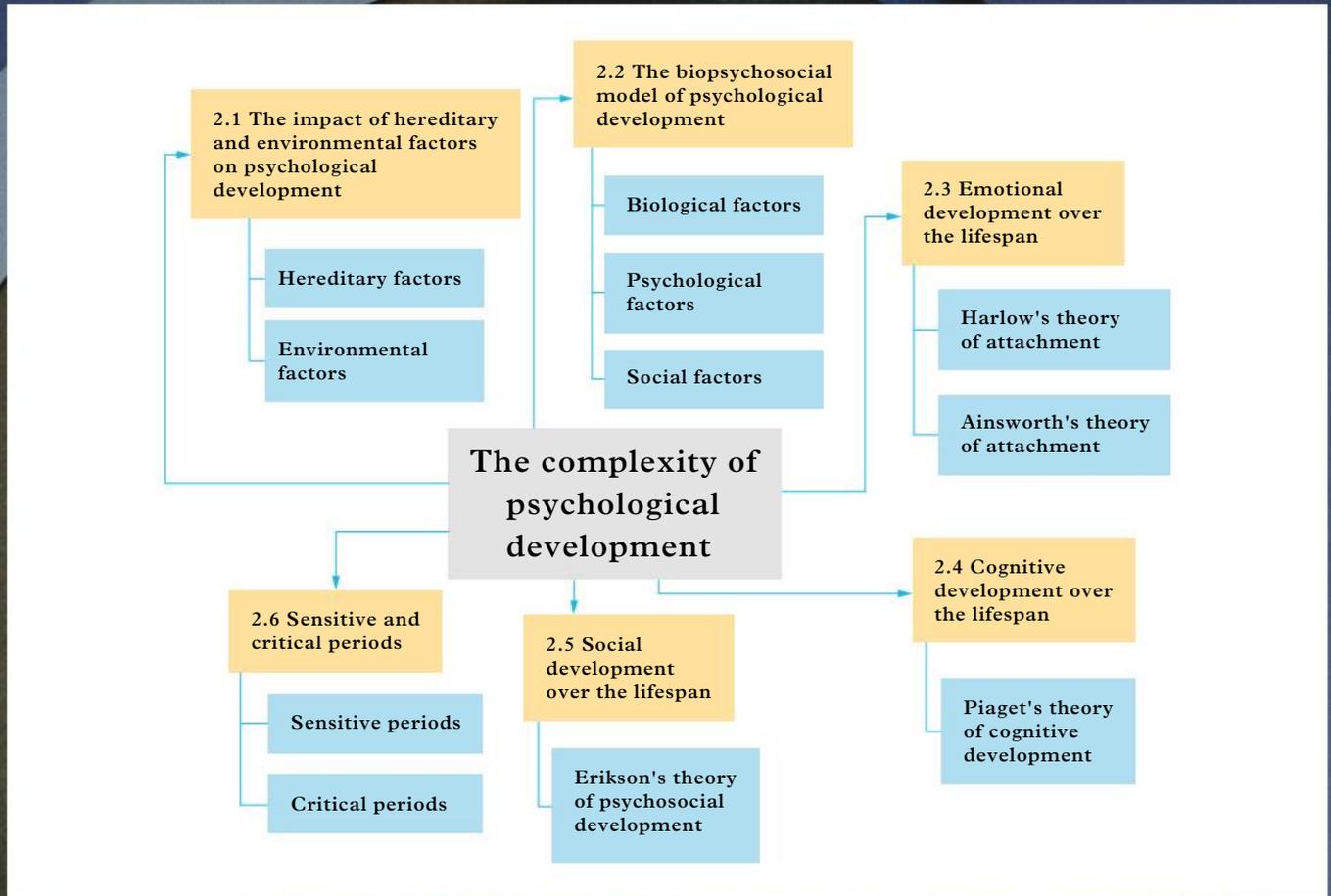
Groundwork quiz  
Chapter 2

## INVESTIGATIONS

2.2	<b>INVESTIGATION: PRODUCT, PROCESS OR SYSTEM DEVELOPMENT</b>	How can we promote mental wellbeing with mobile apps?	Page 472
2.4	<b>INVESTIGATION: CONTROLLED EXPERIMENT</b>	How can we assess conservation as part of cognitive development?	Page 474

**FIGURE 1** No two people are exactly alike, because no two people have the same biological, psychological or social factors affecting their psychological development.

## CONCEPT MAP



# 2.1

## The impact of hereditary and environmental factors on psychological development

### KEY IDEAS

- ✦ Psychological development is shaped by both hereditary factors and environmental factors.
- ✦ Hereditary factors and environmental factors interact and thus impact each person differently, producing unique individuals.



### psychological development

how a person's social, emotional and cognitive capabilities change over time

Have you ever questioned why you think, feel and behave the way you do? Were you born this way or have your experiences shaped you? The answers to these questions lie in the study of **psychological development** – how a person's social, emotional and cognitive capabilities change over time. Psychological development is influenced by a range of different factors. These factors can be broadly grouped into two categories – hereditary factors and environmental factors.

## Hereditary factors and environmental factors



**FIGURE 1** Children often resemble their biological parents. This is due to genetic material or genes passed on (inherited) from their biological parents that play a role in the development of physical appearance.

### hereditary factor

genetic material transmitted by biological parents to their offspring at the time of conception that influences development

Historically, one of the most debated issues in psychology was whether nature (hereditary factors) or nurture (environmental factors) was responsible for shaping development. Consider the child of two musically talented parents. If the child also developed the ability to play music beautifully, what would you attribute this to? The parents' genetic material linked to musical skill or the parents exposing the child to an environment that nurtured a love of music supported with music lessons? If the child never had music lessons would they still have developed this talent?

It is now understood that both nature and nurture influence and interact together to shape psychological development. This understanding has shifted the focus of the nature versus nurture debate. The focus is now on determining the extent to which each factor is responsible for development, and how the two factors interact with each other to produce unique individuals.

50 per cent from the biological mother and 50 per cent from the biological father. The **genes** that biological parents transmit to their offspring at the time of conception form the basic plan for a person's development, which is also influenced by environmental factors that we will explore later.

## Hereditary factors

**Hereditary factors** refer to factors coming from within a person's internal environment that can influence their development.

Everyone's unique DNA is inherited from their biological parents –

The genes we inherit are known to influence our biological development – this includes our eye colour, blood type and how likely we are to develop a physical condition. Hereditary factors also influence our psychological development. Research has shown that psychological attributes including intelligence, temperament and personality have a genetic component. This means these attributes are partially determined by the genetic material we receive from our biological parents. Many psychological disorders are also subject to **genetic vulnerability**. Genetic vulnerability refers to a person's increased risk of developing a particular disorder due to genetic factors. For example, if a parent has a psychological disorder such as schizophrenia or depression, their child may inherit genetic material from the affected parent that could make them more likely to develop the disorder themselves.

The presence of a genetic vulnerability does not mean that if a parent has a mental or physical disorder, their child will inevitably develop the same disorder. Rather, the chance that the child will develop the disorder is greater than for someone without this genetic vulnerability. Whether the disorder develops will depend on a number of other things, including environmental factors.

## Environmental factors

**Environmental factors** originate from a person's external environment and can influence development. These factors include the experiences, events, objects and people that we are exposed to in our lifetime. Some examples of environmental factors that can influence your development include:

- how you are brought up by your parents or caregivers
- where you live
- your friendship groups
- your culture or religion
- your exposure to experiences such as illness or trauma.

For example, consider the psychological development of two children who are raised by different caregivers who use completely different styles of caregiving. A child who is raised by loving, affectionate caregivers is likely to develop different emotional, cognitive and social skills compared to a child who is raised by caregivers who are cold and distant.



**FIGURE 2** A parent with depression may pass on genes that increase the likelihood of their offspring developing depression.

### **genes**

sections of DNA that have a functional purpose, such as coding for proteins that determine different traits

### **genetic vulnerability**

a person's increased susceptibility to a particular disorder due to genetic factors

### **environmental factor**

factor originating from a person's external environment that influences their development



**FIGURE 3** Consider the teenagers in the images. How might different hobbies lead to unique personalities?

## The interaction between hereditary and environmental factors

Both hereditary and environmental factors are viewed as equally important in influencing our psychological development. These factors also interact to influence each other. For example, a person’s genetic make-up can determine whether they have the potential to play sport at a professional level. Whether or not they reach that potential is also dependent on environmental factors that are present throughout their lives, such as whether they are taught to value sport, have supportive parents or have access to local clubs and teams.

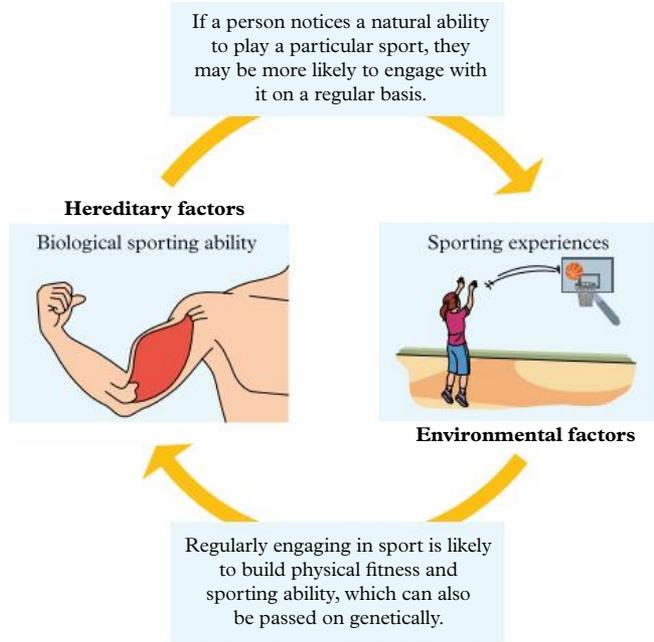
In turn, environmental factors can also affect a person’s biological development. For example, a child with a family that values nutrition and exercise may be more likely to engage in physical activity to build their physical fitness and skill in a sport than a child raised by a family who does not value exercise or nutrition.

Figure 4 illustrates how the relationship between hereditary factors and environmental factors is **bidirectional**, which means that not only can hereditary factors influence environmental factors, but that the influence can also travel in the opposite direction – environmental factors can influence hereditary factors.

Each experience that a person faces over their lifetime has the potential to influence their development. However, the degree and direction of this influence will depend on what other environmental and hereditary factors are present. No two people have the exact same experiences, which explains why every person develops into a unique individual. Twin studies provide evidence to support the influence of both environmental and hereditary factors on development, as shown in Real-world psychology 2.1.

### bidirectional

where a relationship of influence travels in two directions



**FIGURE 4** The bidirectional relationship between hereditary and environmental factors

## 2.1 REAL-WORLD PSYCHOLOGY

### The Jim twins

The “Jim twins” were identical twins who were separated early in life and reared apart. Because identical twins share 100 per cent of the same genetic material, the Jim twins became important participants in the Minnesota Twins Study, a study that highlighted the interaction of hereditary factors and environmental factors on psychological development. Jim Lewis was adopted when he was four weeks old.



**FIGURE 5** The Jim twins when they were reunited. Jim Lewis is on the left and Jim Springer is on the right.

He was informed of his twin brother at a young age but was not interested in finding him until he was in his 30s. When searching for his biological family, Jim Lewis finally found his identical twin brother, Jim Springer.

Jim Lewis and Jim Springer discovered some amazing similarities in their lives. As children, both twins had been fretful sleepers and nail-biters. As adults, both twins suffered from migraines, haemorrhoids and high blood pressure. The similarities went further – both had pet dogs named Toy when they were young, both had married women named Linda, and both had divorced and then remarried women named Betty. Jim Lewis named his first son James Allen and Jim Springer named his first son James Alan. Both worked as sheriff's deputies, enjoyed stock-car racing, made dolls' furniture and constructed unusual circular benches around the trees in their garden. They both liked to visit the same Florida beach on holidays, drink the same brand of beer and smoke the same brand of cigarettes.

The Minnesota Twins Study found that identical twins raised together or apart were far more similar on many psychological tests than non-identical twins and siblings raised in the same family. The Jim twins scored strikingly similar scores on a series of personality and intelligence tests, and even had very similar handwriting. However, key differences between the twins showed that their identical **genetics** were not fully responsible for their development. For example, one Jim preferred to express himself through speaking while the other preferred to express himself through writing. Additionally, the two Jims liked to style their hair differently: Jim Lewis wore his hair short, neat and with sideburns, while Jim Springer liked to wear his hair long, straight and down like one of the Beatles.

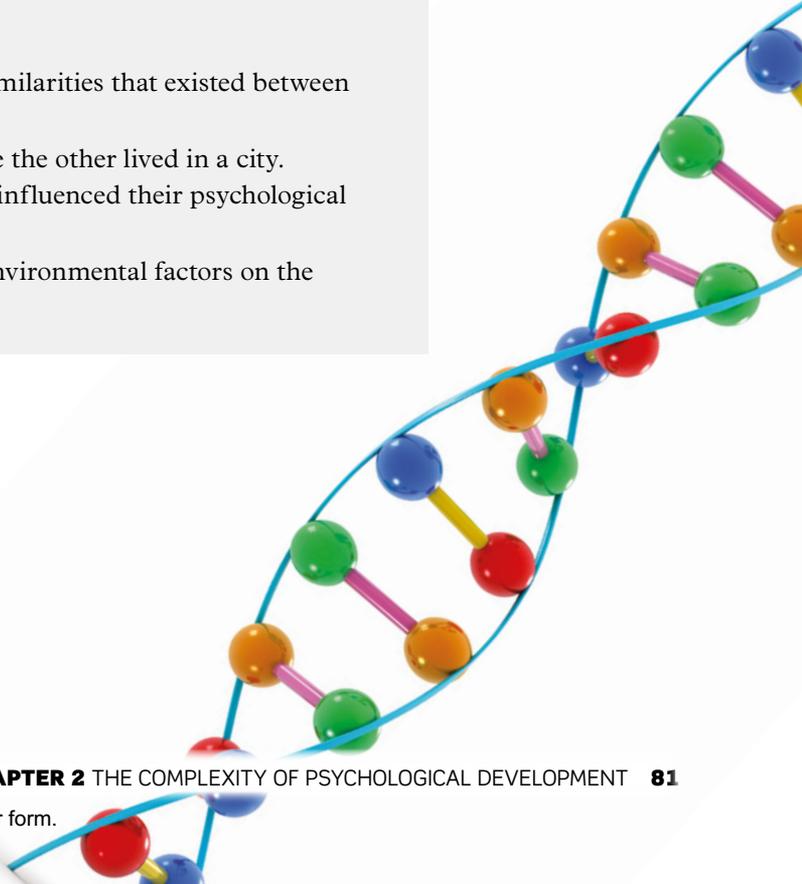
As they grew up in separate households and did not meet until they were well into adulthood, it is likely their environment and experiences were vastly different. For example, one Jim lived in the city while the other lived in the country. These different experiences would have also influenced their psychological development, which is why the Jim twins were two clearly different people, despite some striking similarities.

### Apply your understanding

- 1 With reference to hereditary factors, explain the similarities that existed between the Jim twins.
- 2 One of the Jim twins lived in a country town, while the other lived in a city. Suggest how this environmental factor could have influenced their psychological development differently.
- 3 Discuss the interaction of hereditary factors and environmental factors on the Jim twins.

#### **genetics**

the basic plan for the development of psychological and physiological characteristics, the unfolding of which is influenced by our environment



## 2.1 SKILL DRILL

### Exploring the use of case studies

#### Key science skill: Plan and conduct investigations

The study of the Jim twins is an example of a case study. Read Real-world psychology 2.1 and answer the following questions.

#### Practise your skills

1 Define the term “case study”.

- 2 Identify and explain two advantages of collecting data via a case study with reference to the Jim twins example.
- 3 Identify and explain two limitations of collecting data via a case study, with reference to the Jim twins example.
- 4 Discuss the use of case studies over experiments in twin studies.

Need help planning and conducting investigations? Go to Topic 1.3 in your Psychology toolkit.

## 2.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify three biological traits that are determined by hereditary factors.
- 2 Give three examples of environmental factors and explain how each factor could influence psychological development.
- 3 Explain what is meant by the term “genetic vulnerability”.

### Apply, analyse and compare

- 4 Distinguish between hereditary factors and environmental factors, using examples to illustrate your response.
- 5 Analyse the bidirectional interaction of hereditary factors and environmental factors, using an example not included in the text to illustrate your response.

### Design and discuss

- 6 Ursula’s mother has major depression. With reference to hereditary factors and environmental factors, discuss the likelihood of her son, Oscar, developing major depression later in life.
- 7 Discuss whether being born with “intelligent” genes means that a person will be highly intelligent.
- 8 Discuss the role of hereditary and environmental factors in producing unique individuals.

## 2.2

# The biopsychosocial model of psychological development

## KEY IDEAS

- ✦ The biopsychosocial model is a holistic framework used to consider and categorise all the biological, psychological and social factors that influence a person's psychological development and wellbeing.
- ✦ Biological, psychological and social factors interact with each other, making psychological development and wellbeing complex.



### biopsychosocial model

a holistic framework used to consider and categorise all the biological, psychological and social factors that influence a person's psychological development and mental wellbeing



Video

Biopsychosocial model

### holistic

taking into account all the individual parts of a whole

### internal factor

factor affecting psychological development and wellbeing that originates within the individual

### external factor

factor affecting psychological development and wellbeing that originates from outside the individual

### mental wellbeing

a person's overall mental state in terms of their level of functioning, their social and emotional wellbeing, and their resilience to cope with change and uncertainty

In Topic 2.1 you learnt that there are many environmental and hereditary factors that can affect our development in both positive and negative ways. Psychologists aim to consider all possible influences on our development and behaviour to fully understand why we are the way we are. One approach to ensure all factors are considered is the use of a holistic framework called the **biopsychosocial model**.

## The biopsychosocial model

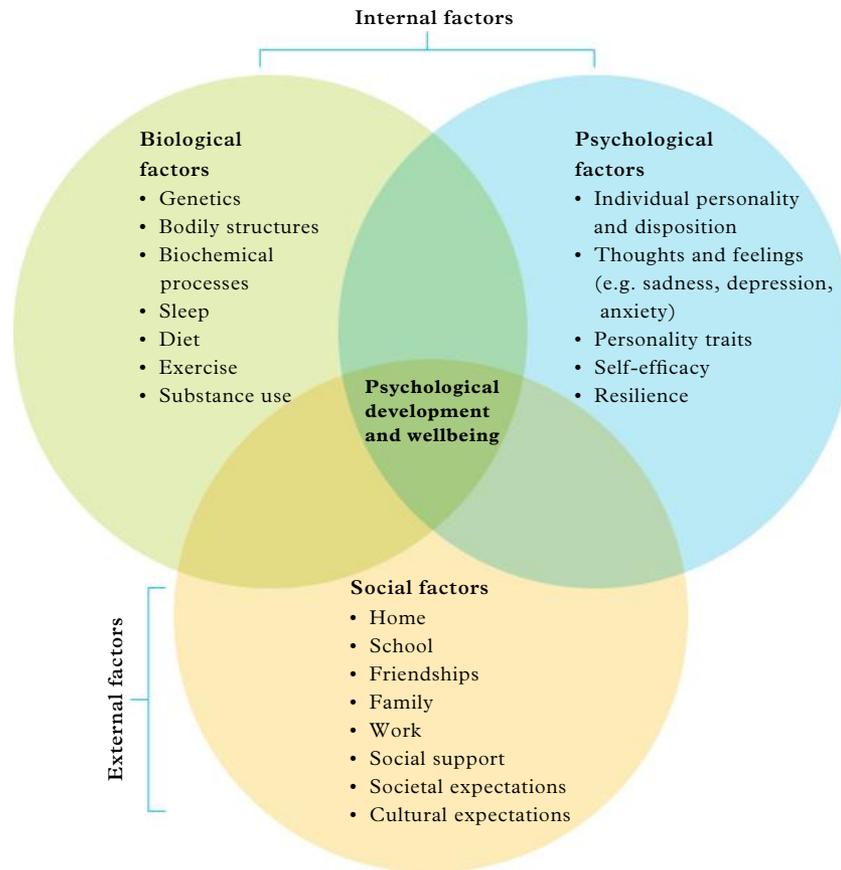
The biopsychosocial model is a **holistic** framework used to consider and categorise all biological, psychological and social factors that influence a person's psychological development and mental wellbeing. The factors in this model have distinct origins.

**Internal factors** are those that originate or develop within the individual, while **external factors** originate or develop outside of the individual. Biological and psychological factors are classified as internal factors, while social factors are classified as external factors.

While they exist in separate categories, biological, psychological and social factors interact with each other to influence development and wellbeing. According to this model, all these factors are considered equally important in forming a comprehensive understanding of a person's development and wellbeing. Figure 1 shows a visual representation of the biopsychosocial framework.

The presence or absence of biopsychosocial factors can influence a person's psychological development and mental wellbeing. Some factors can enhance wellbeing and development, while others may increase the chances of developing mental or physical health problems. Some factors can affect different people in different ways, and combinations of factors can also influence psychological experience.

**Mental wellbeing** refers to a person's overall mental state in terms of their level of functioning, their social and emotional wellbeing, and their resilience to cope with change and uncertainty. Our mental wellbeing is an important component of psychological development. Mental wellbeing is not static; it fluctuates throughout our life because we continue to develop as we are exposed to a range of factors. For this reason, it is logical to apply the biopsychosocial model to both psychological development and mental wellbeing to explore all possible factors that influence our psychological experiences.



**FIGURE 1** Psychological development and mental wellbeing are influenced by biological, psychological and social factors.

## Biological factors

**biological factor**  
factor relating to physiological functioning that originates from within the body

**genetic predisposition**  
where an individual has an increased chance of developing a specific trait or disorder due to genetic material passed down to them by their biological parents

**Biological factors** originate within your body or directly relate to your physiological functioning. Some examples of biological factors include your age, biological sex, diet, hormones and the body's response to medications or substance use. Hereditary factors passed on to you by your biological parents, such as **genetic predispositions**, are also examples of biological factors.

Let's look at diet as an example: the kinds of foods you eat determine the nutrition that your body receives. This can influence your physical growth, energy levels and the operation of your internal organs. Maintaining an adequate, healthy diet enables us to grow and develop at optimal levels and ensures that we feel physically well and have enough energy to cope with the daily tasks of life, which in turn allows us to feel fulfilled and mentally well. Another example of a biological factor is our body's response to medications. A person with a mental or physical disorder might take a medication to treat the symptoms or cause of that disorder. In turn, this medication may have side effects on our bodies, or we may have an intolerance to the medication, meaning it is unable to be effective. Ideally, if the medication works and makes us feel better it will improve both our mood and overall wellbeing.



**FIGURE 2** Our response to medication we take is a biological factor that can affect our psychological development.

## Psychological factors

**Psychological factors** relate to mental processes that originate or occur within the individual. Some examples of psychological factors include mood, attitudes, emotions, personality, memory, self-esteem and resilience.

Each psychological factor mentioned can influence our psychological development. For example, a child with an outgoing and inquisitive personality might be more open to new experiences. This then enables them to develop and learn new skills. A timid child who rarely steps out of their comfort zone might be less enabled to develop and learn new skills. Similarly, a student with high self-esteem and resilience might be able to effectively cope with the disappointment of receiving a lower-than-expected mark on a SAC. A student with lower self-esteem and low resilience may find this mark so disappointing that it severely affects their mood and mental health.

## Social factors

**Social factors** refer to our interactions with others and our environment. They originate outside the individual but are still influential in affecting a person's internal development and mental wellbeing. Some examples of social factors include interpersonal relationships, level of education, cultural values, pressures from school or work, support available from others, and stigma.



**FIGURE 3** Psychological factors relate to mental processes and originate from within the individual. Some examples include personality, self-esteem and the way we perceive ourselves.

**psychological factor**  
factor relating to mental processes that originates or occurs within the individual

**social factor**  
factor relating to interactions with others and the environment that originates from outside the individual



**FIGURE 4** Education level and pressure from school are both examples of social factors.

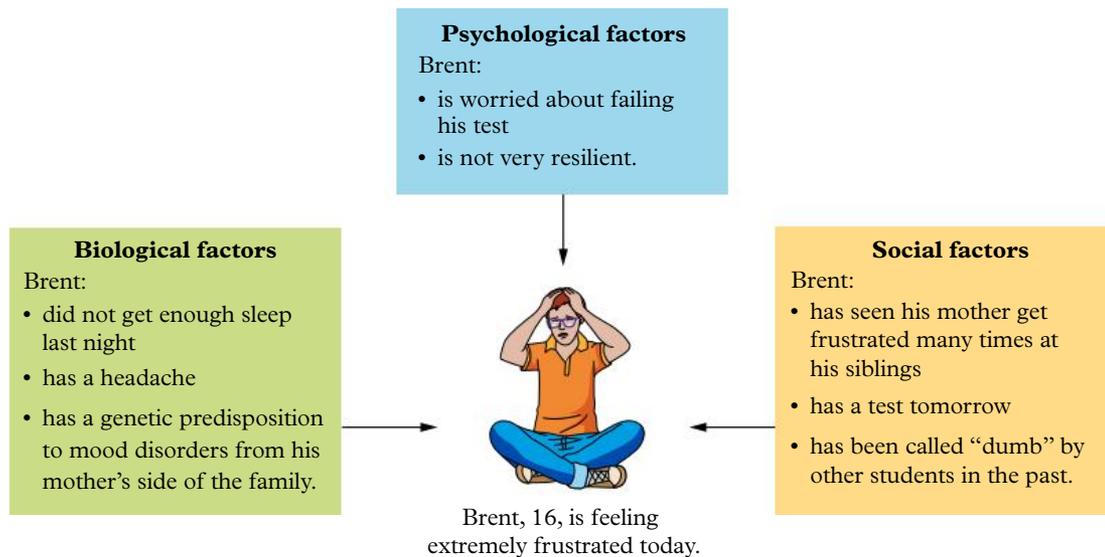
### Study tip

Biological and psychological factors are also known as **internal** factors, because they originate within the individual. Social factors are also called **external** factors because they originate from outside the individual.

To better understand social factors, consider two siblings: Henrika, who has completed a science degree at university, and Joachim, who left school at 16 to become a carer for his ill father. Due to their differing education levels, it is likely that Henrika and Joachim would have access to different jobs, incomes and support systems, all of which would influence their psychological development and mental wellbeing.

## The interaction of biopsychosocial factors

Biological, psychological and social factors do not operate in isolation. They are affected by each other and can influence different people in different ways. Take the student mentioned earlier who receives a lower-than-expected SAC score. They might not have the resilience to cope effectively with the disappointment (psychological factor) but their lack of such a skill might be partly due to a lack of home support (social factor). How well that student does on a SAC could also relate to their energy levels (biological factor), their mood on that day (psychological factor) or the time they had available to study due to work commitments (social factor). Figure 5 shows an example of how multiple factors could be affecting a person at any one time.



**FIGURE 5** An example of how biological, psychological and social factors can influence a person's state of mind

All factors from each of the three domains of the biopsychosocial model are considered equally important in forming a holistic understanding of psychological development and mental wellbeing. However, individual factors from each domain can have different levels of influence depending on the absence or presence of other factors.

## 2.2 CHALLENGE

### Considering the context behind biopsychosocial factors

Copy and complete the table by:

- 1 identifying one factor from each of the three domains of the biopsychosocial model
- 2 explaining how each factor could have a positive effect on psychological development or wellbeing for one person and how the same factor could have a negative impact on another person
- 3 justifying each of your responses.

Domain	Example of a factor from this domain	How could this factor have a positive impact on psychological development?	How could this factor have a negative impact on psychological development?	Justification
Biological factor				
Psychological factor				
Social factor				

## 2.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain what the biopsychosocial model is and explain why it is important in understanding psychological development and mental wellbeing.
- 2 Copy and complete the following table and provide at least five examples of each type of factor.

Factor	Definition	Examples
Biological		
Psychological		
Social		

### Apply, analyse and compare

- 3 Danae is a Year 11 student with her first exams approaching. Explain how one factor from each domain of the biopsychosocial model could affect Danae's mental wellbeing during the exam period.
- 4 Compare the biological and psychological domains of the biopsychosocial model.
- 5 Consider a mindset or attitude that you have developed in your lifetime. Apply your understanding of the biopsychosocial model to analyse how one factor from each domain may have influenced the development of your mindset or attitude.

- 6 Consider a time in your life that you were feeling a negative emotion, such as stress or sadness. Analyse how each domain from the biopsychosocial model could have influenced your wellbeing at this time.

### Design and discuss

- 7 Daisuke, who is 14, is struggling to concentrate at school. His parents have recently separated, and he is feeling stressed due to the change in routine this has caused for him. His teachers report that he constantly appears tired and often throws his lunch in the bin after walking around alone in the yard, rather than hanging out with his friends like he used to.
  - a Create a diagram depicting the range of biological, psychological and social factors affecting Daisuke at present. Refer to the diagram in Figure 5 for inspiration.
  - b Discuss how two or more of the factors affecting Daisuke could interact with each other to affect his psychological development or wellbeing.

## 2.3

# Emotional development over the lifespan

### KEY IDEAS

- ✦ Attachment refers to the emotional bond between an infant and caregiver. The degree and style of attachment formed depends on a range of factors.
- ✦ Harry Harlow found that contact comfort was more likely to lead to attachment between an infant and caregiver than provision of sustenance.
- ✦ Mary Ainsworth found that attachment formed during infancy (specifically the first 12 months of life) affects an individual's emotional development throughout the lifespan.



#### emotion

physical or psychological change that influences your response to a feeling or situation

#### attachment

the emotional bond formed between an infant and a caregiver

Have you ever wondered why some people cry more than others? Or why some people seem able to keep calm no matter how frustrating a situation may appear? The study of emotional development explores how we learn emotions and how to deal with them over our lifespan.

**Emotions** are mental states that occur in response to people, objects or experiences.

Emotions can be pleasant, such as joy, love and excitement, or unpleasant, such as sadness, anxiety and anger. All emotions are integral to our psychological experience as they are essential for developing and maintaining relationships that bring meaning to our lives.

Emotions also provide a lens for decision-making and reflection.

In this chapter we will consider two theories of emotional development – one proposed by Harry Harlow and the other by Mary Ainsworth. Both theories explore the concept of **attachment**, which refers to the emotional bond formed between an infant and a caregiver.

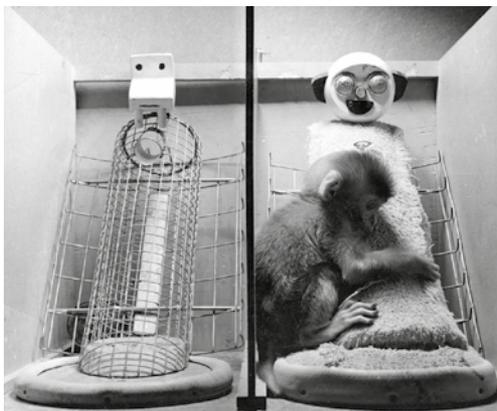
## Harlow's theory of attachment

Harlow's (1958) research into attachment was conducted on rhesus monkeys. He separated some monkeys from their mothers at birth in an attempt to raise them in a germ-free environment and avoid illness. Through this he discovered something – while the monkeys did not get sick, they were unable to form relationships with other monkeys once they had

grown up. He also found that the monkeys became upset if he removed a blanket from their cages that they had become used to, suggesting they had formed an attachment of some sort to the blanket.

Based on these observations, Harlow extended his research. Harlow separated rhesus monkeys from their mothers immediately after birth and conducted two experiments. First, he placed the infant rhesus monkeys in an environment with two “surrogate mothers”. One of the surrogate mothers consisted of a wire frame that had a baby bottle attached to it, while the other surrogate was made of soft cloth without a feeding bottle attached to it (Figure 1).

The second experiment that Harlow conducted involved dividing rhesus monkeys into two groups and giving each group access to either the wire surrogate mother or the cloth surrogate mother only, for a period of six months.



**FIGURE 1** Despite the wire surrogate mother (left) having a feeding bottle attached, the rhesus monkeys showed a marked preference for the cloth surrogate (right), which provided a source of contact comfort and warmth.

## Harlow's key findings

Through his research Harlow found that:

- when the rhesus monkeys had access to both mothers, they would only spend time with the wire mother when nourishment was required. After feeding, they would go back and spend most of their time with the cloth mother.
- the infant monkeys placed with only the cloth mother spent more time with their surrogate mother than the monkeys placed with the wire mother, even though the wire mother provided them with food and the cloth one did not
- when frightened with a teddy bear, the infant monkeys with access to the cloth mother sought comfort from the surrogate mother, while the monkeys with the wire mother did not seek contact comfort from their surrogate (Figure 2)
- when extra features were added to the cloth mother, such as the ability to rock and feed the infant monkeys, the infant monkeys developed an even stronger attachment to the surrogate mother
- infant monkeys raised by the wire surrogate mother developed atypically, struggling to socialise with other monkeys when grown.



**FIGURE 2** When frightened with a teddy, the monkeys reared by the cloth surrogate ran towards their source of comfort. Monkeys raised by the wire mother did not seek the same comfort from their own surrogate.

## Practical implications of Harlow's research

Harlow's research provided a lot of information on attachment and emotional development. It showed that **contact comfort**, which was provided by being in proximity to the soft, cloth mother, is more important for forming attachment than food or nourishment. Harlow's findings provided a good foundation for further research into the concept of attachment.

**contact comfort**  
the positive emotional state experienced by organisms when they are in proximity to something soft, such as their mother or other soft material

## Criticisms of Harlow's research

While Harlow's findings provided a new insight into the concept of attachment, his research did not go without criticism. Two key criticisms of Harlow's research are that:

- the research was conducted on rhesus monkeys and therefore may not generalise to human beings
- some investigations that Harlow conducted on rhesus monkeys in the 1950s would not be considered ethical by modern research ethics standards. This is explored further in Skill drill 2.3.

### 2.3 SKILL DRILL

#### Evaluating ethics in Harlow's research

##### **Key science skill: Comply with safety and ethical guidelines**

While Harlow's research was conducted on monkeys, ethical considerations still apply. The VCE Study Design for Psychology states that students must be able to "consider the implications of their own and others' investigations of living things" (VCAA, 2022). As you learnt in Topic 1.4, the five ethical concepts are beneficence, integrity, justice, non-maleficence and respect.

#### Practise your skills

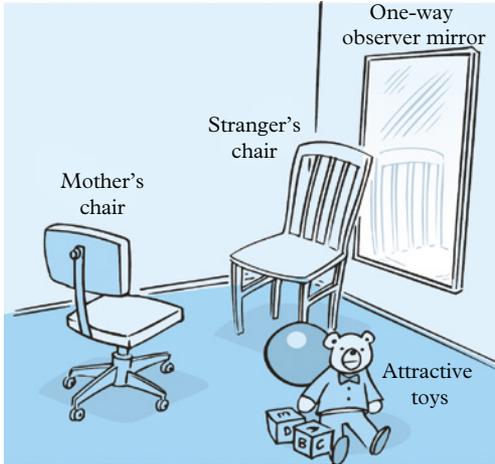
- 1 Explain the concept of "beneficence", using Harlow's research as an example.
- 2 Discuss why Harlow's research might not be considered ethical by today's standards, referring to one or more ethical concepts in your response.

Need help complying with safety and ethical guidelines? Go to Topic 1.4 in your Psychology toolkit.

## Ainsworth's theory of attachment

While Harlow's research focused on whether attachment will be formed and factors affecting the strength of attachment in monkeys, Mary Ainsworth and her colleagues were the first to conduct research into the different types of attachment that exist between human infants and their caregivers.

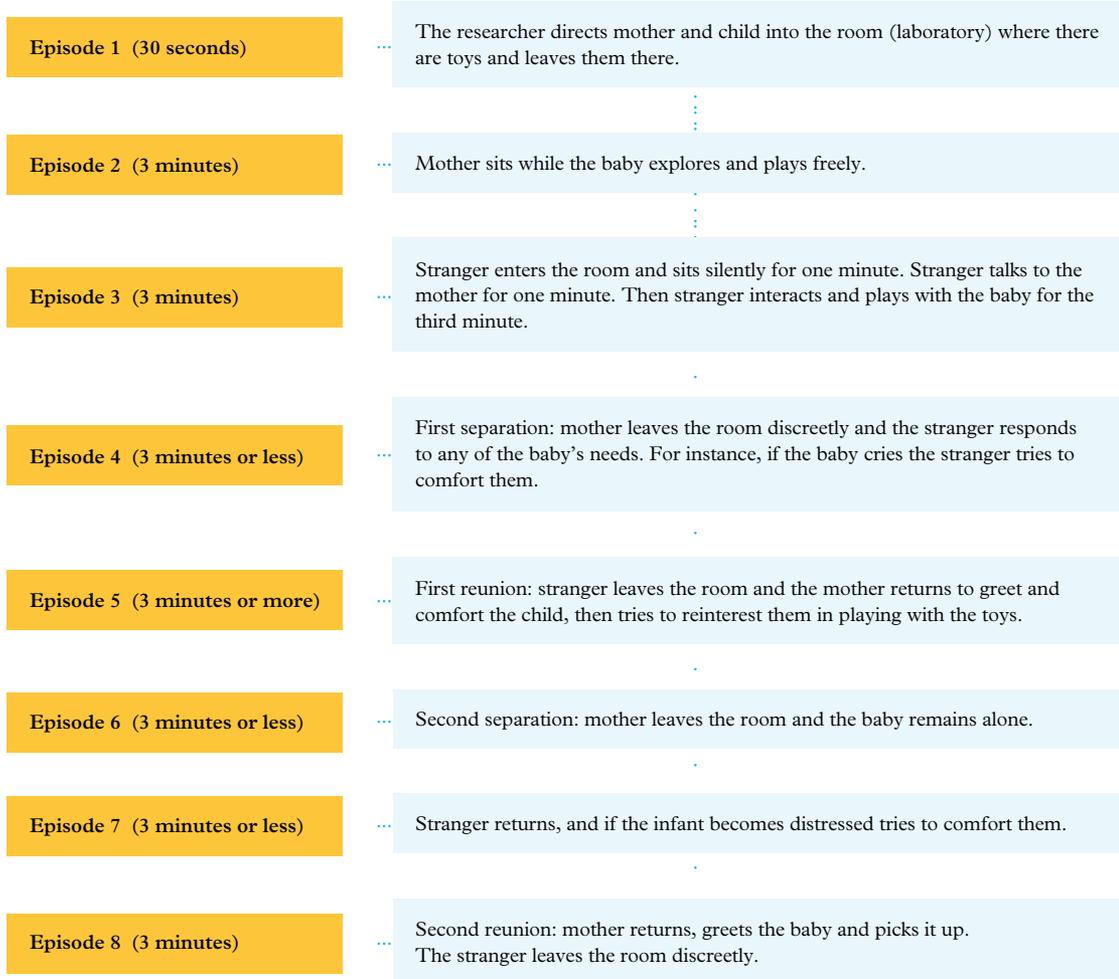
Ainsworth's (1971) research used a contrived laboratory setting called the **Strange Situation**, the layout of which can be seen in Figure 3. Within this laboratory, she would expose infants (aged 9 to 18 months) to a sequence of events involving their caregiver and a stranger. Ainsworth would use the infants' responses to these events to categorise their attachment styles. The sequence of events can be seen in Figure 4.



**FIGURE 3** The Strange Situation laboratory setting used to test the quality of attachment

### Strange Situation

the contrived setting where Ainsworth conducted her research into infant attachment, which consisted of a chair for the mother and stranger, some toys for the infant, and a one-way mirror for observation



**FIGURE 4** The Strange Situation procedure

When analysing information collected from the Strange Situation procedure, Ainsworth considered:

- how the infant reacted to the stranger compared to the mother
- how the infant’s reactions differed between separations and reunions with the mother
- how long it took the mother or the stranger to calm the infant down when they got upset
- the infant’s range of verbal and non-verbal behaviours throughout the experiment.

From this, Ainsworth found that infants tended to fall into one of three main categories of attachment style, though there was a small percentage of infants that did not fit into any of these categories. A fourth type of attachment (disorganised attachment) was added by Main and Solomon (1986) after further research. The four attachment styles and descriptions of their typical behaviours in the Strange Situation are presented in Table 1.

**TABLE 1** Summary of the four attachment styles

Attachment style category	Description of attachment	Description of behaviour from the Strange Situation	Percentage of infants that fell into this category from initial research	
1: <b>Secure attachment</b>	These infants feel safe and confident because they feel they can rely on their caregivers, allowing them to explore and be social.	These infants play quite happily while the mother is present but become somewhat distressed when the mother leaves. The infant allows the stranger to comfort them, but they do not act the same way towards the stranger as they do to the mother. When the mother returns to the room, the infant will seek immediate comfort and shows delight at their return.	65%	<b>secure attachment</b> one of Ainsworth's attachment styles, where infants feel safe and confident because they feel they can rely on their caregivers, allowing them to explore and be social
2: <b>Insecure avoidant attachment</b>	These infants are protective of themselves and remain distant from others.	The infant treats both adults the same way, neither clinging to nor avoiding them. These infants do not get upset when the stranger enters the room. They are not distressed when the mother leaves the room but are distressed when left alone. They can be comforted by either the mother or the stranger. When the mother returns to the room the infant can ignore them, they do not seek immediate comfort.	20 to 25%	<b>insecure avoidant attachment</b> one of Ainsworth's attachment styles, where infants are protective of themselves and remain distant from others
3: <b>Insecure resistant attachment</b>	These infants appear anxious and have an overall negative temperament. They cling to caregivers but also resist their contact.	These infants become extremely distressed when the mother leaves and do not accept comfort from the stranger. They do not play or explore as much as infants from categories 1 and 2. When the mother returns to the room, the infant will seek immediate contact with them, but the infant will continue to be distressed.	10%	<b>insecure resistant attachment</b> one of Ainsworth's attachment styles, where infants appear anxious and have an overall negative disposition. They cling to caregivers but also resist their contact

(continued)

TABLE 1 continued

Attachment style category	Description of attachment	Description of behaviour from the Strange Situation	Percentage of infants that fell into this category from initial research
4: <b>Disorganised attachment</b>	These infants do not feel safe or reassured by the presence of a caregiver. They display inconsistent or conflicting patterns of behaviour towards the caregiver.	The infant might start approaching the caregiver when they re-enter the room, but change their mind halfway there. They might stare at the caregiver but avoid eye contact. This is thought to develop due to the caregiver behaving inconsistently with the infant in the past, so the infant appears anxious, not knowing what to expect.	Not a part of initial research

**disorganised attachment**

an attachment style added to complement Ainsworth's research where infants demonstrate conflicting or inconsistent patterns of behaviour towards their caregiver

## Practical implications of Ainsworth's research

Ainsworth's research has been replicated numerous times and been useful to measure and describe the types of attachment styles between infants and caregivers. It provides helpful information about the impact of parent-child relationships on a child's temperament and attachment to their caregiver. For example, insecure avoidant attachment in infants is likely to result from abusive or neglectful parents, while insecure resistant attachment tends to form when caregivers are not as responsive to the needs of their child compared to parents of securely attached children. Furthermore, the type of attachment formed in infancy has been found to have long-term impacts on relationships between adults and how they interact with each other.

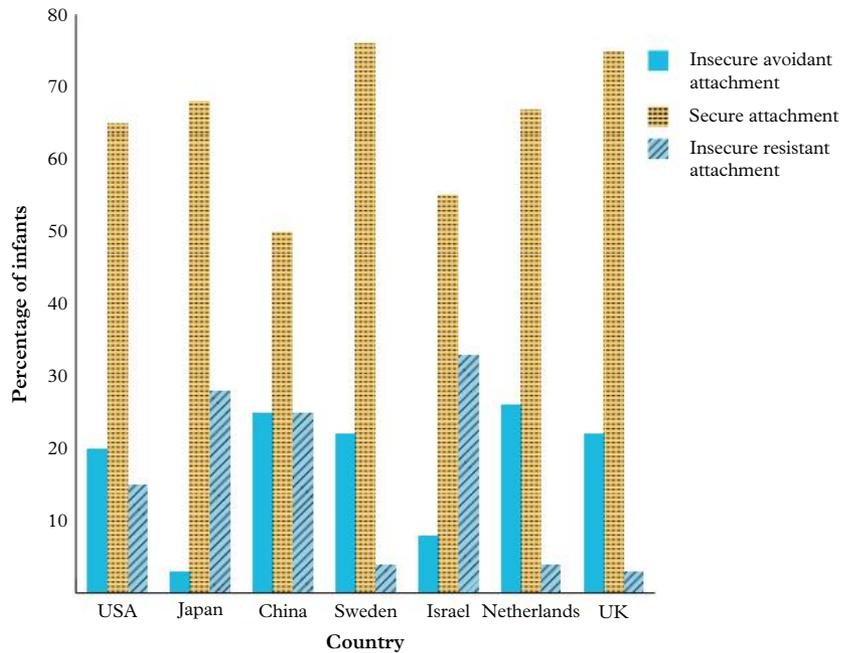
## Criticisms of Ainsworth's research

Three major criticisms of Ainsworth's research are that:

- replication of the research worldwide has shown the proportion of children showing each attachment style can differ according to culture (Figure 6); Ainsworth's research does not account for nor explain these cultural differences
- by being based in a contrived laboratory setting, with only brief separations and reunions, the findings of Ainsworth's research may not be a valid representation of how children behave in a real-world setting or varied situations
- the research has been criticised for violating the ethical concept of non-maleficence, as infants were knowingly placed into a situation where they would become distressed. (Note, however, that if an infant became too distressed, researchers cut the separation periods short so the caregiver could provide comfort.)



FIGURE 5 Ainsworth's research does not account for or explain cultural differences in attachment style.



**FIGURE 6** Attachment classifications of infants from different cultures tested in replications of the original Strange Situation

## 2.3 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify the aim of Harlow's research into the attachment of rhesus monkeys.
- 2 Describe the method used by Harlow to investigate the attachment of rhesus monkeys to their caregivers.
- 3 Explain whether Ainsworth's research used participant observation or controlled observation for data collection.

### Apply, analyse and compare

- 4 Write a hypothesis that would be supported by findings from Harlow's second experiment.
- 5 Contrast the monkeys' behaviour towards the wire mother and the cloth mother demonstrated in Harlow's research. Analyse what this means about their attachment to each of the mothers.
- 6 Compare the findings of Ainsworth's research with the findings of Harlow's research.
- 7 Explain whether the results of Harlow's research can be generalised to humans. Justify your response.

- 8 Distinguish between the three attachment styles that Ainsworth identified in terms of:
  - a how the infant acts during separation from the caregiver
  - b how the infant acts during reunion with the caregiver
  - c how the infant acts towards the stranger
  - d the infant's overall temperament.

### Design and discuss

- 9 Discuss why human replication of Harlow's research would be unethical.
- 10 Select one attachment style from Ainsworth's research. Imagine you are asked to direct a re-enactment of the Strange Situation scenario that demonstrates your chosen attachment style with three actors playing the role of caregiver, stranger and infant. Create a short script for your performance and discuss which aspects of the script replicate the criteria used to assess attachment.

## 2.4

# Cognitive development over the lifespan

## KEY IDEAS

- ✦ As children age, the way that they think about their world evolves to become more complex.
- ✦ Piaget proposed that cognitive development occurs in a set of four stages, gradually moving from assimilating to schemata to accommodating schemata.



### cognitive development

the development of mental processes and abilities throughout the lifespan

The way you thought about and interacted with the world as a child is vastly different from the way in which you do so now, which is different again to how you will remember it later in your adulthood. **Cognitive development** refers to the change and growth in our mental processes and abilities across the lifespan, and Jean Piaget posed a theory to explain this type of development and how it occurs during our formative years.

## Piaget's theory of cognitive development

Jean Piaget (1896–1980) was an influential psychologist in the twentieth century who studied childhood development. He formed a theory of cognitive development proposing that all children go through four distinct cognitive stages as part of their development. He suggested that we must go through all four stages sequentially, and that progression through these stages depends on how mature a person's brain is. This is because of the brain's influence on how we experience and adapt to the world around us.

### Key concepts of Piaget's theory

To understand Piaget's theory, you must first understand three key concepts: schemata, assimilation and accommodation.

### Schemata

**Schemata** (singular: schema) are mental frameworks that our brains use to organise past experiences and provide a way of understanding future experiences. Piaget proposed that as children develop cognitively, they form schemata that shape their understanding of an object or experience. As we develop and learn through exposure to new experiences, our schemata become more complex. For example, a newborn infant's schema about food would be limited to milk. As the infant grows and develops, their understanding of food expands to involve different schemata.

### schema

(pl: schemata) an organised mental framework of knowledge about a person, place or thing



FIGURE 1 Jean Piaget

## Assimilation

**Assimilation** is the process by which new experiences and ideas are made to fit in with pre-existing ideas and understanding. During assimilation, new experiences and ideas are combined with existing schemata. You may have noticed that infants tend to put many objects into their mouths, particularly objects new to them. Infants have a sucking schema. When handed a new toy, infants will often place this toy in their mouth, in an attempt to fit this object in with their existing schema about sucking. This is one example of assimilation.



**FIGURE 2** Infants will often place new toys in their mouth in attempt to fit the new object into their existing schema about sucking.

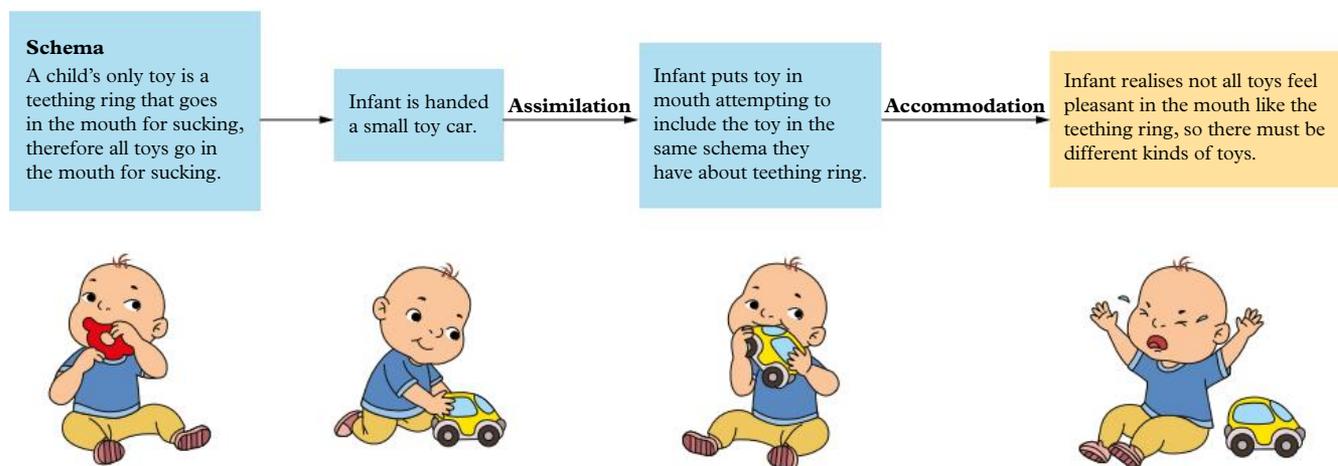
**assimilation**  
the process whereby new experiences and ideas are made to fit in with pre-existing ideas and understanding

Another example is if a young child saw a toy truck for the first time, they might examine it and decide it fits into their schema of cars, since trucks have similar qualities to cars. It is important to note that as the same child becomes older or has other experiences with toy trucks, they might discover that a toy truck does not fit into their understanding of cars, due to distinct differences. This is where accommodation occurs.

## Accommodation

**Accommodation** is the process by which pre-existing ideas are changed or adapted to fit with new information or experiences. This process is more complex than assimilation. During accommodation, new experiences cause schemata to be modified. Building on from the examples above, a child who places a toy in their mouth and discovers it does not taste nice will probably alter their schema so that sucking no longer applies to toys of that nature. Similarly, when a child realises that trucks are different to cars, they may alter their schema about cars to exclude trucks or create new schemata about vehicles that include both trucks and cars.

**accommodation**  
the process whereby pre-existing ideas are changed or adapted to fit new information or experiences



**FIGURE 3** Example of how assimilation and accommodation can occur in relation to the same schema

**sensorimotor stage**

the first stage in Piaget's theory of cognitive development, where infants aged from birth to two years learn about their world through their senses and actions

**preoperational stage**

the second stage in Piaget's theory of cognitive development, where children aged two to seven years use symbols, images and language to represent their world

**concrete operational stage**

the third stage in Piaget's theory of cognitive development, where children aged seven to 12 years can perform basic mental operations that involve physical objects

**formal operational stage**

the fourth and final stage in Piaget's theory of cognitive development, where children aged 12 and above can think logically and methodically about both physical and abstract problems

## Piaget's four stages of cognitive development

According to Piaget, a child's cognitive development involves both understanding new experiences in relation to knowledge that they already have (assimilation), and modifying thinking for new experiences (accommodation) that do not fit into current schemata. Piaget's model includes four separate stages that summarise the different schemata he proposed children have at different ages: **sensorimotor**, **preoperational**, **concrete operational** and **formal operational stages**. His model also suggests how schemata change as children grow. Table 1 summarises these four stages and their schemata.

**TABLE 1** Piaget's four stages of cognitive development

Stage	Age range	Summary of schemata
Sensorimotor	0 to 2 years	Infants learn about their world through their senses and actions.
Preoperational	2 to 7 years	Children use symbols, images and language to represent their world.
Concrete operational	7 to 12 years	Children can perform basic mental operations that involve physical objects.
Formal operational	12+ years	Children can think logically and methodically about both physical and abstract problems.

### Sensorimotor stage

From birth until two years of age, Piaget proposed that the way in which infants mentally represent their world is limited to what they can learn from their senses and movements. As they are unable to use much verbal communication, they explore their world through what they can hear, see and taste, as well as their physical motor actions (for example, moving their arms or grasping an object). During this stage infants realise there is a relationship between their own actions and what happens around them. This allows them to integrate sensory information and motor information to develop goal-directed behaviour. That is, behaviour that is intentionally performed to help obtain a desired outcome.

Early in life, infants do not have the cognitive ability to understand that an object exists when it cannot be seen. When you cover your face with your hands or duck behind a chair, infants think you have disappeared. This is why playing peekaboo with infants often leaves them thrilled. One key cognitive development that occurs during the sensorimotor stage is that infants develop **object permanence**, meaning that they learn that objects can still exist even when they can no longer see them. Once object permanence has been established, the game of peekaboo is much less entertaining for a child because they know you are there!



**FIGURE 4** During the sensorimotor stage, infants develop object permanence.

## Preoperational stage

From 2 to 7 years of age, a child’s thinking becomes more sophisticated than an infant’s because they understand more about language and communication. Children begin engaging in make-believe play, where they demonstrate **symbolic thinking** (use of symbols or other objects to represent things that are not there) and **animism** (the belief that everything is alive and conscious). To a preoperational child, a leaf or stick found at the park could act as money or a ticket while playing trains, and the child may perceive the trains to have their own personalities and to speak to the passengers.

Despite children’s thinking generally advancing during the preoperational stage, preoperational children can often experience limitations to their logic and cognitive abilities in these years. These limitations are summarised in Table 2.



**FIGURE 5** When playing with objects such as trains, preoperational children often perceive the trains to be alive and conscious and may even speak to the objects as if they could reply.

### object permanence

a development in cognition where children learn that objects continue to exist even when they cannot be seen

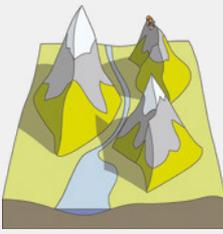
### symbolic thinking

according to Piaget, the cognitive process of using symbols or other objects to represent things that are not there

### animism

a limitation of young children’s thinking where they believe that everything is alive and conscious

**TABLE 2** Limitations to cognitive abilities during the preoperational years

Limitation	Explanation	Example
<b>Egocentrism</b>	Preoperational children are unable to view the world from someone else’s perspective. Towards the end of the preoperational stage, the child moves from egocentrism to decentred thinking.	Piaget used a “Three Mountain Task” where children viewed a model like the one pictured.    When showed pictures of the mountain model from various angles, they could pick out their own view, but not views from other perspectives.
<b>Centration</b>	Children in the preoperational stage can only focus on one aspect of a task at a time.	A preoperational child asked to sort a box of blocks according to colour and shape is likely to be only able to sort by one of these features at a time.
<b>Difficulty with seriation</b>	Children find it difficult to arrange items in order, such as size.	If given an assortment of different-sized sticks, a child in the preoperational stage would struggle to sort them from shortest to longest.

(continued)

### egocentrism

a limitation of young children’s cognition which means they are unable to view the world from someone else’s perspective

### centration

a limitation of young children’s cognition that only allows them to focus on one aspect of a task at a time

### seriation

the ability to arrange items in order

TABLE 2 continued

Limitation	Explanation	Example
<p><b>conservation</b> a development in cognition where children become able to understand that the same object can take different forms, or that an object can stay the same even if it changes appearance</p>	<p>Children are unable to understand that the same object can take different forms, or that an object can stay the same even if it changes appearance. This applies to all the different ways that objects can be manipulated – including volume, mass, number, size and length.</p>	<p>The same number of counters sorted into different-sized lines would each be viewed as different numbers to a preoperational child.</p>  <p>Child says both rows have the same number.</p>  <p>Preoperational child says the bottom row has more.</p>  <p>Preoperational child says the top row has more.</p>
<p><b>irreversibility</b> the inability to understand that actions can be done and then undone</p>	<p>Children in the preoperational stage do not understand that actions can be done and then undone.</p>	<p>A preoperational child whose tower of blocks gets knocked over by a sibling may not grasp the fact that they can build the tower once more.</p>

### Concrete operational stage

Between the ages of 7 to 12, children’s cognitive abilities continue to develop as they gain the ability to perform mental operations. These operations are limited to “concrete” objects and problems that can be seen, touched or experienced in some way. Throughout this stage children often struggle to solve problems that involve abstract thinking, where parts of the problem are not represented to them physically in some way. During this stage children reduce many of the limitations they faced in the preoperational stage, such as beginning to understand reversibility, and they display less centration and less egocentrism. Children also develop their ability to classify objects and ideas into groups in this stage. Additionally, Piaget found that it is within the concrete operational stage that children also start to understand conservation. The investigation he used to demonstrate this is explored further in Skill drill 2.4.

## 2.4 SKILL DRILL

### Identifying variables and formulating hypotheses in relation to Piaget’s research

#### Key science skills: Develop aims and questions, formulate hypotheses and make predictions

To investigate conservation of volume, Piaget performed simple tasks that changed the appearance of water and clay and asked children questions about these changes.

In one investigation, Piaget started with two glasses with the same amount of water in each. After having the child identify that both glasses held the same amount of water, he poured one glass of water into a taller, skinnier glass. Preoperational children believed the tall, skinny glass held more water, while concrete operational children could understand that the volume of liquid remained the same.

In another investigation, Piaget started with two balls of clay that were the same size.

He then rolled one of the balls into a long sausage shape, and asked which one was bigger. Preoperational children identified that the sausage-shaped clay was bigger (despite having seen it rolled out from the same sized ball of clay as the unrolled ball). The concrete operational children could identify that both lumps of clay were the same size.

#### Practise your skills

- 1 Identify the independent and dependent variables for Piaget’s two investigations.
- 2 Formulate a hypothesis that would be supported by Piaget’s findings for one of the above investigations.
- 3 Suggest the type(s) of data that Piaget could collect through these investigations and justify your choice(s).

Need help identifying variables and formulating hypotheses? Go to Topic 1.2 in your Psychology toolkit.

## Formal operational stage

From the age of 12 and onwards, Piaget believed that children's cognitive abilities develop to improve thinking logically and methodically (formally) about both physical and abstract problems. The limitations from preoperational and concrete operational stages cease, and children's thinking becomes more flexible as they master the ability to solve complex and hypothetical problems.

Children in the formal operational stage can engage in abstract thinking. **Abstract thinking** refers to performing mental operations without reliance on seeing or hearing physical elements of the world, but instead being able to see these elements in one's head. For example, children can imagine what things would or could be like, without them actually being so. This can lead to **idealistic thinking**, a thinking style where children are able to imagine a perfect world, and can subsequently expect this or long for it, even though it does not exist.



**FIGURE 6** Children in the concrete operational stage can perform mental operations provided they can physically represent them in some way. This child is using blocks to represent numbers.

**abstract thinking**  
the ability to perform mental operations without reliance on seeing or hearing physical elements of the world, but instead being able to perform these in one's head

**idealistic thinking**  
according to Piaget, a child's ability to imagine a perfect world, even though it does not exist

## Practical implications of Piaget's theory

Understanding which cognitive skills are accessible to children of different ages (and conversely, which ones are not) is useful when deciding on appropriate activities to effectively communicate with, entertain, teach and challenge children. For example, we know not to give a language-dependent task to a child in the sensorimotor stage, and that a child in the concrete operational stage might prefer a physical jigsaw puzzle rather than a brain teaser puzzle.

## Criticisms of Piaget's theory

Though research has supported Piaget's theory of cognitive development regarding the sequential nature of our development, there are some criticisms of his theory.

- The age ranges assigned to Piaget's stages could be inaccurate, as some children gain cognitive skills earlier than the ages Piaget defined.
- While Piaget's theory suggests that cognitive skills progress from simple thinking to complex thinking as we age, other research has suggested that early cognition is more complex than Piaget described.
- Development does not always occur in discrete stages as Piaget suggested. Children may show cognitive abilities of two stages at the same time. For example, a child might operate most in line with the concrete operational stage but have begun demonstrating some abstract thinking characteristic of the formal operational stage.
- Piaget's theory does not account for cultural influences on cognitive development. Some cultures may teach or foster cognitive skills in ways other than logical or methodological thinking.
- Piaget's research was conducted mostly on his own children, which raises questions about the integrity of his scientific methodology. Some of his research was conducted on a small, biased convenience sample and thus may not generalise to all human children.

## 2.4 CHECK YOUR LEARNING



### Describe and explain

- 1 Briefly outline Piaget's theory of cognitive development.
- 2 Identify and explain the three key concepts that underpin Piaget's theory.
- 3 Copy and complete the table by identifying the age ranges assigned to each of Piaget's four stages of cognitive development and briefly summarise the cognitive development(s) and limitation(s) characteristic of each stage.

Stage	Age range	Cognitive development(s)	Limitation(s)
Sensorimotor			
Preoperational			
Concrete operational			
Formal operational			

### Apply, analyse and compare

- 4 Distinguish between accommodation and assimilation using an example not used in the text.
- 5 Contrast the types of cognitive processes that are accessible to children in the concrete operational and formal operational stages.
- 6 Copy and complete the table by applying your understanding of Piaget's stages of development. Provide examples of tasks a child could and could not complete for each stage.

Stage	Example of a cognitive task that a child in this stage could complete	Example of a cognitive task that a child in this stage could not complete
Sensorimotor		
Preoperational		
Concrete operational		
Formal operational		

- 7 Jarrah, aged 20, is babysitting his niece Jane (3 years old) and his nephew Hugo (9 years old). Assess how Piaget's theory could be useful to Jarrah as he entertains the two children. Use examples in your responses.

### Design and discuss

- 8 Evaluate the integrity and external validity of Piaget's research.
- 9 Design a test to assess each of the following characteristics of cognitive development. For each test design, suggest the likely performance of a child on that test both before and after they have mastered the skill:
  - a object permanence
  - b conservation
  - c egocentrism
  - d seriation
  - e centration.

## 2.5

# Social development over the lifespan

### KEY IDEAS

- ✦ Erikson proposed that social experiences during certain periods of our lives contribute to whether we successfully resolve dilemmas and continue to develop psychologically.
- ✦ Erikson developed an eight-stage model to represent the dilemmas we experience throughout our lives and what happens if we are successful or unsuccessful in resolving them.



Have you ever learnt something by watching someone else do it? This is just one example of how an external factor from your social environment can influence your development. By watching someone else do something, you have developed a new skill you can execute yourself. We live in a social world where external factors influence us almost constantly. As such, social factors are integral to a comprehensive understanding of psychological development. Erik Erikson is one renowned psychologist who investigated social influences on development over the lifespan.

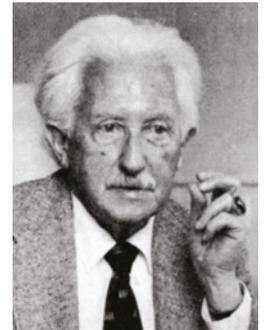


FIGURE 1 Erik Erikson

## Erikson's theory of psychosocial development

Erik Erikson (1902–1994) proposed that human beings develop by moving through a series of eight psychosocial stages, which are influenced by our social experiences during those periods. He believed that during each stage of life we experience **psychosocial dilemmas**, or conflicting psychological states, that need to be resolved. Erikson described these psychosocial dilemmas as a conflict between the individual person and the outside world. He proposed that the outcomes of these conflicts work to shape our personality.

### psychosocial dilemma

a conflict between the individual and the outside world, the outcome of which Erikson believed shapes our personality



FIGURE 2 Erikson's first stage of psychosocial development, "trust versus mistrust", is proposed to affect 0 to 1 year old children.

Erikson suggested that if we resolve the conflict within each stage, a balance is created between the self and society, which would lead to optimal personal development. In a step-by-step process, each dilemma needs to be resolved so that the next dilemma in the following stage can also be resolved. Erikson also proposed that if dilemmas were left unresolved, they would result in personal development being held back. Erikson’s eight psychosocial stages and the dilemma for each period are shown in Figure 3 and described in Table 1.

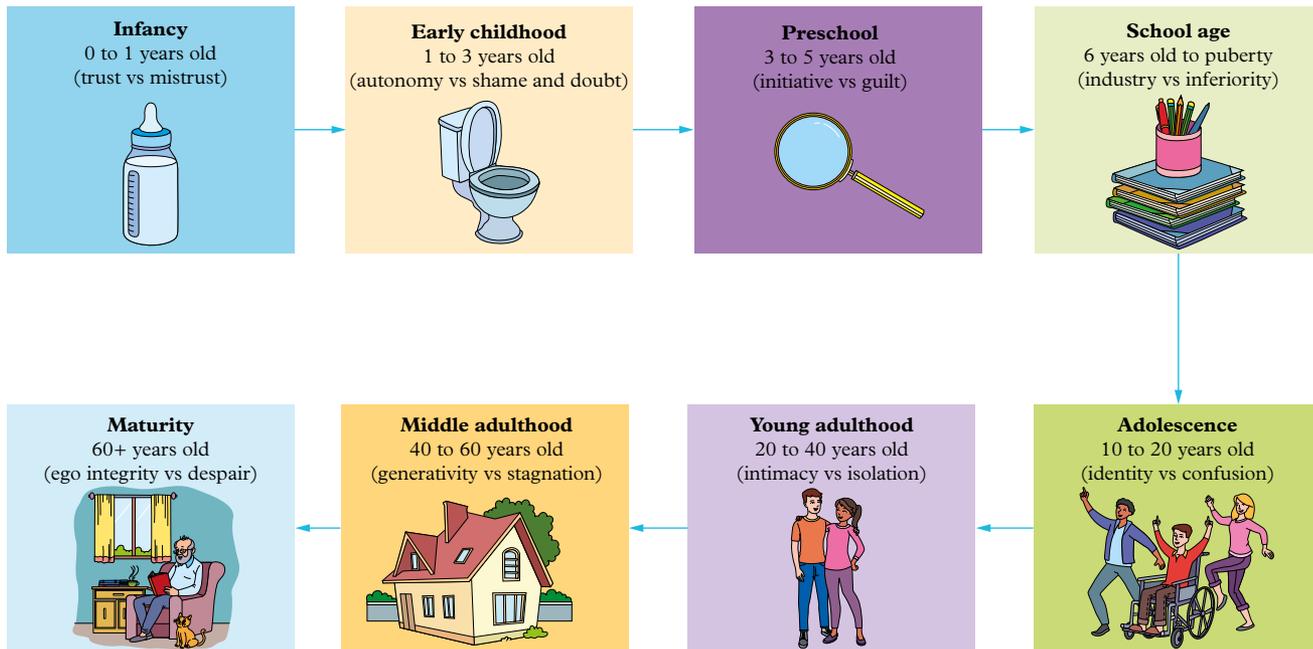


FIGURE 3 Erikson’s eight stages of psychosocial development

TABLE 1 Descriptions of each psychosocial dilemma

Stage	Age	Psychosocial dilemma	Examples of important events in this stage	Outcome
1: Trust versus mistrust	0 to 1 year old	<p>Infants are completely dependent on others. During this time, if infants are provided with warmth, love, care and attention from their caregivers, they are likely to acquire a sense of <b>trust</b> towards the caregiver and the world around them. This enables infants to develop attachment to and a relationship with their caregivers.</p> <p>If infants are deprived of consistent love and support, they are likely to develop <b>mistrust</b>. This can lead to issues such as insecurity and an inability to relate to others.</p>	Children can develop trust if they are fed and comforted when needed, but might struggle with this if their needs are not met.	Infants develop what Erikson called <b>hope</b> – they are open to exploration and experiences but are also safely hesitant of potential dangers.

(continued)

**trust**

Erikson’s term for when children successfully form attachment to their caregiver and establish a trusting relationship with them

**mistrust**

Erikson’s term for when an infant does not achieve trust, leading to insecurity, suspiciousness and an inability to relate to others

TABLE 1 continued

Stage	Age	Psychosocial dilemma	Examples of important events in this stage	Outcome
2: Autonomy versus shame and doubt	1 to 3 years old	As children seek out independence, they develop <b>autonomy</b> when they feel they have freedom to explore and discover the world around them.	Children are often being toilet trained in this stage. Ideally, they feel empowered to attempt this challenge and make choices for themselves.	If successful in resolving the dilemma here, children develop what Erikson called <b>will</b> – a belief that they can act in line with their intentions and goals.
		However, if a child in this period feels restricted due to overprotective caregivers, they can develop <b>shame and doubt</b> .		
3: Initiative versus guilt	3 to 5 years old	While children continue to develop and explore their world, they can develop <b>initiative</b> when caregivers create an environment where children feel safe to explore, ask questions and make independent choices. This encourages them to use their imagination, which helps to boost their confidence and self-esteem.	Children often have increased social interactions with other children during this stage. They make up games and play with other children if they feel confident enough to do so.	Erikson believed that successful resolution of the dilemma in this stage leads to a sense of <b>purpose</b> – where children feel able to step out of their comfort zone, as well as to connect with and lead others.
		However, children who do not feel safe to explore and question the world, due to being harshly criticised or punished, might develop feelings of <b>guilt</b> instead. This can lead to the child having impaired self-esteem and lacking courage or confidence to use their imagination and explore the world.		
4: Industry versus inferiority	6 years to puberty	In this stage, children start becoming interested in how things are made and how they work, and may engage in related play and activities like building, painting and reading. Encouragement and praise lead to children feeling worthwhile, enabling them to develop a sense of <b>industry</b> about their efforts.	Children are at school for the first time in this stage. They are learning new skills and being challenged regularly. Encouragement and reinforcement can teach them to feel competent.	Erikson believed that this dilemma leads to a feeling of <b>competence</b> – where children believe they can achieve tasks that they set for themselves or that others set for them.
		However, if their work is not praised, or they can tell that their efforts are considered otherwise inadequate, the child can feel discouraged and develop feelings of <b>inferiority</b> . This can come about by comparing themselves to others, too.		

**autonomy**

Erikson's term for children wanting independence as their mental and physical abilities develop

**shame and doubt**

Erikson's term for what children feel when they do not achieve autonomy, which is a lack of independence corresponding with their abilities

**initiative**

Erikson's term for children feeling as though they are safe to play, explore and use their imagination

**guilt**

Erikson's term for when initiative is not achieved because children do not feel comfortable exploring, playing or asking questions

**industry**

Erikson's term describing how children feel when they are praised and encouraged for their interest in how things are made and how they work

**inferiority**

Erikson's term for when industry is not achieved, leaving children to feel inadequate

(continued)

TABLE 1 continued

Stage	Age	Psychosocial dilemma	Examples of important events in this stage	Outcome
5: Identity versus role confusion	10 to 20 years old	During adolescence, we start to think about who we are and what we will do with our lives. Adolescents who experience consistency in their values, culture and relationships develop a sense of <b>identity</b> . This fosters feelings of safety around self-expression and inspiration.	Social relationships are integral to young people’s lives during this stage. Our interactions with others, such as friends, peers and colleagues, shape our identity with each new experience.	In this stage, adolescents develop what Erikson called <b>fidelity</b> – a sense of being able to live in accordance with the expectations and standards of society.
		However, inconsistent or conflicting experiences with culture, values and relationships can lead to <b>role confusion</b> , where an adolescent feels isolated and struggles to develop their identity. They might feel uncertain about who they are or lose their identity by conforming to the crowd.		
6: Intimacy versus isolation	20 to 40 years old	An adult with a secure identity and the ability to care about others develops a sense of <b>intimacy</b> . This enables them to successfully maintain fulfilling relationships with other people in the forms of both friendship and love.	People in this stage are likely to experience more serious, romantic relationships with long-term commitments, which fosters their ability to love and care in new ways.	It is in this stage where Erikson states that we develop <b>love</b> – the ability and desire to develop and maintain lasting and meaningful romantic relationships.
		However, adults who have not developed a stable identity yet can struggle to form caring and fulfilling relationships with others, leading to <b>isolation</b> .		
7: Generativity versus stagnation	40 to 60 years old	Middle-aged adults can feel that their life should make contributions to that of others, particularly those of the next generation. This feeling is known as <b>generativity</b> . It enables adults to make a positive contribution to society that they find fulfilling, such as through parenthood, careers and other community endeavours, such as volunteering.	In this stage, adults often work hard to leave their mark on society – this may be through achievements in their career or the parenting of their children.	Erikson believed that we begin showing <b>care</b> in this stage – a sense of pride and satisfaction in our accomplishments.
		However, adults that do not develop generativity may feel <b>stagnation</b> , where they struggle to find a way to contribute to society due to self-absorption and a lack of personal growth. This can make them feel disconnected from society.		

(continued)

**identity**

Erikson’s term for when adolescents build a steady and authentic identity for themselves

**role confusion**

Erikson’s term for the uncertainty that adolescents can feel about themselves and their place in the world if they have not achieved a sense of identity

**intimacy**

Erikson’s term for adults feeling as though they can share their lives with others and develop caring relationships

**isolation**

Erikson’s term for when an adult feels as though they are unable to develop caring relationships

**generativity**

Erikson’s term for older adults’ investment in the next generation

**stagnation**

Erikson’s term for how older adults can feel frustrated at not having achieved generativity and so struggle to feel connected to society

TABLE 1 continued

Stage	Age	Psychosocial dilemma	Examples of important events in this stage	Outcome
8: Integrity versus despair	60 years +	<p>If all prior psychosocial dilemmas have been resolved successfully, a sense of <b>integrity</b> is developed when adults feel that they have made all the right choices and lived a satisfactory life. This fosters wisdom and the person can continue living their life to the fullest without fear of death, which they merely see as inevitable rather than something to be feared.</p> <p>However, failure to resolve past dilemmas and regret about life choices or missed opportunities can lead to a sense of <b>despair</b>. This can result in a fear of death due to wishing they could go back and do things differently in life.</p>	<p>In this stage, older adults reflect on their lives and whether they have achieved all their goals, making an overall judgment on whether their life has been worthwhile.</p>	<p><b>Wisdom</b> is the ultimate goal of Erikson’s final stage – a sense of closure based on how we have lived our life, with no reason to fear death.</p>

**integrity**  
Erikson’s term for successfully resolving the final psychosocial dilemma where older adults feel a sense of self-worth and are not afraid of death, having achieved what they feel they have needed to

**despair**  
Erikson’s term for when an older adult has not achieved integrity and feels regret about the path their life has taken

Erikson believed that the dilemma at each stage needed to be resolved to successfully move to the next stage of development and resolve the next dilemma. However, the aspirations and desires of each stage are not limited to the age range assigned to that stage – most people seek out things like intimacy, autonomy and integrity throughout their lives.

## Practical implications of Erikson’s theory

The dilemmas discussed by Erikson are notable opportunities for growth and development that occur in most people’s lives. An understanding of social factors that contribute to development at different stages of our lives can help us anticipate and manage challenges we face along the way and prepare for their impacts on our psychological development.

## Criticisms of Erikson’s theory

Some criticisms of Erikson’s theory include:

- whether it is necessary for all stages to be experienced sequentially, as well as whether the psychosocial dilemmas are confined to the age ranges specified
- the theory failing to explain exactly what social experiences are necessary to successfully resolve the dilemmas in each stage in order to move to the next stage.



FIGURE 4 Erikson’s theory has been criticised for confining psychosocial dilemmas to specific age ranges. A dilemma such as “intimacy versus isolation” could be experienced both before and after 20 to 40 years of age.

## Study tip

Erikson's theory comprises several key terms and stages. Developing your own mnemonic for these can help you remember the names and order of the stages.

## 2.5 SKILL DRILL

### Comparing investigation design methods in relation to Erikson's research

#### Key science skill: Plan and conduct investigations

Erikson's theory of psychosocial development encompasses the entire human lifespan.

#### Practise your skills

- 1 Compare the practical implications of using a within-subjects or a between-subjects design to test Erikson's theory.

Need help planning and conducting investigations? Go to Topic 1.3 in your Psychology toolkit.

## 2.5 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe Erikson's theory of psychosocial development.
- 2 Identify the eight stages of Erikson's theory and their corresponding psychosocial dilemmas.
- 3 Explain what is meant by the term "psychosocial dilemma" with reference to an example.

### Apply, analyse and compare

- 4 Choose one stage of Erikson's theory that you have experienced. Use an example from your own life to illustrate the dilemma associated with that stage. Comment on whether you believe the dilemma was successfully resolved or not.
- 5 For each of the following scenarios, identify the psychosocial dilemma that is being experienced. Justify your response.
  - a Jamal is conflicted about whether to join the school play or not, worried his friends will judge him even though he loves performing.

- b Adeebea does not want to have children of her own, but instead has chosen a career in education to work with young people.
- c Following the death of his wife, Giacomo wishes he had spent longer appreciating his time with her.
- d Marika looks at the toys on the shelf in the store with interest but will not touch them for fear of breaking one.
- e After an unsuccessful marriage, Bashaar struggles to connect with new people.

### Design and discuss

- 6 Choose any two stages of Erikson's theory and discuss how unresolved dilemmas from those stages could negatively affect psychological development.
- 7 Design a flowchart depicting Erikson's eight stages according to whether the dilemmas at each stage are resolved or unresolved.

# 2.6

## Sensitive and critical periods

### KEY IDEAS

- ✦ Sensitive and critical periods are times during human development where we are primed to learn or develop certain skills, provided we have the right experiences.



### plasticity

the ability of the brain's synapses to be modified

Have you ever wondered why humans experience so many developmental milestones in their early years, or why there are fewer of them as we age? Or perhaps you have questioned why some young children can pick up a second or third language with ease, while you find learning a second language more challenging in your senior school years. Generally as we age, the brain loses **plasticity** and becomes less able to adapt in response to experience.



**FIGURE 1** Children are often able to pick up a second or third language faster than adults.

Research suggests that there are certain time periods during a person's development when we are primed to learn or develop certain skills, provided we have the right experiences. These periods coincide with times when our brain's nervous system undergoes rapid growth, such as forming new synapses between neurons. These periods occur in abundance during our younger years, and they relate to when and how we develop certain traits and skills.

### sensitive period

a period of time during development when an individual is more responsive to specific experiences from their environment that can shape their development

## Sensitive periods

A **sensitive period** is a period of time during development when an individual is more responsive to specific experiences from their environment that can shape their development. This does not mean that a person will not develop a skill or trait if they are not exposed to a certain experience during the sensitive period. Rather, it is the period in which a person can most efficiently develop a certain trait or skill.

Attempts to learn specific skills after the end of the sensitive period tend to take longer and may result in inferior skill development. For example, human language development is subject to a sensitive period. Human brains are primed to learn language in the early years before puberty. The example in Real-world psychology 2.6 shows what can happen to language skills if a person has limited interaction and exposure to language early in life.

## Critical periods

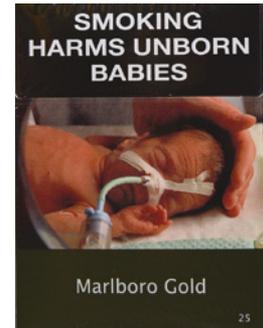
### critical period

a period of time during development when an individual is especially susceptible to specific environmental experiences that shape their development, and their development is particularly vulnerable to deprivation of this experience

A **critical period** is a period during development when an organism is especially susceptible to specific environmental experiences that shape their development. For example, researchers have long known that exposure to certain substances while in the womb can impair an infant's development. This is because the experiences a human fetus has during its time in the womb are critical to its development.

During critical periods, an organism's development is also particularly vulnerable to deprivation of certain experiences. This means that an element of an organism's development can be disrupted or fail to occur if they are not exposed to an essential learning experience during the critical period. For example, ducklings need to imprint on their mother (or another moving object) within the first few days after birth. If they miss this window they will fail to imprint.

While time in the womb is a critical period for humans, there are not many critical periods that occur after we are born. Another example of a critical period for humans is vision development. Human babies must receive exposure to light in the first year of life so that sensory neurons develop in the retina. If this does not happen (for example, because the baby is kept in total darkness), the baby may become permanently visually impaired.



**FIGURE 2** Time in the womb acts as a critical period for human development. It is widely accepted that the ingredients in cigarettes pose a threat to the development of babies during this period.



**FIGURE 3** These ducklings are following their mother because they imprinted on her within the first few days following their birth.

## 2.6 REAL-WORLD PSYCHOLOGY

### Genie Wiley

In 1970, a 13-year-old girl who came to be known as “Genie the Wild Child” was rescued from appalling conditions in Los Angeles, USA. For most of her life, Genie’s parents had kept her confined to a small room, bound to a toilet so she could not move. During this time, she had virtually no interaction with other people, and was punished if she made any sounds. Consequently, she was hardly exposed to any language or communication during the first 13 years of her life.

When she was rescued, she was malnourished, frail and barely made a sound. After working with psychologists after her rescue, Genie was able to develop physical and social skills. However, she was only able to learn a minimal amount of vocabulary and could not understand the rules of grammar. She learnt to speak in short, primitive sentences. The assumption is that Genie failed to acquire language due to the lack of exposure to it during her childhood, the stage when the human brain is most primed to learn language.



FIGURE 4 Genie Wiley, aged 13

### Apply your understanding

- 1 Explain why Genie’s case provides evidence for the existence of a sensitive period, rather than of a critical period for language development.
- 2 One limitation of case studies is that they cannot be replicated. Explain why replication of what happened to Genie would not get approval from a human research ethics committee today.

Because development is such a complex, multifaceted process and there are not many critical periods for humans after they are born, the existence of these critical periods is somewhat controversial. The field of psychology is sceptical of (has doubts about) definitive statements about when development must be influenced. However, we do know that there are times in our lives when it is important for us to be exposed to certain experiences to facilitate our development.

## 2.6 CHECK YOUR LEARNING



### Describe and explain

- 1 Define the term “sensitive period”.
- 2 Identify an example of a critical period for humans and a critical period for a non-human species.
- 3 Explain why psychologists are sceptical about the existence of critical periods in humans.

### Apply, analyse and compare

- 4 Distinguish between a critical period and a sensitive period, using examples.

- 5 With reference to psychological development, compare the impacts of being deprived of an experience during a critical period versus during a sensitive period.

### Design and discuss

- 6 Discuss the influence of environmental and hereditary factors on whether a skill is developed during a sensitive period. Use an example to illustrate your response.
- 7 Research critical and sensitive periods that exist in humans. Create a timeline that represents five of these periods.

## Chapter summary

- 2.1** • Psychological development, which refers to how a person's social, emotional and cognitive capabilities change over time, is shaped by both hereditary factors and environmental factors.
  - Hereditary factors are the genetic material that biological parents transmit to their offspring at the time of conception, such as biological sex, hair colour and genetic predispositions.
  - Environmental factors are factors that originate from a person's external environment such as education, family and experiences.
- 2.2** • The biopsychosocial model is a holistic framework used to consider and categorise all of the biological, psychological and social factors that influence a person's psychological development and wellbeing.
  - Biological factors originate within your body and directly relate to physiological functioning, while psychological factors originate within the individual and directly relate to mental processes.
  - Social factors originate from outside the individual and relate to our interactions with others and the environment.
- 2.3** • Attachment refers to the emotional bond between an infant and caregiver.
  - The degree and style of attachment that is formed depends on a range of factors.
  - Harlow's research with rhesus monkeys found that contact comfort was more likely to lead to attachment between an infant and caregiver than provision of sustenance.
  - Ainsworth's research with human infants found that the level of responsiveness from a caregiver to a child affected the style of attachment the child formed to the caregiver, which had long-term effects on the way the child interacted with others throughout life.
- 2.4** • As children age, the way they think about their world evolves to become more complex.
  - Piaget proposed that cognitive development in children occurred as they progressed through four stages, each of which involved their cognition becoming more advanced: sensorimotor, preoperational, concrete operational and formal operational.
- 2.5** • Erikson proposed that an individual's social experiences determined whether psychosocial dilemmas faced at various points throughout life were successfully resolved or not.
  - Erikson's model proposed eight psychosocial dilemmas which must be successfully resolved to move on to the next stage and thus progress psychological development. According to Erikson, failure to resolve dilemmas has a negative impact on psychological development.
- 2.6** • There are times during human development where we are primed to learn or develop certain skills, provided we have the right experiences.
  - Sensitive periods refer to periods of time during development when an individual is more responsive to specific experiences from their environment that can shape their development.
  - Critical periods refer to periods of time during development when an individual is especially susceptible to specific environmental experiences that shape their development.

## Revision questions

### Multiple choice

1 Psychological development is influenced by hereditary factors, also known as \_\_\_\_\_, and environmental factors, also known as \_\_\_\_\_.

- A nurture; nature
- B nature; nurture
- C biological factors; psychological factors
- D external factors; internal factors

2 The biopsychosocial framework used to explain psychological development considers biological, psychological and social factors. Which of the following includes accurate examples of each of the biopsychosocial factors?

	Biological	Psychological	Social
A	Genetic predisposition	Socioeconomic status	Drug use
B	Medications	Personality	Depression
C	Genetic predisposition	Personality	Peer pressure
D	Medications	Age	Diet

3 Which of the following statements about factors influencing psychological development is untrue?

- A Biological, psychological and social factors interact with each other to influence psychological development.
- B Psychological and biological factors are internal factors, while social factors are external.
- C The nature versus nurture debate seeks to explain the relative influence of hereditary and environmental factors on psychological development.
- D Psychological development is more susceptible to influence from nature rather than nurture.

4 Harry Harlow's experiments with rhesus monkeys demonstrated:

- A that neither nourishment nor contact comfort was essential for attachment to form.
- B that both nourishment and feeding are essential for attachment to form.
- C that contact comfort is not enough to create attachment; nourishment is more important.
- D that feeding and nourishment are not adequate to form attachment; contact comfort is more important.

5 Which of the following is not one of Mary Ainsworth's attachment styles?

- A Secure attachment
- B Insecure attachment
- C Insecure avoidant attachment
- D Insecure resistant attachment

6 According to Piaget's theory of cognitive development, during which stage would a child require physical items to assist them in performing mental operations?

- A Sensorimotor
- B Preoperational
- C Concrete operational
- D Formal operational

7 According to Piaget's theory of cognitive development, children develop \_\_\_\_\_ during the preoperational stage and develop \_\_\_\_\_ during the concrete operational stage.

- A symbolic thinking; reversibility
- B object permanence; symbolic thinking
- C reversibility; centration
- D centration; abstract thinking



- 8 Lucy discovered that her great-aunt has been feeling depressed lately. She regrets not re-marrying after her first husband passed away because she never had any children or grandchildren. Lucy's great-aunt has started to feel like her life lacks purpose, especially since she has had to stop volunteering at the local community garden.

According to Erikson's theory, Lucy's great-aunt is likely to be in the midst of which psychosocial dilemma?

- A Identity versus role confusion
  - B Intimacy versus isolation
  - C Generativity versus stagnation
  - D Integrity versus despair
- 9 Compared to critical periods in development, sensitive periods are:
- A less likely to be found in humans.
  - B more dependent on experiences necessary for development.
  - C less likely to result in a significant impairment to psychological development if denied the required experiences.
  - D more likely to result in an impairment to psychological development if exposed to the required experiences.
- 10 As we age, our brains become \_\_\_\_\_ plastic, making the brain \_\_\_\_\_ flexible.
- A more; more
  - B more; less
  - C less; less
  - D less; more

### **Short answer**

#### **Describe and explain**

- 11 Describe the nature versus nurture debate.
- 12 Outline the Strange Situation experiment conducted by Mary Ainsworth.
- 13 Describe the biopsychosocial framework as it is used to model psychological development.
- 14 Explain the importance of critical and sensitive periods for psychological development.

### **Apply, analyse and compare**

- 15 Compare the practical implications of Harry Harlow's and Mary Ainsworth's research into psychological development.
- 16 Apply your understanding of the biopsychosocial model to the person you have become today, by explaining the impact of one biological, one psychological and one social factor on your own psychological development.
- 17 Compare how environmental and hereditary factors can influence psychological development, using examples to illustrate your response.
- 18 Analyse the relationship between biological and psychological factors as they affect psychological development.
- 19 Distinguish between Piaget's four stages of cognitive development with reference to tasks that a child in each stage could or could not complete.
- 20 Analyse the case of Genie Wylie by suggesting the likely impact of one biological, one psychological and one social factor on her development of language.
- 21 Distinguish between any two stages in Erik Erikson's theory of psychosocial development with reference to the dilemma faced in each.
- 22 Analyse the relationship between the biopsychosocial model and environmental versus hereditary factors as they each explain psychological development.
- 23 With reference to their usefulness in explaining psychological development across the lifespan, compare the four theories of psychological development discussed in this chapter.

### **Design and discuss**

- 24 Suggest whether the biopsychosocial model or the nature versus nurture debate enables a more holistic view of mental wellbeing and psychological development. Justify your response.

- 25 Discuss the following statement: “The Jim twins provide evidence for the importance of both hereditary and environmental factors for psychological development.”
- 26 With reference to the case study of Genie Wylie, discuss the advantages and disadvantages of a case study as a scientific investigation methodology.
- 27 Design an experiment to replicate either Harry Harlow’s or Mary Ainsworth’s research on attachment, keeping in mind current ethical considerations for research with animals.



**FIGURE 1** Research on rhesus monkeys conducted in modern times would need to pass ethical standards.

- 28 Discuss the relative influence of sensitive and critical periods on psychological development. You may use examples to support your response.
- 29 Discuss what the existence of sensitive and critical periods suggests about the interaction between environmental and hereditary factors.
- 30 Draw a three-way Venn diagram to classify the following theories according to the biopsychosocial model of psychological development:
- Harry Harlow’s theory of attachment
  - Mary Ainsworth’s theory of attachment
  - Jean Piaget’s theory of cognitive development
  - Erik Erikson’s theory of psychosocial development.

You can find the following resources for this section in your **obook pro**:

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

CHAPTER

3

# Defining and supporting psychological development

## KEY KNOWLEDGE

- the usefulness, and limitations, of psychological criteria to categorise behaviour as typical or atypical, including cultural perspectives, social norms, statistical rarity, personal distress, and maladaptive behaviour
- the concepts of normality and neurotypicality, including considerations of emotions, behaviours and cognitions that may be viewed as adaptive or maladaptive for an individual
- normal variations of brain development within society, as illustrated by neurodiversity
- the role of mental health workers, psychologists, psychiatrists and organisations in supporting psychological development and mental wellbeing as well as the diagnosis and management of atypical behaviour, including culturally responsive practices.

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## GROUNDWORK

This chapter will build on concepts you may have come across in Year 10. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



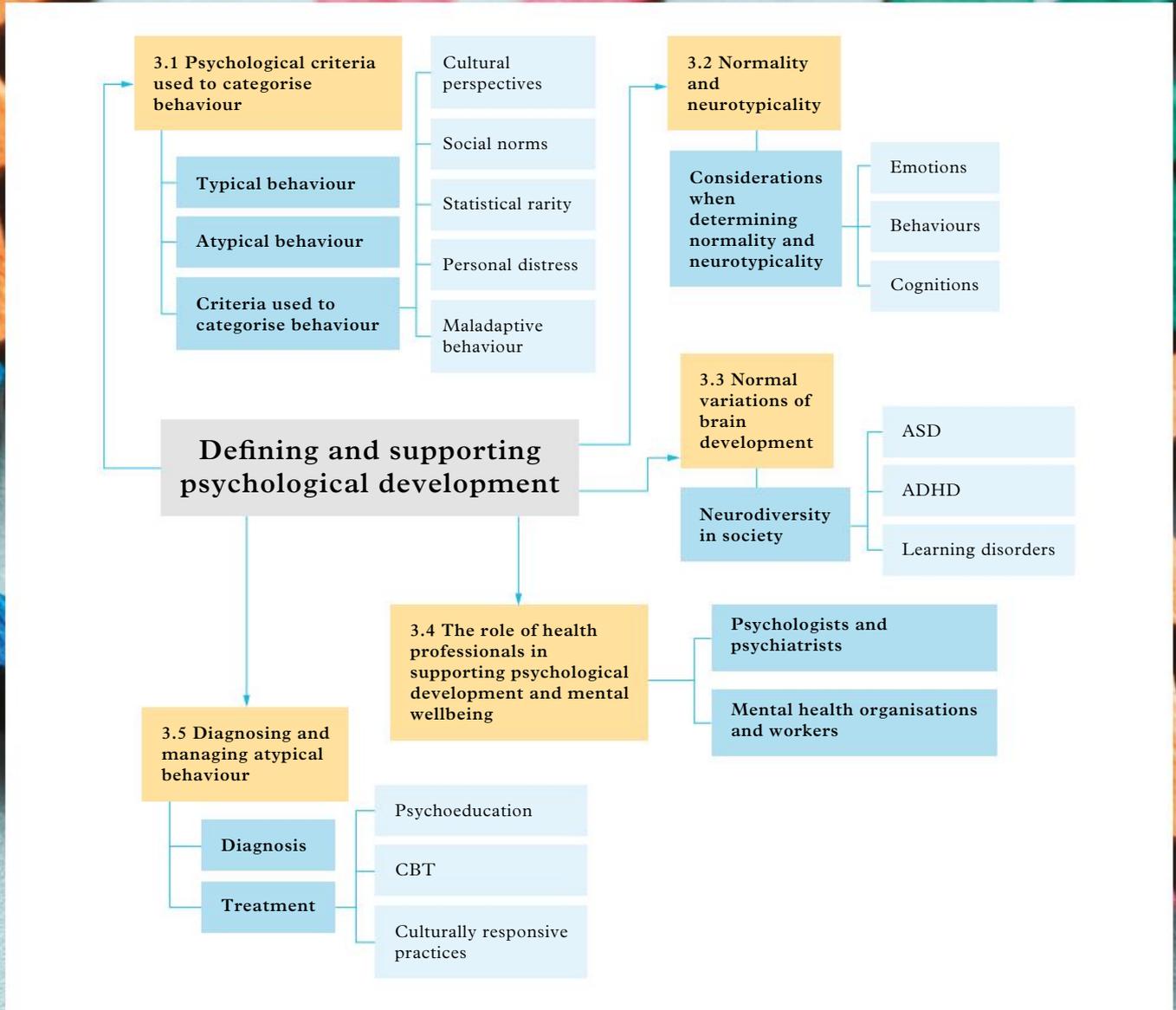
Groundwork quiz  
Chapter 3

## INVESTIGATIONS

<b>3.1A</b>	<b>INVESTIGATION: CLASSIFICATION AND IDENTIFICATION</b>	How can we categorise typical and atypical behaviour?	Page 476
<b>3.1B</b>	<b>INVESTIGATION: CORRELATIONAL STUDY</b>	Is there a relationship between the number of atypical behaviours exhibited daily and perceived mental wellbeing?	Page 478

**FIGURE 1** Neurodiversity refers to the differences that can exist among the population regarding psychological development and function.

## CONCEPT MAP



# 3.1

## Psychological criteria used to categorise behaviour

### KEY IDEAS

- ✦ Behaviours can be categorised as typical or atypical as part of assessing psychological development and wellbeing.
- ✦ Different criteria, including cultural perspectives, social norms, statistical rarity, personal distress and maladaptive behaviours can be used to categorise behaviour as typical or atypical.
- ✦ The more context available when categorising behaviour, the more accurate the judgments about typicality or atypicality.



#### inference

conclusion drawn from reasoning or evidence

#### typical behaviour

behaviour that would be expected or is consistent with the behaviours usually shown by a specific person in a particular situation, or behaviour that conforms with standards deemed acceptable for that situation

#### atypical behaviour

behaviour that is unexpected or inconsistent with what would generally occur within a particular situation or circumstance

## Typical and atypical behaviour

Psychologists often rely on interpretations of a person's observable behaviour when assessing psychological development and mental wellbeing. Behaviours can be suggestive of someone's current psychological state and can also provide information about the progress of a person's psychological development. For example, the behaviour of a person acting aggressively could indicate that the person is feeling angry or frustrated. If a one-year-old has been observed to complete a Rubik's Cube quickly, it might suggest that they are cognitively advanced for their age, as most children who can complete Rubik's Cubes are older than three.

**Inferences** can be made about a person's internal state based on the behaviours they exhibit (show). These inferences are most useful when considered alongside what might be typical or atypical for that person or situation. **Typical behaviour** refers to behaviour that would be expected, or is consistent with, the behaviours usually shown by that person in that situation, or behaviour that conforms with standards deemed acceptable for that situation. On the other hand, **atypical behaviour** describes behaviours that are not usually shown by a person. Categorising behaviour in this way can be useful in psychology as atypical behaviour can be indicative of mental health problems, particularly if the behaviour is persistent, causes distress or impairs day-to-day functioning.

For example, if you witnessed a child behave aggressively in the classroom, you might infer that the child is frustrated. However, if the child is often aggressive even when not frustrated, inferences about the child being frustrated based on aggression may not be accurate. Conversely, if a child who rarely displays aggressive behaviours suddenly becomes aggressive, it is more accurately indicative of the child experiencing some sort of distress since they are acting out of character (atypically). The concepts of typicality and atypicality rely largely on context. What is considered typical or atypical varies according to different psychological criteria, including cultural perspectives, social norms, statistical rarity, personal distress and maladaptive behaviour. These criteria are explored in more detail in the following sections.



**FIGURE 1** A young child solving a Rubik's Cube might suggest that the child is cognitively advanced for their age.

## Cultural perspectives

What is considered typical or atypical behaviour can vary according to **cultural perspectives**. There are many behaviours that are considered typical or expected in one culture that can be considered atypical in another. For example, in some religious cultures attending a church or another place of worship on a regular basis is seen as typical and failure to attend would be seen as atypical. However, this may not apply to other religious cultures where practising religion and spirituality is considered an individual activity or state of being.

Culture influences many behaviours, including dining habits. For example, in Australia, the United Kingdom and America, consuming food while walking down the street is a typical behaviour that many people exhibit. However, in Japan, eating while walking on the street or “*tabearuki*” is considered by many as a rude behaviour, so exhibiting the behaviour would be seen as atypical.



**FIGURE 2** Eating on the street is a typical behaviour in Australia but an atypical behaviour in Japan due to different cultural norms.

## Social norms

**Social norms** refer to behaviours that are considered standard and are expected within a society. A person whose behaviour aligns with social norms would be categorised as behaving typically, while a person whose behaviour does not align with social norms would be categorised as behaving atypically. For example, it would be considered a social norm in many environments to maintain eye contact with someone you are speaking to. This is typically how conversational behaviour takes place. However, a person with social anxiety disorder may avoid eye contact with others, which might be considered atypical behaviour in that conversational situation. Social norms can also vary according to the social situation that a person is in. For example, a social norm for attending a job interview is to dress in a formal or smart casual outfit. Based on this social norm, wearing your pyjamas to a job interview would be seen as atypical.

## Statistical rarity

Whether or not a behaviour is considered typical can also be considered in terms of frequency or **statistical rarity**. Common behaviours that occur frequently would be considered typical, while behaviours that are statistically less frequent would be considered atypical. For example, most adults typically leave their house at some point during the day – to go to work, purchase groceries, exercise or socialise. However, for a small percentage of people, such as those with the anxiety disorder **agoraphobia**, the behaviour of leaving the house can cause extreme distress and is often avoided. Based on statistical rarity, never leaving the house would be seen as an atypical behaviour because it is not frequent in the general population. Under the criteria of statistical rarity, dying your hair a non-natural hair colour, such as pink or green, might also be seen as atypical because it differs from the more statistically common hair colours (blonde, brunette, black) that most people have.

### cultural perspective

a criterion used to classify behaviour as typical or atypical according to what would be expected in line with the beliefs and values of a given culture

### social norm

an informal rule or standard understood by members of a group or society

### statistical rarity

a criterion used to classify behaviour as typical or atypical according to how prevalent that behaviour is within the population

### agoraphobia

an anxiety disorder characterised by fear of leaving environments that a person knows or considers to be safe

## Personal distress

### personal distress

a criterion used to classify behaviour as typical or atypical according to whether the behaviour results in an overall pleasant or unpleasant emotional state

**Personal distress** refers to the negative psychological and physiological state that someone can be in when they are feeling an unpleasant emotion such as sadness or stress. Personal distress can be a typical state, as everyone will experience distress from time to time. It is typical to feel distressed in response to certain life events; for example, as exams approach, or when a loved one passes away. In most cases, the distress subsides once the stressor is removed or after a period of adjustment time. While everyone feels distress from time to time, feelings of personal distress could be classified as atypical if a person feels distressed for extended periods, or to a degree that impairs their ability to function in everyday life.

Generally, people avoid putting themselves in situations that are going to cause personal distress; however, this is not always possible. Furthermore, the course of action that avoids distress might not always be the best approach to a situation (for example, avoiding an important conversation because it might be unpleasant). What is considered typical or atypical in personal distress situations is more nuanced and requires context to be properly assessed.

## Maladaptive behaviour

### adaptive behaviour

a behaviour that allows a person to successfully cope in their environment

### maladaptive behaviour

a criterion used to classify behaviour as typical or atypical according to whether the behaviour is useful or detrimental to the organism performing the behaviour

**Adaptive behaviours** are behaviours that facilitate personal growth and ability to adjust to different environments. For example, getting up, eating breakfast and going to school are generally considered to be adaptive behaviours. In contrast, **maladaptive behaviours** are those behaviours which inhibit personal growth and ability to adapt to the environment. A person who does not get up in the morning, but instead remains in bed all day, might be showing maladaptive behaviour. Adaptive behaviours tend to be considered more typical than maladaptive behaviours, because they are logical and enhance survival, whereas maladaptive behaviours can be harmful or dangerous.

An example of an adaptive behaviour might be exercising once a day. This behaviour is known to be good for your health and is a common, typical behaviour. On the other hand, binge drinking is a less common behaviour that can be detrimental to health; this behaviour would be classified as atypical and maladaptive.

Classifying a behaviour as adaptive or maladaptive also depends on context. Washing your hands before dinner or washing your hands after gardening would be considered adaptive in terms of hygiene. However, washing your hands several times an hour even when they are not dirty, so that the behaviour interferes with your day-to-day activities, would be considered maladaptive and therefore atypical.



**FIGURE 3** Eating a healthy breakfast each morning is generally considered an adaptive behaviour.

# Usefulness and limitations of psychological criteria for classifying behaviour as typical or atypical

As the same behaviour can be classified as either typical or atypical in different circumstances, it is important to consider behaviour through multiple criteria.

For example, it would be far too simplistic to say that a behaviour such as shouting at the top of your lungs is atypical. Shouting might be considered atypical during a funeral or while sitting an exam according to the criteria of social norms. However, shouting at the top of your lungs could be considered typical according to social norms if you are at a football game cheering on your team. Additionally, if you were lost in the woods and calling for help, shouting would probably be considered a typical and adaptive behaviour against the criteria of maladaptive behaviours. Table 1 gives a summary of the relative usefulness and limitations of each criterion for classifying typicality of behaviour.

**TABLE 1** Usefulness and limitations of psychological criteria for classifying behaviour as typical or atypical

Criteria	This criterion is useful for classifying typicality of behaviour when ...	This criterion is limited in its ability to classify typicality of behaviour when ...
Cultural norms	<ul style="list-style-type: none"> <li>behavioural norms differ significantly between cultures.</li> </ul>	<ul style="list-style-type: none"> <li>there are no cultural factors to guide classification of typicality.</li> <li>culture is considered without the context of other criteria.</li> </ul>
Social norms	<ul style="list-style-type: none"> <li>behavioural norms differ significantly between social settings.</li> </ul>	<ul style="list-style-type: none"> <li>factors that affect people's ability to interpret and respond to social situations are not considered.</li> <li>social setting is considered without the context of other criteria.</li> </ul>
Statistical rarity	<ul style="list-style-type: none"> <li>there are significant differences in frequencies of the behaviours being considered.</li> <li>there are relevant statistics available to use for classifying the behaviour.</li> </ul>	<ul style="list-style-type: none"> <li>there are no relevant statistics to form a reference point.</li> <li>behaviours do not stand out from others in terms of frequency or rarity.</li> <li>statistics are considered without the context of other criteria.</li> </ul>
Personal distress	<ul style="list-style-type: none"> <li>personal distress levels are overt or evident.</li> <li>there is a frame of reference for a person's typical temperament.</li> </ul>	<ul style="list-style-type: none"> <li>there is no indication of personal distress levels or no baseline to compare against.</li> <li>factors that affect ability to regulate distress are not considered.</li> <li>personal distress is considered without the context of other criteria.</li> </ul>
Maladaptive behaviours	<ul style="list-style-type: none"> <li>a person's behaviour is significantly more or less adaptive than would be typical for them.</li> </ul>	<ul style="list-style-type: none"> <li>factors that may limit choice or selection of behaviours are not considered.</li> <li>adaptivity of behaviour is considered without the context of other criteria.</li> </ul>

While the different criteria are useful for categorising behaviour, it is important to note that using only one psychological criterion to determine how typical a behaviour is limits the accuracy of the judgment. The more context that is considered when determining whether behaviour is typical or atypical, the more accurate the judgment is likely to be.

For example, imagine that you call a friend and they do not answer your call. This might be a statistical rarity for them, as you have always known them to be eager for a chat on the phone. You might immediately think that this is an atypical behaviour and become worried about them. However, there are many social situations in which choosing not to pick up the phone would be considered typical (for example, when sitting around the dinner table or during a speech at a wedding). Perhaps your friend is out bushwalking and relying on GPS with low phone battery, so answering a call and talking could waste battery and be maladaptive for their safety. In those situations, your friend choosing to answer the phone call could be considered atypical. Judgments about whether a behaviour is typical or atypical are the most accurate when all relevant factors are considered.

### 3.1 SKILL DRILL

#### Analysing and evaluating raw data

##### Key science skill: Analyse and evaluate data and investigation methods

Mrs Ramirez surveys her psychology class to determine how much preparation they typically do in the lead-up to assessment tasks. She asks each student how many hours they spent revising for the mid-year exam. The raw data can be found in Table 2.

**TABLE 2** Raw data from Mrs Ramirez's class

Student	Self-reported hours spent revising for mid-year exam
Student A	6
Student B	4
Student C	5
Student D	4
Student E	5
Student F	1
Student G	6
Student H	6
Student I	4

#### Practise your skills

- 1 Calculate the mean number of hours students in Mrs Ramirez's class spent studying for the exam.
- 2 Discuss two factors that could limit the validity of the data collected.
- 3 Evaluate whether the mean calculated is an accurate representation of how much time each student spent studying.
- 4 Mrs Ramirez has taught Student F for several years and knows that they usually spend an average of four hours revising for major assessments. Discuss whether this information, along with the data presented in Table 2, provides enough context to categorise Student F's individual revision for this assessment as typical or atypical behaviour.

Need help analysing and evaluating data and investigation methods? Go to Topic 1.7 in your Psychology toolkit.

### 3.1 CHECK YOUR LEARNING



#### Describe and explain

- 1 Explain the difference between typical and atypical behaviour.
- 2 Describe an instance in your life when you have shown an atypical behaviour. Explain why this behaviour would be considered atypical.
- 3 Explain why judgments about the typicality of behaviour can be useful for psychologists.
- 4 Copy and complete the table to describe each of the psychological criteria used to classify behaviour, and give examples of behaviours that would be considered typical and atypical for each.

Criteria	Description	Example of typical behaviour according to this criterion	Example of atypical behaviour according to this criterion
Cultural perspectives			
Social norms			
Statistical rarity			
Personal distress			
Maladaptive behaviour			

#### Apply, analyse and compare

- 5 List three behaviours that you have demonstrated today. Analyse how each behaviour could be classified as both typical and atypical according to different psychological criteria.
- 6 Apply your understanding of the typicality of behaviour by providing an example of a behaviour that would be considered typical according to one criterion but atypical according to another. Justify your classifications.
- 7 Sarah has obsessive-compulsive disorder, an anxiety disorder that around 3 per cent of Australians will experience in their lifetime. Sarah's compulsions involve locking the doors and windows of her house and checking that they are locked multiple times a day, or else she feels very anxious and distressed. Only once Sarah feels sure that the doors and windows are all locked can she relax and turn her attention to other things.

Determine the typicality of Sarah's behaviour according to the criteria of statistical rarity and personal distress.

#### Design and discuss

- 8 Discuss how each of the following scenarios could demonstrate both typical and atypical behaviour depending on which psychological criteria is being used to categorise the behaviour.
  - a Brian screams loudly during a school assembly.
  - b Jeremy does not eat white bread.
  - c Neisha wears a bikini to the beach.
  - d Sam and Taylor hold hands in public.
  - e Dimitri refuses to put on a hat when going outside.
  - f Zara procrastinates and avoids doing her assignment until the night before it is due.
- 9 Discuss the importance of context when classifying behaviour as typical or atypical, using examples.

# 3.2

## Normality and neurotypicality

### KEY IDEAS



- ✦ The normality of emotions, cognitions and behaviours can be assessed in terms of whether they are adaptive or maladaptive.
- ✦ Adaptive emotions, cognitions and behaviours are considered more normal than their maladaptive counterparts.
- ✦ The concepts of normality and neurotypicality are useful in psychology as they provide a point of comparison for when emotions, cognitions and behaviours deviate from what is considered “normal”, which can indicate psychological disorder or the need for support.

Psychology is the study of how we think, feel and behave. Of course, no two people in the world think, feel and behave in the same ways all the time – this is because our society is richly diverse. However, certain elements of human development and the psychological experience can occur in a predictable and consistent manner across the population. Therefore, when someone conforms to or deviates from what is considered typical, it can offer valuable insights to psychologists about psychological development and wellbeing.

## Normality and neurotypicality

**Normality** is a term that describes behaviour and thinking consistent with that shown by most people in the general population. Historically, the concept of normality has been difficult to define. This is because our society is so diverse and complex that binary concepts such as “normality” and “**abnormality**” do not always adequately explain human behaviour. Different approaches have been used to describe normality from a range of perspectives; six of these perspectives are outlined in Table 1. You might notice some overlap between these approaches and the criteria used to classify behaviour as typical or atypical that were discussed in Topic 3.1.

**TABLE 1** Different approaches to describing normality

Approach to describing normality	Your thoughts, feelings and behaviours are considered normal under this approach if they ...
Sociocultural	align with expectations of the society and culture within which they take place.
Functional	align with what is going to best enable optimal functioning.
Historical	align with what has happened consistently in the past.
Statistical	align with the thoughts, feelings and behaviours that are displayed most prevalently by others.
Situational	align with what would typically be expected of a person in that particular situation.
Medical	align with those of a medically healthy person as opposed to a person with a biological or psychological illness.

In psychology, the term “normal” is used to describe expressions of thoughts, feelings and behaviours that are typical or expected because they are common to most people or most situations. Thoughts, feelings and behaviours that occur more often in society than their less common counterparts would be classified as normal. **Neurotypicality** is a term used to describe brain development and function that is aligned with what would be considered

**normality**  
typical behaviours, thoughts or emotions that align with those common in society

**abnormality**  
deviation from the norm

**neurotypicality**  
a term used to describe brain development and function that is aligned with what would be considered normal or typical for most individuals within society

normal or typical for most individuals within society. A neurotypical person would develop, think, feel and behave in ways that would be expected of the general population.

In contrast, **neurodiversity** refers to the differences in brain function that exist among the population. Neurodiversity includes all variations and presentations of psychological function, including both neurotypical and neurodivergent people. **Neurodivergent** people are those who have psychological or cognitive attributes that are not common to most people in society. In other words, a neurodivergent person's brain functioning is somewhat different from what is considered "typical" for most people. For example, dyslexia is a neurodivergent condition that affects the processing of words and reading. A dyslexic person might read "the cat was black" as "the cat saw black", which diverges from how most people would read the sentence. Due to unique ways of processing information, dyslexia can also result in increased ability to recognise patterns, think holistically and think in pictures.

Having a benchmark to recognise what is considered normal or neurotypical is useful for psychologists when studying and supporting the psychological development of diverse individuals. Psychologists assess whether a psychological trait is adaptive or maladaptive when they are establishing whether that trait is normal or typical.

## Classifying emotions, cognitions and behaviours as adaptive or maladaptive

"**Adaptive**" is used to describe any behaviour, emotional response or cognitive process that is helpful or beneficial to our functioning and survival. For example, brushing your teeth twice a day is beneficial to your long-term oral health, so is considered an adaptive behaviour.

"**Maladaptive**" is used to describe any behaviour, emotional response or cognitive process that is harmful or detrimental to our functioning and survival and that interferes with our ability to adapt. Failure to brush your teeth on a regular basis is considered a maladaptive behaviour because it increases the risk of oral health problems such as cavities and gum disease.

Logically, adaptive traits tend to be more common than maladaptive traits in society because they enhance survival and contribute to the continuation of functioning – this makes adaptive traits the "norm". For this reason, psychologists often consider our emotions, cognitions and behaviours in terms of whether they are adaptive or maladaptive to assess their normality.



**FIGURE 1** Brushing your teeth is an adaptive behaviour.

## Emotions

Emotions are the psychological feelings that we experience, often in relation to a specific object or event. Some examples of emotions include happiness, sadness, anger, surprise, fear and frustration. Emotions can be positive or pleasant (for example, happiness) but can also be negative or unpleasant (such as fear or frustration). Experiencing both positive and negative emotions is considered a normal part of the psychological experience. While our individual experience of emotions varies, emotions can present in very predictable ways, so they can be used to determine normality. For example, it would be considered normal to feel the emotion of sadness soon after the death of a beloved pet or relative, even though it is not pleasant. Feeling an emotion such as joy or happiness in this situation would be rarer, and in most circumstances, would not be considered normal.

**neurodiversity**  
the differences that can exist among the population with regard to psychological development and function

**neurodivergent**  
where a person's thoughts, feelings and behaviours are not aligned with those of a person who is considered to be neurotypical

**adaptive**  
a term used to describe when something is considered beneficial for survival or functioning

**maladaptive**  
a term used to describe when something is considered detrimental to survival or functioning

**adaptive emotion**  
psychological feeling  
that is beneficial  
for survival

**maladaptive  
emotion**  
psychological feeling  
detrimental to survival

**cognition**  
mental process  
that individuals  
undertake, such as  
planning, thinking  
and evaluating

**adaptive  
cognition**  
mental process  
beneficial for survival

When considering whether someone's experience of emotion is normal, psychologists assess whether their experience of that emotion is adaptive or maladaptive. **Adaptive emotions** occur when feelings we experience are beneficial for our survival. For example, even though it is not pleasant to feel disappointment when you receive a speeding fine, this emotional experience is potentially adaptive because it could help to prevent you from driving unsafely in the future. Feeling the emotion of fear when you are face-to-face with an angry magpie that is squawking at you can also be adaptive, as it could assist you to decide to keep your distance from the magpie and its nest to avoid getting swooped.

On the other hand, **maladaptive emotions** are feelings that are detrimental to our survival. For example, feeling fear at the sight of any magpie, even non-threatening ones, could be maladaptive, particularly if it gets in the way of your day-to-day functioning. In this case, the fear experienced would not be considered normal (Figure 2).

## Cognitions

**Cognitions** are the mental actions or processes that we undertake. Examples of cognitions include planning, reflecting, imagining and evaluating. Like emotions, cognitions can also be classified as either adaptive or maladaptive. **Adaptive cognitions** are mental processes that are beneficial for our survival; for example, planning to ration out food for a seven-day hike. Conversely, **maladaptive cognitions** are mental processes that are detrimental to survival; for example, choosing to ignore a problem which may escalate into a bigger problem if not dealt with. Generally, it is preferable to operate with adaptive cognitions and, for the most part, adaptive cognitions are considered normal. Maladaptive cognitions may be symptomatic of someone experiencing a mental health or neurodivergent condition.

Consider a professional footballer who has played an overall great game but makes an error during the match that costs the team a point. She can think about her error in different ways. If she lets the error get to her and has thoughts such as, "I never do anything right" or, "it's my fault if we lose now", then her performance in the rest of the game is likely to be weakened due to her negative thought patterns and maladaptive cognitions. Persistent maladaptive cognitions like this could be indicative of a mental health disorder or neurodivergence.

Alternatively, if the footballer approaches the error with thoughts such as, "everyone makes mistakes sometimes" and "I know I can do better next time", these cognitions are more likely to be adaptive and to allow her to continue performing throughout the game at her usual level. This is because cognitions and behaviours are inherently linked. In fact, one of the most effective forms of psychotherapy, cognitive behavioural therapy, is designed to identify and replace unhelpful cognitions and behaviours with more adaptive cognitions and behaviours. You will learn more about cognitive behavioural therapy later in this chapter.

## Behaviours

**Behaviour** refers to our actions and the way we conduct ourselves. Psychologists rely on behaviours that can be seen to infer things about our psychological experience. Unlike cognitions and emotions, behaviours are obvious and observable to others. Like emotions and cognitions, behaviours can be either adaptive or maladaptive.



**FIGURE 2** Many people fear magpies during their breeding season when they aggressively protect their young. In what situations would fear of a magpie be adaptive and in what situations would it be maladaptive?

As you learnt in Topic 3.1, adaptive behaviours refer to those actions that are beneficial for our survival. For example, eating food when we are hungry is adaptive. It is considered normal for most of our behaviours to be adaptive, useful behaviours that enhance our day-to-day functioning. Repeatedly or persistently engaging in maladaptive behaviours, which are behaviours that are detrimental to our survival, could indicate that a person is deviating from what we would consider a normal psychological experience. For example, extreme nail-biting can harm your nail beds and cause pain to your fingers. Frequent nail-biting in stressful situations would be considered a maladaptive behaviour. It is important to remember that behaviours are complex and cannot be accurately judged as adaptive or maladaptive without context.

For example, a person with no plans for the weekend might choose to engage in relaxing behaviour by lying in bed for a couple of extra hours on Saturday morning, watching television. This could be considered a normal or adaptive behaviour, as many people like to sleep in or relax on weekends and find they can do this without it having any negative consequences. In fact, a little extra rest could even enhance their functioning if they had been otherwise sleep-deprived or overworked. In contrast, a person who chooses to lie in bed every day for weeks instead of getting up to eat, going to work or socialising with others would be displaying maladaptive behaviours that indicate deviation from their normal experience. This deviation might be seen as symptomatic of a mental health disorder, such as depression.

## Practical implications of classifying normality and neurotypicality

While classifying thoughts, feelings and behaviours as normal or abnormal, adaptive or maladaptive can be useful for psychologists, it is important to remember that normality exists along a spectrum and that there is not always a clear separation between what is considered normal or abnormal. A person might think, feel or behave in ways that are considered more normal or less normal in a variety of situations. We know that human thoughts, feelings and behaviours are complex and cannot always be explained simply.

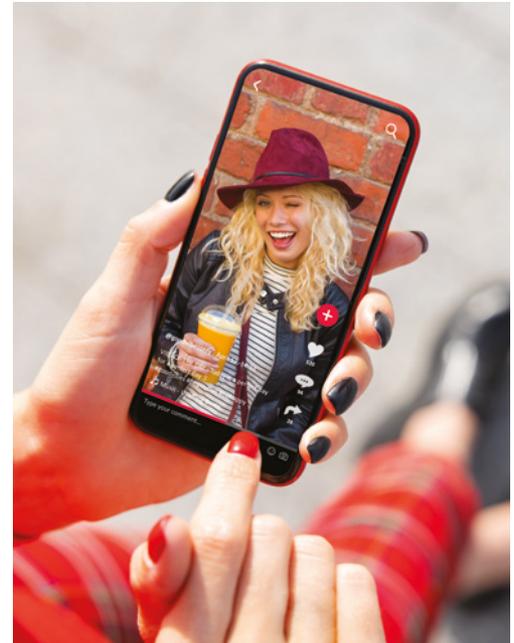
It is also important to note that while thinking, feeling and behaving in ways consistent with the norm is generally considered to be adaptive, it is incorrect to assume that those who comply with the norm are more functional or better than those who deviate from the norm. Neurodivergent people should not be marginalised or prejudiced against. In many ways, society values those who stand out from a crowd – consider how society holds sporting athletes who break world records in such high regard, or how we can appreciate a news story about someone who goes above and beyond the norm to help someone less fortunate. Diversity is a feature of our society that should be appreciated and celebrated. When divergence from the norm causes impairment, psychological support should be offered in a way that is respectful and equitable. Topic 3.3 will explore some more common examples of neurodivergence.

### maladaptive cognitions

mental process detrimental to survival

### behaviour

physical action undertaken by an individual



**FIGURE 3** Many behaviours can be adaptive in some circumstances but maladaptive in others. When would browsing videos on TikTok be considered adaptive, and when would it be maladaptive?

## 3.2 REAL-WORLD PSYCHOLOGY

### Beyoncé's battles with mental health

Beyoncé Knowles is one of the world's most successful singer-songwriters and has been a role model to many individuals throughout her long career. With 28 Grammy Award wins and multiple record-breaking albums and tours, on the surface it may seem like Beyoncé has had a flawless career. However, she openly shared that her success has also come with immense pressure that has forced her to battle with mental health on more than one occasion.

After her girl-group Destiny's Child broke up, Beyoncé dealt with a severe bout of depression. She refused to leave her room, stopped eating and isolated herself from others. During this period, she would constantly question who she was, who her friends were and her direction in life. Beyoncé picked herself up and continued to have a successful solo career but that brought its own challenges.

The success of her solo career resulted in a jam-packed schedule and frequent world tours. The constant touring and laborious schedule exhausted the singer and contributed to her developing insomnia (a sleep disorder). Beyoncé has shared that, in the past, she did not understand the toll her lifestyle was taking on her mental and physical wellbeing. She would work to points of exhaustion, go on extreme diets and over-exercise under the misconception that these actions were conducive to self-care.

Beyoncé has now shifted her mindset and career to prioritise her mental health and avoid giving in to pressures that frequently fall upon stars in the music industry.

### Apply your understanding

- 1 Describe the behaviours that Beyoncé was engaging in to deal with the pressures mounting in her solo career. Analyse whether these behaviours were adaptive or maladaptive.
- 2 Discuss whether Beyoncé's changed mindset would be considered adaptive or maladaptive.

## 3.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain why the concept of normality is hard to define.
- 2 Describe two approaches to normality that have been used in the past.
- 3 Explain the difference between emotions, cognitions and behaviours and describe an example of each.

### Apply, analyse and compare

- 4 Analyse why adaptive thoughts, feelings and behaviours are generally considered to be more normal than their maladaptive counterparts.
- 5 Using an example, compare how the same behaviour could be considered adaptive in one situation but maladaptive in another.

- 6 When are maladaptive thoughts, feelings and behaviours considered to be indicative of an atypical psychological experience?

### Design and discuss

- 7 Using an example, discuss the importance of context when classifying emotions, cognitions or behaviours as either adaptive or maladaptive.
- 8 Design an infographic to inform people about the differences between the concepts of normality, neurotypicality, neurodiversity and neurodivergence.

# 3.3

## Normal variations of brain development

### KEY IDEAS

- ✦ Neurodiversity refers to the differences in psychological development and function that exist within a diverse population.
- ✦ Neurodivergence is a type of neurodiversity associated with normal variations of brain development, such as neurodevelopmental disorders.
- ✦ Some common examples of neurodivergence include autism spectrum disorder, attention deficit hyperactivity disorder and learning disorders.
- ✦ Personalised treatments can assist neurodivergent individuals to harness their strengths and manage day-to-day functioning.



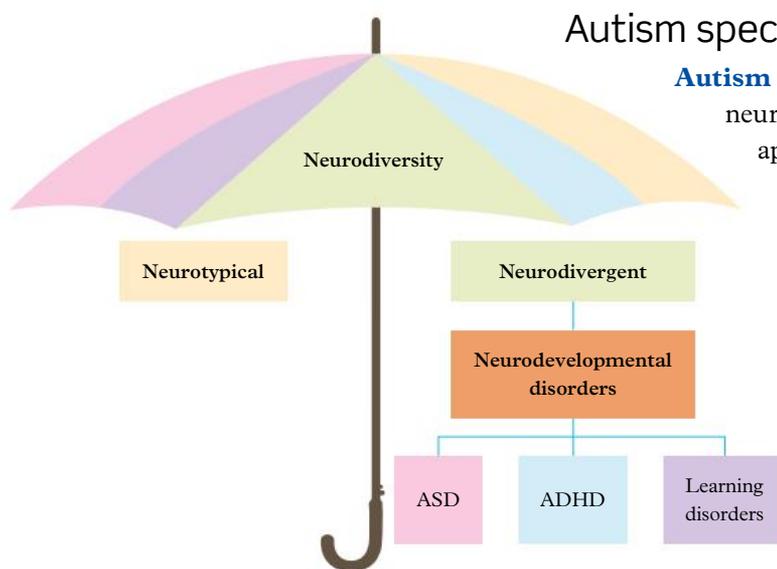
### Neurodiversity

As you learnt in Topic 3.2, neurodiversity refers to the differences in brain function that occur within our diverse population. We know that no two individuals are ever exactly alike, due to the unique combination of biological, psychological and social factors that influence our development. This is why our society is made up of unique individuals and is what makes diversity the norm, rather than an exception to the rule. Society is attempting to refine how we frame **neurodevelopmental disorders** so that we can embrace the unique ways in which individuals experience and understand the world around them, rather than viewing neurodivergence as a disabling experience.

#### neuro-developmental disorder

condition that affects the development of the nervous system, causing variations in brain function that may affect processes involved with emotion, learning, motor control and memory

Figure 1 demonstrates how both neurotypical and neurodivergent people fit under the umbrella term “neurodiversity”. In this chapter we will explore some common examples of neurodivergence that exist within our society, the symptoms of these neurodivergent conditions and the treatments used to support their functioning.



### Autism spectrum disorder

**Autism spectrum disorder (ASD)** is a neurodevelopmental disorder that typically appears within the first few years of a child’s life and generally persists into adolescence and adulthood. Around 1 in 150 people experience ASD (Figure 3). People with ASD may interact with the world in ways that are different to neurotypical people because the disorder can affect how a person thinks, feels, behaves, communicates and learns. The **stigmatisation** of people who are neurodivergent has led to many misconceptions about ASD. Common misconceptions are shown in Figure 2.

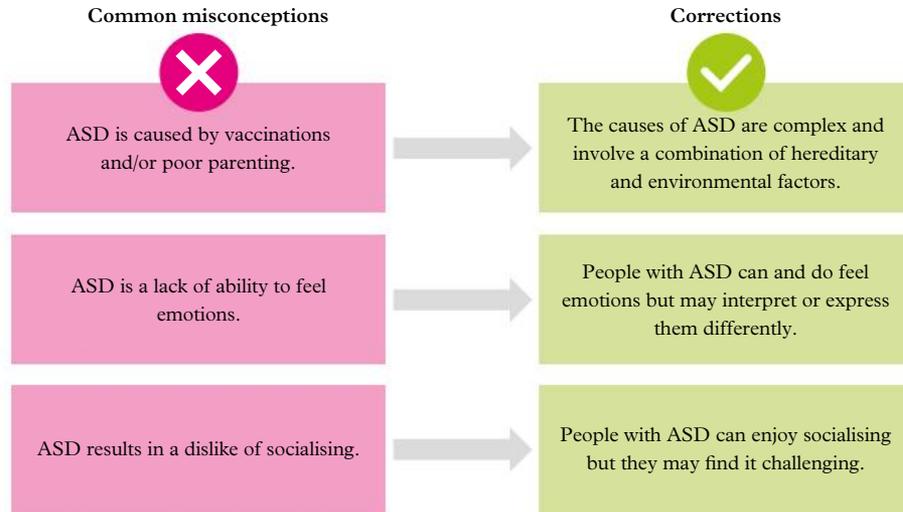
**FIGURE 1** Both neurotypical people and neurodivergent people are part of our neurodiverse society.

**autism spectrum disorder (ASD)**

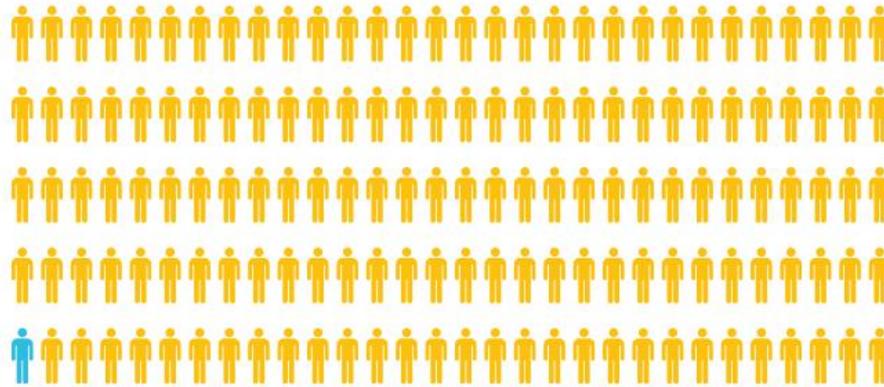
neurodevelopmental disorder characterised by problems with social communication and restrictive or repetitive behaviours and interests

**stigmatisation**

treating someone or something unfairly by publicly disapproving of them or perpetuating negative stereotypes



**FIGURE 2** Corrections to some common misconceptions about ASD



**FIGURE 3** Around 1 in 150 Australians will experience autism spectrum disorder.



**Symptoms**

Some common symptoms of ASD include:

- unique and novel thought processing
- problems developing and maintaining social connections
- high attention to detail
- challenges with verbal and non-verbal communication
- hyper-focus and freedom from distraction
- unusual emotional reactions and/or difficulty interpreting the emotions of others
- creativity
- restricted or repetitive behaviours and interests (Figure 4)
- honesty
- delayed cognitive, language and/or motor skills.

Neurotypical people may also experience one or more of these symptoms, but in ASD these symptoms can significantly affect an individual’s day-to-day functioning. There is large variation in the presentation of people with ASD, which is why it is described as a “spectrum” disorder. The type and severity of the impacts that the disorder has on people’s lives is different for every person with ASD. For example, some people with ASD can be

very social and outgoing, while others might find communication in social settings quite challenging.

ASD is often also **comorbid** with other physical and/or mental health conditions, such as learning disorders, epilepsy, attention deficit hyperactivity disorder, anxiety and depression.

## Treatment

ASD is a **long-term condition**; however, treatments exist that aim to manage symptoms and improve day-to-day functioning and quality of life. As ASD will affect each person differently, treatments are catered to the specific needs of individual patients. Treatment can involve therapy for speech, social skills and motor skills, training to assist parents, medications for comorbid conditions and individual education plans to assist teachers in meeting an individual student's learning needs.



**FIGURE 4** Children with ASD can show intense interest in particular topics, such as cars. They might engage in repetitive play by doing the same thing with their toys over and over, such as lining them up in order.

### **comorbid**

present at the same time as another condition

### **long-term condition**

an ongoing, persistent or recurring condition that has a significant impact on a person's life

### **attention deficit hyperactivity disorder (ADHD)**

a neurodevelopmental disorder characterised by inattentive and/or hyperactive-impulsive symptoms

## Attention deficit hyperactivity disorder

One of the most common neurodevelopmental disorders diagnosed during childhood is **attention deficit hyperactivity disorder (ADHD)**. ADHD is a condition characterised by patterns of inattention and/or hyperactivity that can affect day-to-day functioning. It is usually first diagnosed in childhood and persists into adulthood. Around 1 in 20 Australians will experience ADHD.

## Symptoms

The symptoms of ADHD are classified into two groups: **inattentive symptoms** and **hyperactive-impulsive symptoms**.

Inattentive symptoms may include:

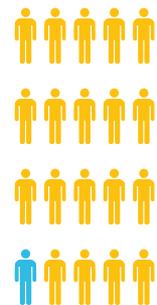
- difficulty staying focused
- difficulty paying attention to detail
- being easily distracted
- forgetfulness.

Hyperactive-impulsive symptoms may include:

- fidgeting and squirming
- being constantly in motion
- excessive talking and difficulty remaining quiet
- difficulty controlling impulses, such as not being able to wait their turn or interrupting others.

Positive traits associated with ADHD include:

- being energetic
- have spontaneity and openness to try new things
- creativity and ingenuity
- hyperfocus.



**FIGURE 5** Around 1 in 20 Australians will experience ADHD.

### **inattentive symptom**

symptom present in a person with ADHD that is characterised by difficulty maintaining attention

### **hyperactive-impulsive symptom**

symptom present in a person with ADHD that is characterised by an inability to remain still and quiet

Not all individuals with ADHD present in the same way – there is a high level of neurodiversity within this condition. Some individuals mostly show inattentive symptoms, such as forgetfulness and distractedness. Others mostly show hyperactive-impulsive symptoms, such as fidgeting and restlessness. Other individuals with ADHD may show a combined presentation of both types of symptoms.

### Treatment

Symptoms of ADHD can be treated through a combination of medication and behavioural therapy. Some medications can relieve some symptoms of ADHD, however, medications can vary in effectiveness from person to person. Behavioural therapy can be used to manage symptoms by teaching children and adults how to manage the behaviours that otherwise negatively affect their quality of life. School students with ADHD can have individual education plans put into place to inform teachers on how to best meet a child's needs while at school.

## 3.3 SKILL DRILL

### Drawing conclusions using data

#### Key science skill: Constructing evidence-based arguments and drawing conclusions

Research carried out between 2013 and 2014 and published by the Australian Institute of Health and Welfare showed that 9.8 per cent of males aged 12 to 17 and 2.7 per cent of females aged 12 to 17 were identified as having ADHD. The overall percentage of persons in the population (regardless of gender) who were identified as having ADHD was 6.3 per cent.

#### Practise your skills

- 1 Formulate a possible research hypothesis for the data.
- 2 Based on the data, draw a conclusion for this research.
- 3 Explain three ethical guidelines that would have had to be upheld in this research.
- 4 More recent research has shown that ADHD symptoms present differently in males and females. Considering this, discuss the internal and external validity of a study that uses the same criteria to identify ADHD in both men and women.

Need help constructing evidence-based arguments and drawing conclusions? Go to Topic 1.8 in your Psychology toolkit.

## Learning disorders

**learning disorder**  
neurodevelopmental disorder that affects a person's ability to learn in one or more specific areas such as reading, writing or maths

**Learning disorders** are a group of developmental disorders that affect a person's ability to learn in one or more specific areas, such as reading, writing or maths. Around one in 10 Australians will experience some type of learning disorder. Common learning disorders include dyslexia, dysgraphia, dyscalculia and dysphasia.

### Symptoms

Four different types of learning disorders and some symptoms associated with each disorder are identified in Table 1. Experience of difficulty with one particular process or area often gives rise to diverse and creative ways of thinking and/or communicating. For example, as the video “Dyslexic Spies” reveals, a UK intelligence agency has been recruiting dyslexic individuals due to the unique way their brains process information.



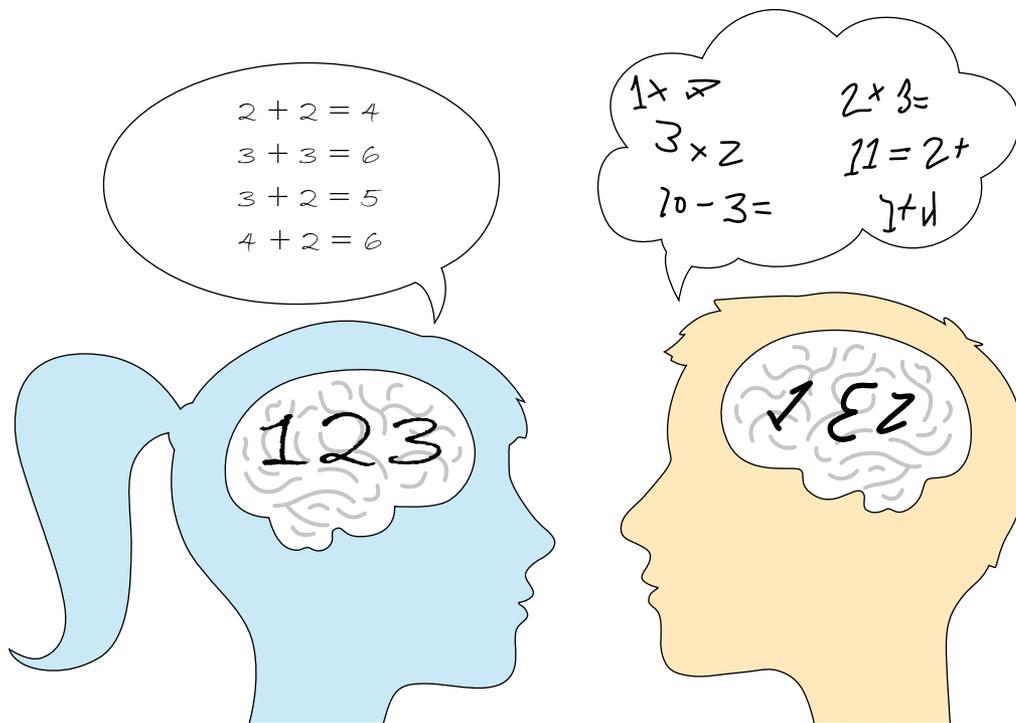
**TABLE 1** Summary of learning disorders and their symptoms

Learning disorder	Symptoms
Dyslexia	<ul style="list-style-type: none"> <li>• Difficulty with reading and writing</li> <li>• Difficulty remembering or recognising words and letters, making sense of words, and putting words in the correct order</li> <li>• Good problem-solving</li> <li>• Creativity</li> <li>• Good at identifying connections/patterns</li> <li>• Three-dimensional thinking</li> </ul>
Dysgraphia	<ul style="list-style-type: none"> <li>• Difficulty producing written language</li> <li>• Difficulty with spelling and handwriting</li> <li>• Good listening skills</li> <li>• Strong memory</li> </ul>
Dyscalculia	<ul style="list-style-type: none"> <li>• Difficulty understanding numbers</li> <li>• Difficulty working with mathematical concepts (Figure 7)</li> <li>• Good verbal communication</li> <li>• Creative, intuitive and lateral thinking</li> </ul>
Dysphasia	<ul style="list-style-type: none"> <li>• Difficulty producing speech</li> <li>• Difficulty understanding speech</li> </ul>



**FIGURE 6** Around 1 in 10 Australians will experience some type of learning disorder.

Neurotypical people can have varied literacy and numeracy skills and can even experience similar symptoms to the ones listed above – this is a characteristic of our diverse society. However, people with learning disorders can have their day-to-day functioning significantly affected by their condition, especially if they are lacking adequate treatment and support.



**FIGURE 7** People with dyscalculia can have trouble interpreting, recalling or manipulating numbers.

## Treatment

Learning disorders are lifelong conditions. The earlier that support is provided to people with learning disorders, the better their outcomes tend to be. People with learning disorders can get support to help them be successful at school or work. Specific therapies are usually catered to the individual needs of the person and the way that the disorder affects their functioning. Therapies can also involve targeted interventions to correct misunderstandings, provision of specialised learning programs and one-on-one tutoring. Individual education plans can be developed for school-aged children to better enable teachers to meet their specific learning needs.

### 3.3 CHALLENGE

#### Researching the stigmatisation of neurodevelopmental disorders

Neurodevelopmental disorders can often have stigma (negative perceptions or assumptions) associated with them. Research the stigmatisation of neurodevelopmental disorders and answer the questions below.

- 1 Identify three common misconceptions about either ADHD or a learning disorder and correct them.
- 2 Explain how stigmatisation can negatively affect people diagnosed with neurodevelopmental disorders.
- 3 Discuss the importance of inclusivity for improving the outcomes and quality of life for neurodivergent people.

### 3.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Explain what is meant by the term “neurodiversity”.
- 2 Explain why neurodiversity is something to be embraced.
- 3 Identify and describe three common experiences of neurodivergence.

#### Apply, analyse and compare

- 4 Compare the treatments available for ASD, ADHD and learning disorders.
- 5 Apply your understanding of neurodivergence to explain why many symptoms of these conditions can be experienced by people who are neurotypical.

#### Design and discuss

- 6 Consider the following statement: “Neurodivergence is not a disease, so there is no cure.” Discuss the extent to which you agree with this statement, justifying your response.
- 7 Research three neurodevelopmental disorders mentioned in this chapter. Identify how prevalent each disorder is in Australia and create an infographic or graph that can be used to easily communicate this information to the general public.

# 3.4

## The role of health professionals in supporting psychological development and mental wellbeing

### KEY IDEAS

- ✦ Psychiatrists, psychologists, mental health organisations and mental health workers have different roles in supporting development and wellbeing, according to their training and objectives.



#### psychiatrist

a mental health professional trained in psychology as well as medicine, who can prescribe medication as part of treatment

#### psychologist

a mental health professional trained in thoughts, feelings and behaviours, who uses psychotherapy to support the development and wellbeing of their patients; they cannot prescribe medication as part of treatment

### Health professionals

Career options related to mental health include several different professions. Each of these professions exists to promote and support psychological development and wellbeing, but their approaches and methods differ based on their respective qualifications and the objectives of the organisations they work within. In this topic, we will explore the roles that psychiatrists, psychologists, mental health organisations and mental health workers have in supporting both psychological development and mental wellbeing.

### Psychologists and psychiatrists

Both **psychiatrists** and **psychologists** undertake university training to understand how people think, feel and behave. Both professions use their training to support and promote mental wellbeing through various forms of therapy. Psychiatrists and psychologists work with a variety of people, from those who are mentally well to those suffering from mental health problems. Their role is to provide support and help improve their patients' functioning. While you may picture a person lying on a couch, talking about their life to a therapist taking notes on a clipboard, psychotherapy involves more than that. Psychologists and psychiatrists use their training to help their patients understand their own mental wellbeing and use strategies that can help improve their day-to-day lives.



**FIGURE 1** Psychologists are one category of the many professionals that help support psychological development and wellbeing.

The main difference between a psychologist and a psychiatrist is that a psychiatrist trains as a medical doctor. This allows psychiatrists to prescribe medication to their patients as part of their treatment for a mental health condition, alongside the psychotherapies they implement. A psychologist, although university-qualified, is not a medical doctor so they are unable to prescribe medication to their clients; they rely on psychotherapy to treat their patients.

The role of a psychologist is broad, as there are many different fields to support psychological development and wellbeing. The Australian Psychological Society (APS) recognises 10 main types of psychologists, which are outlined in Figure 2.

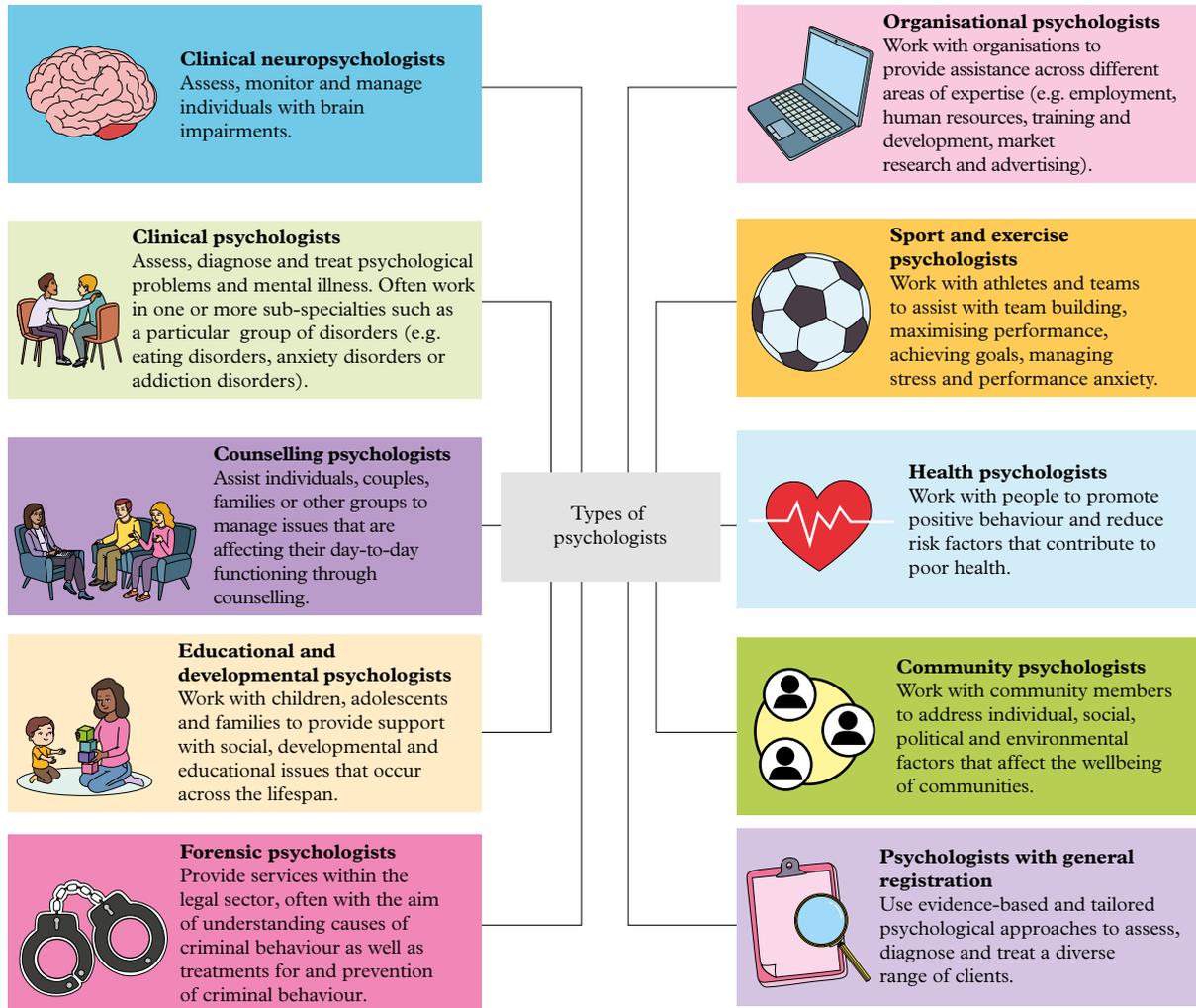


FIGURE 2 The 10 different types of psychologists recognised by the APS

### 3.4 WORKED EXAMPLE

#### Differentiating between health professionals

Distinguish between a psychologist and a psychiatrist. (2 marks)

Think	Do
Step 1: Identify whether there are any command terms in the question and what is required to address the command terms used (a glossary of command terms is provided in Topic 1.12).	The question uses the command term <b>distinguish</b> , which requires you to make the differences between two concepts clear. In this case it is the differences between psychologists and psychiatrists.
Step 2: Look at the mark allocation to determine how many pieces of information are required. Link this back to what the command term(s) are requesting.	There are two marks allocated to this question so two differences should be included.
Step 3: Construct your answer.	A psychiatrist is trained as a doctor and can prescribe medication as part of treatment (1 mark), whereas a psychologist is not trained as a doctor and is unable to prescribe medication as part of treatment (1 mark).

## Mental health organisations and workers

**Mental health organisations** are organisations and groups that work to promote or support mental health in a variety of ways. Some examples of mental health organisations, their objectives and endeavours are outlined in Table 1.

**mental health organisation**  
organisation that works to promote or support mental health

**TABLE 1** Examples of mental health organisations with their objectives, services and contact details

Mental health organisation	Objectives	Services	Contact details
<p>Beyond Blue</p> 	<p>Beyond Blue provides information and support designed to promote mental health, with a particular focus on anxiety and depression.</p>	<ul style="list-style-type: none"> <li>• Immediate one-on-one support available through phone, online chat or email followed by direction to other support services specific to your mental health needs.</li> <li>• Provision of information and resources to promote mental health.</li> </ul>	<p>beyondblue.org.au Phone: 1300 224 636</p>
<p>headspace National Youth Mental Health Foundation</p> 	<p>headspace National Youth Mental Health Foundation provides early intervention mental health services for 12- to 25-year-olds.</p>	<ul style="list-style-type: none"> <li>• headspace can help young people with mental health and wellbeing, physical health (including sexual health), alcohol and other drug services, and work and study support.</li> <li>• headspace has centres in more than 150 locations across Australia, online and phone counselling services, vocational services, and has a presence in schools and communities.</li> </ul>	<p>headspace.org.au Phone: 1800 650 890</p>
<p>Lifeline</p>	<p>Lifeline is a national charity organisation that focuses on suicide prevention and provides 24-hour crisis support to any Australian experiencing emotional distress.</p>	<ul style="list-style-type: none"> <li>• Provision of free telephone, text and online chat crisis support services.</li> <li>• Provision of training programs to build skills and foster safe behaviours and suicide awareness in the community.</li> </ul>	<p>lifeline.org.au Phone: 131 114 Text: 0477 131 114</p>
<p>RUOK?</p> 	<p>RUOK? aims to prevent harm and suicide through empowering people to communicate with each other meaningfully about mental health.</p>	<ul style="list-style-type: none"> <li>• Provision of resources and instruction about how to communicate meaningfully about mental health and suicide.</li> </ul>	<p>ruok.org.au</p>

### 3.4 CHALLENGE

#### Researching mental health organisations

Research a mental health organisation not mentioned in this topic that is in your local area. Use your research to answer the questions.

- 1 What is the name of the organisation and what are their objectives?
- 2 What services do they offer and who are they directed at?
- 3 How is this organisation funded?

#### mental health worker

a person who works in the mental health care sector, often providing support in addition to that of psychiatrists and psychologists

In addition to psychologists and psychiatrists, mental health organisations rely on **mental health workers** to care for people who have mental health problems. Mental health workers have diverse roles, which can include assisting their clients to work through counselling or running therapy sessions or groups. Mental health workers must also have a thorough understanding of the mental health care system and the range of organisations available to help. They are often tasked with connecting clients to services that will provide them with the best health outcomes specific to their needs.

To gain a comprehensive understanding of the system that they will be working in, mental health workers will either need to complete a Bachelor's degree or diploma in either social work, counselling or nursing. They also pursue additional training specific to the mental health sector they will work in. Some examples of mental health workers and their roles are outlined in Table 2.

**TABLE 2** Different types of mental health workers and their respective roles

Mental health worker	Description	Roles and duties
<b>Social workers</b>	Allied health professionals who assist people needing support, particularly when they are in crisis.	<ul style="list-style-type: none"> <li>• Provide counselling and information to clients.</li> <li>• Refer clients to other support services relevant to their specific needs.</li> </ul>
<b>Mental health nurses</b>	Nurses specially trained to care for people who have mental health problems. They can work in hospitals, mental health facilities, aged care facilities, and in the community.	<ul style="list-style-type: none"> <li>• Assist doctors, psychiatrists and psychologists to provide information, support and care to clients.</li> <li>• Administer medication and other treatments, such as behaviour modification programs.</li> <li>• Visit clients and treat them in their homes if required.</li> </ul>
<b>Aboriginal and Torres Strait Islander health workers</b>	Allied health workers who understand health issues relevant to Aboriginal and Torres Strait Islander peoples and use culturally responsive health services.	<ul style="list-style-type: none"> <li>• Promote the social and emotional wellbeing of Aboriginal and Torres Strait Islander people through counselling and provide access to all seven domains of social and emotional wellbeing (you will learn more about this in Unit 4).</li> <li>• Provide information, referrals and support to individuals and families of individuals affected by social and emotional wellbeing challenges.</li> </ul>

#### social worker

allied health professional who assists people needing mental health support, particularly when they are in crisis

#### mental health nurse

nurse who is specially trained to care for people who have mental health problems

#### Aboriginal and Torres Strait Islander health worker

allied health worker who has an understanding of health issues relevant to Aboriginal and Torres Strait Islander peoples and uses this to provide culturally responsive health services

### 3.4 CHECK YOUR LEARNING



#### Describe and explain

- 1 Identify three different types of psychologists and describe each of their roles.
- 2 Explain why it is important that a range of different mental health professionals and organisations exist.
- 3 Describe the role of a mental health worker with reference to an example.

#### Apply, analyse and compare

- 4 Compare the roles of psychologists and psychiatrists in supporting mental wellbeing.
- 5 For each of the scenarios below, suggest which of the mental health organisations featured in this chapter would be most appropriate. Justify your answers.
  - a Ayesha, 26, is having thoughts of self-harm. It is midnight and she feels as though she has no-one to talk to.
  - b Tom, 38, is concerned that his daughter is showing signs of anxiety and depression and wants some more information about support he can offer.

- c Wei, 17, wants to start talking to a professional about her mental health issues. She does not feel right and wants to get on top of things before they escalate.
  - d Omar, 31, is the teacher responsible for organising Mental Health Week at his secondary school. He is looking for resources for encouraging conversations about mental health.
- 6 Provide an example of how a person might make use of several mental health professionals or organisations as part of their journey towards improving their mental health.

#### Design and discuss

- 7 Discuss the need for different types of mental health professionals, using examples to support your response.
- 8 Design a flowchart or mind map that directs people with diverse mental health needs to the mental health professional or organisation that is best suited to their needs.

**FIGURE 3** Mental health workers offer care to individuals experiencing mental health problems.



# 3.5

## Diagnosing and managing atypical behaviour



### KEY IDEAS

- ✦ Psychologists and psychiatrists both diagnose and manage atypical behaviour. Diagnosis is an important step in establishing the best course of treatment.
- ✦ Diagnosis of a psychological or neurodevelopmental disorder generally involves assessing the patient's presentation of symptoms and using a diagnostic tool such as the DSM-5-TR to determine their specific diagnosis.
- ✦ Two techniques used to manage atypical behaviour by mental health professionals are cognitive behavioural therapy and psychoeducation.
- ✦ The use of culturally responsive practices by mental health professionals in their treatment promotes better health outcomes for their patients.

### Diagnosing atypical behaviour

One of the many roles of psychologists and psychiatrists is to diagnose psychological disorders. When a person suspects that their wellbeing or psychological functioning is not neurotypical, they will often seek a **diagnosis** to clarify the specific divergence they are experiencing. Accurate diagnosis of psychological disorders is important as it can aid the course of treatment to improve day-to-day functioning.

To diagnose a patient, a mental health professional will generally assess the patient through conversations and interviews. The patient will describe their concerns as well as any atypical behaviours or symptoms they have experienced. A mental health professional will also note down any observable behaviours or symptoms that the patient displays during assessment. Finally, using the collective data they have gathered about the patient, the mental health professional will refer to a diagnostic resource to determine a specific diagnosis.

#### diagnosis

identification of a disease or condition through its signs and symptoms



**FIGURE 1** Mental health professionals use data they have collected about a patient to help form a diagnosis.

## Diagnostic and Statistical Manual of Mental Disorders

The **Diagnostic and Statistical Manual of Mental Disorders (DSM)** is the most widely used classification system for diagnosis of psychological disorders in Australia. The manual is published by the American Psychiatric Association and is currently up to its fifth edition (the DSM-5-TR). The DSM-5-TR has been updated several times and will continue to be updated as our understanding of psychological function and disorders improves.

The DSM-5-TR uses a descriptive method of diagnosis. This means that it describes the nature of psychological disorders, including symptoms. For a diagnosis to be made, the psychologist or psychiatrist must compare the symptoms listed in the DSM-5-TR for a particular disorder with the symptoms experienced by their patient. If enough of the DSM-5-TR symptoms are displayed by the patient, they may receive a diagnosis for that disorder.

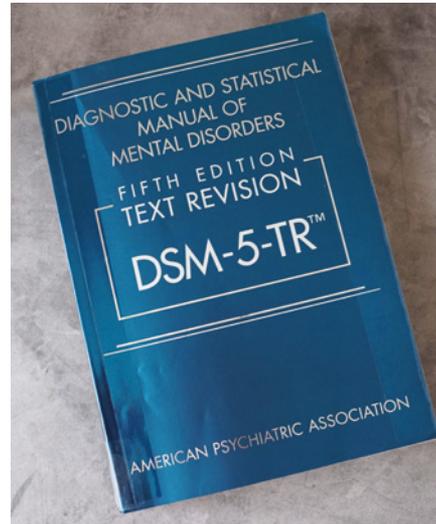


FIGURE 2 The front cover of the DSM-5-TR

### **Diagnostic and Statistical Manual of Mental Disorders (DSM)**

a widely used classification system for psychological and neurodevelopmental disorders published by the American Psychiatric Association

### Strengths of the DSM-5-TR

- The DSM-5-TR allows for consistency and standardisation between mental health professionals in diagnosis. It has contributed to the use of consistent terminology and decreased ambiguity for psychological disorders.
- Similar disorders are grouped together according to their symptoms and behaviours. This allows the mental health professional to identify a general category of disorder before narrowing down to a specific diagnosis as they learn more about their patient.

### Limitations of the DSM-5-TR

- A DSM-5-TR diagnosis often relies on self-reported symptoms and behaviours from patients. Since not all patients may be completely honest about their experiences or may not be able to understand or realise their neurodivergence, this can lead to **misdiagnosis** or **overdiagnosis**.
- The DSM-5-TR does not specify the causes of disorders or the treatments for disorders.

**misdiagnosis**  
an incorrect diagnosis

**overdiagnosis**  
the diagnosis of a condition that would not have produced any symptoms or led to any health problems if it had been left undiagnosed

## Managing atypical behaviour

Diagnosis is an important first step in a person's management of their neurodivergence. Once a diagnosis has been made, a mental health professional can then work on delivering an appropriate course of treatment to help the individual manage their symptoms and behaviour. Ideally this course of treatment will limit the disorder's negative impact on day-to-day functioning.

The management of each patient's atypical behaviour will look different depending on the behaviours each person presents. While treatments and interventions will differ for each patient, there are some commonly practised forms of psychotherapy that can be used to treat many different types of disorders.

## Cognitive behavioural therapy

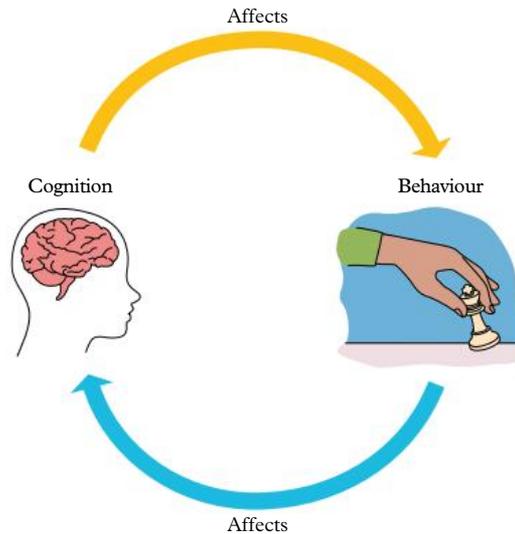
It is widely accepted in psychology that the way you think influences the way that you behave and vice versa. Psychologists and psychiatrists often implement a technique that takes advantage of the relationship between cognition and behaviour, called **cognitive behavioural therapy (CBT)**. It involves identifying maladaptive thoughts and behaviours and replacing them with adaptive thoughts and behaviours.

### **cognitive behavioural therapy (CBT)**

a form of psychotherapy based on the presumption that thoughts and behaviours influence one another; patients are encouraged to identify maladaptive thoughts and behaviours and replace them with more adaptive alternatives

### **Study tip**

When responding to exam questions about CBT or related strategies, you need to mention both the cognitive and behavioural components of the therapy, as well as how they influence each other. This has been made clear in past VCAA examiners' reports.



**FIGURE 3** CBT takes advantage of the bidirectional relationship between cognition and behaviour.

For example, a person with a phobia of birds may have irrational thoughts about how dangerous birds are. Experiencing these irrational thoughts can then influence the person to act out certain behaviours, such as avoiding birds by always remaining indoors. This behaviour would be considered maladaptive for the person, as it prevents them from going to work, shopping and socialising. In this scenario, a mental health professional might try to help the person correct their irrational thoughts about birds by helping them understand that not all birds are dangerous. They might educate them on facts about birds and their nature (for example, only 9 to 12 per cent of magpies will swoop when threatened) to help recognise flaws in maladaptive thoughts. Changing the person's thoughts on how dangerous birds are could assist the person to change their behaviour and enable them to stop demonstrating avoidance behaviours towards birds, allowing them to go outside and live their life (Figure 4).

Similarly, the mental health practitioner could also work to change the person's behaviour first and encourage the person to venture outside. If the person experiences being outside while birds behave in a non-threatening manner, this experience can potentially change the person's perception of how dangerous birds are.

CBT is not only used to treat phobias. It can be used to manage a variety of atypical behaviours associated with developmental and psychological disorders, including mood disorders, addiction disorders, eating disorders, ASD and ADHD.

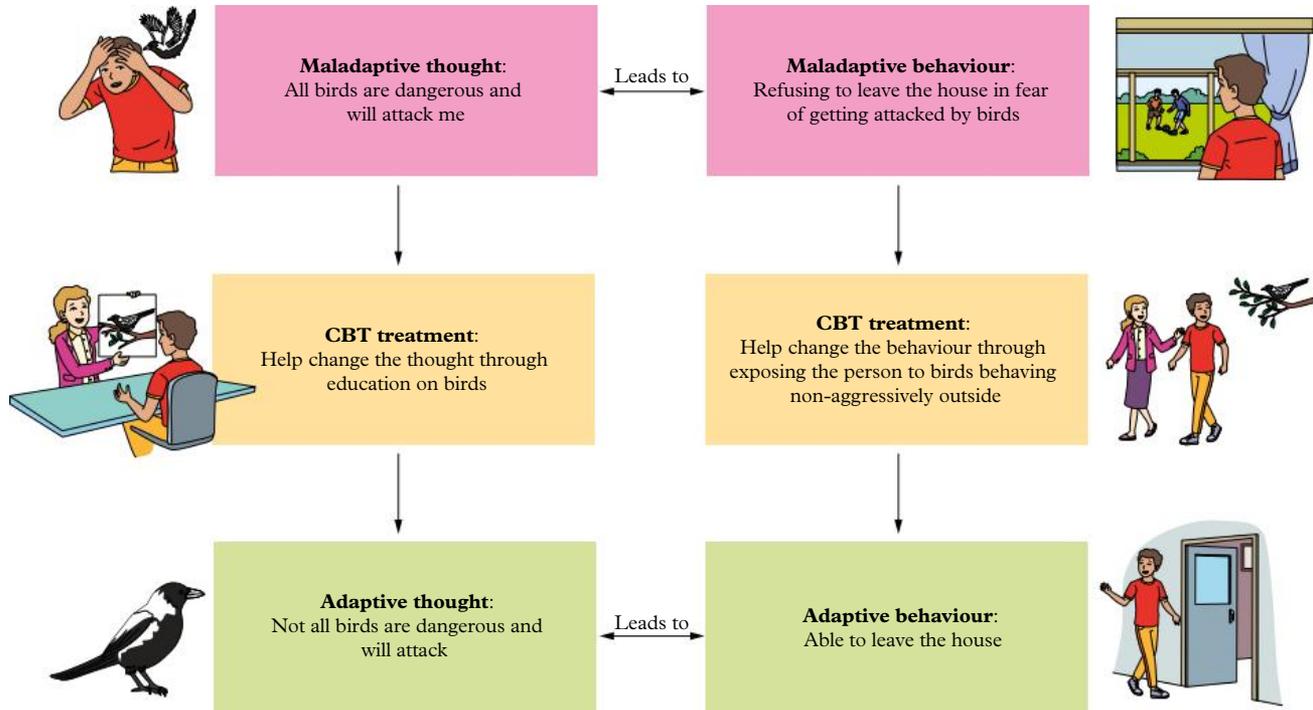


FIGURE 4 CBT can be used to change maladaptive thoughts and behaviours into adaptive thoughts and behaviours.

## Psychoeducation

Another technique that mental health professionals use in behaviour management is psychoeducation. **Psychoeducation** involves providing information about a diagnosed disorder to the patient, their family and their wider support networks to improve understanding and management of the disorder. The more a person understands about the condition they live with, the better they can cope with the challenges it presents. Increasing understanding of the condition among family and support networks can also allow these parties to provide additional support to the person with the disorder. Psychoeducation is particularly important for children affected by psychological or neurodevelopmental disorders, because the child's day-to-day functioning and lifestyle relies heavily on the adults in their lives.

**psychoeducation**  
a form of psychotherapy that involves providing information about a diagnosis or condition to patients and their support networks to help them cope with their diagnosis

The implementation of psychoeducation can vary from patient to patient according to specific needs. The information can include:

- the nature of the diagnosis, including symptoms and prognosis
- possible causes of the condition
- possible treatments and services that are available to support someone with the condition
- the impact of the condition or disorder on the patient and their family and friends.

When a patient understands more about their disorder, they feel more in control of their condition because they have an increased ability to access coping strategies that work for them. Psychoeducation also plays a role in reducing the stigmatisation of disorders by correcting misconceptions about the disorder that the patient or their support network may have.

### 3.5A SKILL DRILL

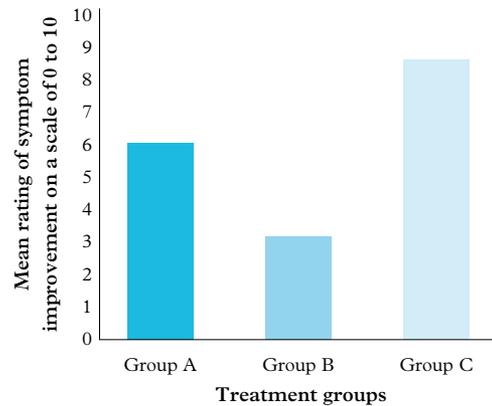
#### Analysing and evaluating CBT data

**Key science skill: Analyse and evaluate data and investigation methods**

Thirty patients from a clinic that specialises in treatment of mood disorders (disorders that mostly affect your emotional state) were asked to rate how much their symptoms had improved on a scale of 0 to 10 (where 0 represents no improvement and 10 represents complete improvement) after a six-month treatment program.

- Group A consisted of 10 patients who underwent a treatment program that involved CBT only.
- Group B consisted of 10 patients who underwent a treatment program that involved psychoeducation only.
- Group C consisted of 10 patients who underwent a treatment program that involved both CBT and psychoeducation.

The results of the survey are shown in the graph below.



**FIGURE 5** The mean rating of symptom improvement by treatment group

#### Practise your skills

- 1 Identify the independent and dependent variables in this study.
- 2 Summarise the data presented in Figure 5.
- 3 Identify and explain one potential source of error from this study. Suggest how it could be improved in a future study.

Need help analysing and evaluating data and investigation methods? Go to Topic 1.7 in your Psychology toolkit.

**FIGURE 6** Psychoeducation may include information on treatments and services available to help manage a condition.



## Culturally responsive practices

Our society should be safe and inclusive for all people, regardless of age, sex, ethnicity, religion, relationship status, sexual orientation or ability. As such, our mental health system needs to actively support and meet the needs of diverse communities. It is well known that diverse factors such as culture can play a significant role in how an individual interprets and experiences their own mental wellbeing, as well as how they expect to be managed or treated.



**FIGURE 7** Some mental health professionals may specialise in working with a particular group or culture; for example, a psychiatrist may specialise in working with elderly patients.

For example, **social and emotional wellbeing** (SEWB) is a framework used to understand and assess the overall health and wellbeing of Aboriginal and Torres Strait Islander peoples. This framework recognises the significance of a variety of cultural factors that contribute to the health and wellbeing of Aboriginal and Torres Strait Islander peoples (cultural determinants of health). You will learn more about SEWB in Unit 4.

No matter which sector a mental health professional works in, they are required to implement **culturally responsive practices** into the care of their clients. This means that psychologists and psychiatrists must have an understanding of and respect for other people's cultural and individual beliefs. There are many different communities and cultures that mental health professionals need to be aware of and able to respond to so that all patients can be adequately supported. For example, some mental health professionals might have expertise in supporting the LGBTQ+ community, Aboriginal and Torres Strait Islander communities, people who have experienced trauma, people who are from linguistically diverse backgrounds, or people with limited mobility.

Psychologists and psychiatrists must use their knowledge of the different cultures and communities that they work with to understand how diverse beliefs and experiences can affect an individual's psychological development and mental wellbeing. A more holistic understanding of factors that could contribute to the mental wellbeing and psychological development of each individual allows the mental health professional to cater to the specific treatment or management needs of their clients.

By being culturally responsive, health professionals are increasing access to health care and improving the quality of health care provided, all of which contribute to better health outcomes for our diverse community.

### **social and emotional wellbeing**

a holistic understanding of wellness for Aboriginal and Torres Strait Islander peoples including intrinsic connections between the relational-self, mind-emotions, body, Country, community, culture, kinship and ancestry

### **culturally responsive practice**

approach towards mental health care where diverse factors, such as cultural beliefs, are considered and respected in terms of their possible impacts on an individual's psychological development and mental wellbeing

### 3.5 REAL-WORLD PSYCHOLOGY

#### Improving Aboriginal and Torres Strait Islander health outcomes with culturally responsive practices

Since European colonisation, many Aboriginal and Torres Strait Islander communities have felt the lasting impacts of colonisation, including systemic inequality, mistreatment, prejudice and racism. These lasting impacts can negatively affect health and social and emotional wellbeing.

Research has demonstrated that Aboriginal and Torres Strait Islander peoples are more likely to experience high psychological stress than non-Indigenous Australians (AIHW, 2018). First Nations perspectives on social and emotional wellbeing can also differ to those of non-Indigenous Australians, and Western psychology is not always equipped to address culturally specific issues. Research has shown that culturally responsive health practices can lead to improved psychological health outcomes for Aboriginal and Torres Strait Islander peoples. Aboriginal and Torres Strait Islander peoples are more likely to experience improved social and emotional wellbeing outcomes when they are supported with practices that:

- take a holistic approach to wellbeing, accounting for First Nations peoples' connection to Country, culture, community and family while still being context-specific for each individual
- acknowledge the racism towards and marginalisation of Aboriginal and Torres Strait Islander communities
- focus on empowering Aboriginal and Torres Strait Islander peoples through recovering from trauma and embracing strengths.

#### Apply your understanding

- 1 Identify one factor that may negatively affect social and emotional wellbeing.
- 2 Discuss the importance of culturally responsive practices in improving health outcomes for Aboriginal and Torres Strait Islander peoples.



**FIGURE 8** Long-term racism has had negative impacts on the social and emotional wellbeing of Aboriginal and Torres Strait Islander peoples.

### 3.5B SKILL DRILL

#### Generating, collating and recording data on mental health outcomes

##### Key science skill: Generate, collate and record data

A psychologist is researching whether implementing culturally responsive practices leads to better mental health outcomes for adolescents. He obtains his patient files from one organisation that uses culturally responsive practices as well as patient files from another organisation that does not use culturally responsive practices.

#### Practise your skills

- 1 Explain whether the investigation described makes use of primary or secondary data.
  - 2 Give examples of both qualitative and quantitative data that could be collected as part of this investigation.
  - 3 Develop a hypothesis for the investigation.
- Need help generating, collating and recording data? Go to Topic 1.5 in your Psychology toolkit.

### 3.5 CHECK YOUR LEARNING

#### Describe and explain

- 1 Explain how diagnosis and treatment of atypical behaviours are related.
- 2 Identify and describe the most-used tool for diagnosis of psychological or neurodevelopmental disorders.
- 3 Describe two techniques used to manage atypical behaviour by mental health professionals.
- 4 Outline the steps a mental health professional would need to take to diagnose a patient with a psychological or neurodevelopmental disorder.
- 5 Explain what is meant by the term “culturally responsive practice”.

#### Apply, analyse, and compare

- 6 Provide an original example (not one used in the text) of how CBT could be used to help to manage a maladaptive thought or behaviour.

- 7 Julio, who is 11, has recently been diagnosed with ADHD. Analyse how psychoeducation would be effective in managing Julio’s behaviour with reference to the different parties involved in this process.
- 8 Suggest how a psychologist could implement both CBT and psychoeducation to help treat a teenager presenting with an anxiety disorder.

#### Design and discuss

- 9 Discuss the usefulness and limitations of the DSM-5-TR as a diagnostic tool.
- 10 Discuss the importance of culturally responsive practices in terms of health outcomes with reference to Aboriginal and Torres Strait Islander peoples and other marginalised groups.
- 11 Design an experiment that compares the effectiveness of treating a mental health condition with either CBT or psychoeducation.



## Chapter summary

- 3.1** • Typical behaviours refer to behaviours that would be expected or are consistent with what usually occurs in a particular context, while atypical behaviours refer to behaviours that would be unexpected or unusual in a particular context. Classification of behaviour is a common aspect of assessing psychological development and wellbeing.
  - Categorisation of behaviour as typical or atypical can be done according to different criteria, including cultural perspectives, social norms, statistical rarity, personal distress and maladaptive behaviours.
  - The more context available when categorising behaviour, the more accurate and useful judgments about typicality or atypicality can be.
- 3.2** • Whether emotions, cognitions and behaviours are normal for a person can be assessed in terms of whether they are adaptive or maladaptive. Adaptive emotions, cognitions and behaviours are considered to be more normal than their maladaptive counterparts.
  - Emotions, cognitions and behaviours that deviate significantly from neurotypicality can indicate psychological disorders or the need for support. However, this is not always the case, and neurodiversity is something that should be respected and appreciated.
- 3.3** • Neurodiversity refers to the differences in brain function that exist within a diverse population.
  - Neurodivergence is a type of neurodiversity associated with normal variations of brain development such as neurodevelopmental disorders.
  - Some common examples of neurodivergence include autism spectrum disorder, attention deficit hyperactivity disorder and learning disorders.
  - Personalised treatments are available to assist neurodiverse people to harness their strengths and manage day-to-day functioning.
- 3.4** • Psychologists and psychiatrists work to support psychological development and wellbeing across a range of sectors. Psychiatrists are also doctors who can prescribe medications, whereas psychologists cannot.
  - In addition to psychologists and psychiatrists, there are a range of mental health organisations and mental health workers that individuals and groups can access which are often specialists in particular areas of mental health and wellbeing.
- 3.5** • Psychologists and psychiatrists work to both diagnose and manage atypical behaviour. Diagnosis is an important step in establishing the best course of treatment.
  - Diagnosis of a psychological or neurodevelopmental disorder generally involves assessing the patient's presentation of symptoms and using a diagnostic tool such as the DSM-5-TR.
  - Cognitive behavioural therapy involves identifying maladaptive thoughts and behaviours and replacing them with more adaptive alternatives.
  - Psychoeducation involves providing patients and their support networks with information about the diagnosis and condition to enhance their ability to cope.
  - Culturally responsive practices are approaches towards health care where diverse factors such as cultural beliefs are considered and respected in terms of their possible impacts on an individual's psychological development and wellbeing, which leads to better health outcomes for clients.

## Revision questions

### Multiple choice

- Behaviours that are expected or consistent with the type of behaviours usually exhibited by a person in that situation are called:
  - normal behaviours.
  - typical behaviours.
  - atypical behaviours.
  - adaptive behaviours.
- Joanna has recently moved to a new school. Upon the submission of her first piece of homework, she learns that she is the only student who uses cursive handwriting. Every other student in the school chooses to write with non-cursive (print) handwriting. Joanna's choice to use cursive handwriting would be classified as atypical behaviour under the criteria of:
  - maladaptive behaviour.
  - social norms.
  - statistical rarity.
  - cultural perspectives.
- Which of the following correctly identifies examples of emotion, cognition and behaviour?

	Emotion	Cognition	Behaviour
<b>A</b>	Being annoyed at a friend	Ignoring a friend who speaks to you	Thinking about ignoring a friend
<b>B</b>	Planning to ignore a friend	Being annoyed at a friend	Thinking about ignoring a friend
<b>C</b>	Belief that your friend has done you wrong	Feeling guilty about ignoring a friend	Ignoring a friend
<b>D</b>	Feeling guilty about ignoring a friend	Belief that your friend has done something wrong	Ignoring a friend

- Identify which of the following statements are true.
  - Neurodiversity includes both neurotypical and neurodivergent people.
  - Neurotypicality includes both neurodiversity and neurodivergent people.
  - Neurodiversity does not include neurodivergent people.
  - Neurodivergent people are also neurodiverse.
- A similarity between common examples of neurodivergence such as ADHD and ASD is that:
  - both ASD and ADHD are treated with medication to cure the condition.
  - neither ASD nor ADHD have cures but treatment can reduce the negative impact of symptoms.
  - both ASD and ADHD negatively impact one or more specific aspects of learning.
  - neither ASD nor ADHD affect people once they reach adulthood.
- Which of the following statements about mental health professionals is correct?
  - Psychologists can prescribe medication while psychiatrists cannot prescribe medication.
  - Psychiatrists can prescribe medication while psychologists cannot prescribe medication.
  - Both psychiatrists and psychologists can prescribe medication.
  - Neither psychologists nor psychiatrists can prescribe medication.



- 7 Hamza is a police officer. Hamza speaks to \_\_\_\_\_ psychologist about the possible causes of an increase in crime in his local town. Hamza also decides to book \_\_\_\_\_ psychologist to work with his own team at the police station, who have had some workplace disputes lately.
- A a clinical; a community
  - B a community; a clinical
  - C an organisational; a forensic
  - D a forensic; an organisational
- 8 Which mental health organisation focuses on crisis prevention by providing a 24-hour hotline for those feeling suicidal to call for support?
- A RUOK?
  - B Lifeline
  - C Beyond Blue
  - D headspace
- 9 Which of the following is not included in the DSM-5-TR?
- A Causes of psychological disorders
  - B Symptoms of psychological disorders
  - C Categories of psychological disorders
  - D Descriptions of psychological disorders
- 10 Which of the following is true about psychoeducation?
- A It can only be provided by psychiatrists, not psychologists.
  - B Its main goal is to replace adaptive behaviours and cognitions with more maladaptive alternatives.
  - C It involves providing information about a disorder to both the patient and their support network.
  - D Its main goal is to replace maladaptive behaviours and cognitions with more adaptive alternatives.

### **Short answer**

#### **Describe and explain**

- 11 Describe an example of atypical behaviour according to the criteria of social norms.
- 12 Describe how autism spectrum disorder is an example of neurodivergence.
- 13 Explain why adaptive behaviours are considered more neurotypical than maladaptive behaviours.
- 14 Describe the process of diagnosing a psychological disorder.
- 15 Explain the term “culturally responsive practice”.

#### **Apply, analyse and compare**

- 16 Compare the roles of three different health care professionals in supporting psychological wellbeing.
- 17 Analyse how the same behaviour could be categorised as either typical or atypical according to different criteria.
- 18 Compare the terms “cognitions”, “emotions” and “behaviours”.
- 19 Distinguish between neurodiversity, neurotypicality and neurodivergence using examples.
- 20 Analyse the relationship between the concepts of diagnosis and treatment using an example.
- 21 Compare dyslexia and dyscalculia.
- 22 Suggest why psychoeducation is often provided to both the patient and their caregiver.
- 23 Using an example, explain how CBT can work to alter both cognitions and behaviour.
- 24 Compare psychoeducation and CBT as methods of managing atypical behaviour.

### Design and discuss

- 25** Discuss the usefulness of using psychological criteria for classifying behaviour as typical or atypical.
- 26** Discuss why diversity is considered the norm and not an exception to the rule.
- 27** Discuss the importance of identifying and categorising maladaptive or atypical behaviours in mental health care.
- 28** With reference to neurodivergence, discuss the importance of support for psychological development and wellbeing being tailored to the patient's specific needs.
- 29** Discuss the importance of mental health care professionals incorporating culturally responsive practices.
- 30** Evaluate the usefulness of the DSM-5-TR as a diagnostic tool for psychological and neurodevelopmental disorders.

You can find the following resources for this section in your **obook pro**:

pro

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

# Checkpoint

## Part A – Assessment support for Unit 1 Area of Study 1

In Unit 1 Area of Study 1, you will be required to complete **one** task from the following options:

- analysis and evaluation of an experiment or case study
- a data analysis of generated primary and/or collated secondary data
- reflective annotations of a logbook of practical activities
- media analysis of one or more contemporary media texts
- a literature review
- response to a psychological issue or ethical dilemma
- a modelling or simulation activity
- problem-solving involving psychological concepts, skills and/or issues
- a report of a scientific investigation, including the generation, analysis and evaluation of primary data.

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The assessment support provided in this section models one way of approaching the following task for Outcome 1:

- analysis and evaluation of a case study.

### Important notice to students and teachers

Your teacher may select one of the other task options above for you to complete as assessment for this Outcome. If so, refer to the table of contents to find the assessment support related to that task.

**The advice, sample assessment and sample response provided should be used as an example only and should not be completed as part of your formal assessment. Instead, your teacher will create a new task for your class to complete.**

**Unless specifically credited, the VCAA has not written this material and does not endorse the content.**

### Overview of Assessment 1 – Analysis and evaluation of a case study

In this sample assessment for Unit 1 Area of Study 1, you will be required to answer a series of questions that relate to a scenario about twins and their psychological development. This task is designed to assess your understanding of differences between hereditary and environmental factors, the biopsychosocial model, previous psychological theories and experiments, neurodiversity and various treatments or diagnoses for neurological conditions. This assessment will require you to carefully read through a case study and extract the necessary information to answer questions that intertwine various theories and psychological development terminology.

### Study tip

If you have access to the *Psychology for VCE Units 1 & 2 Student Workbook*, practise some of the key science skills needed for this assessment by completing the Case cracker activities before attempting this practice assessment.



**FIGURE 1** In this sample assessment you will look at a case of twins and examine how hereditary and environmental factors can influence psychological development.

### **A step-by-step guide to completing Assessment 1**

The information provided in this section is designed to help you prepare and practise for Assessment 1. The tips and advice included are broad and should help you successfully complete an analysis and evaluation of a case study, regardless of the specific requirements of the task your teacher or school has created.

#### **Step 1: Carefully read the requirements of the task and understand how you will be assessed**

The best way to set yourself up for success on Assessment 1 is to read the Real-world psychology sections included in Chapters 2 and 3 and answer the associated questions. This will prepare you for combining your comprehension skills with your understanding of the theory.

#### **Step 2: Be specific with the scenario**

Remember to include names and refer to specific elements of a scenario or case study when answering a question. For example, avoid saying “their symptoms” when you could say “[Name] symptoms would include ...”.

#### **Step 3: Understand command terms**

If asked to “evaluate” a model or theory, it is expected that you discuss both positive and negative aspects of that model or theory.

#### **Step 4: Answering biopsychosocial questions**

When asked questions about the biopsychosocial model, ensure you link the specific factor you are talking about with the relevant component of the model. For example, “a biological factor (*component*) would be their genetics (*specific factor*)”.

Now that you have learned about some key steps to achieve success on your first assessment, it is a good time to practise putting this theory into action.

## Sample Assessment 1

Read the following case study regarding a lost seven-year-old child, Phoebe James, and use the information to answer all questions.

On 27 September 2013, a pair of monozygotic (identical) twin girls named Phoebe and Clarissa James were born. At four months old, Phoebe was kidnapped from her family home. Despite the efforts of her parents to find her, Phoebe remained missing for several years. Finally in 2018, Phoebe was found in a rural town where she had been kept locked in a shed. When Phoebe was found, it became clear that she had had very little contact with the outside world. She spent most of her life in the dark shed surviving on small food rations that were provided by her captor. After being reunited with her parents and sister, Phoebe was referred to prominent child psychologist Dr Adam Drava. He has been working with Phoebe for the past few years. She is currently 10 years old.

When the work began with Phoebe, Dr Adam Drava noted the following:

It is evident Phoebe has missed her sensitive period for language acquisition, which has left her unable to ever communicate in her native tongue. She is capable of grunts and sounds to indicate her approval or disapproval towards basic items like food, toys and images. When allowed to play naturally with toys, Phoebe displays aggressive tendencies where she prefers to throw or hit the toys. Interestingly, on the occasions I have observed her sister Clarissa in the waiting room, I noticed her caring disposition as she cradles and rocks the dolls.

- 1
  - a Use examples from the above extract to outline the difference between hereditary and environmental factors on Phoebe's development. (3 marks)
  - b Based on the current understanding of psychological development, explain whether hereditary or environmental factors are more influential in shaping an individual's development. (1 mark)
- 2 Phoebe immediately moved back home with her parents and sister after she was discovered. She has now been living at home for the last five years. After his most recent meetings with Phoebe, Dr Drava made the following notes:

Since reuniting with her family, Phoebe has demonstrated an extreme case of separation anxiety. As soon as her mother is out of sight, even for a brief period, Phoebe immediately begins crying, which is making life very difficult for her mother, who is unable to even use the bathroom without taking her daughter with her. To confirm Phoebe's attachment style, I conducted the "Strange Situation" experiment in my own office to observe her behaviour. While this experiment is traditionally conducted with young infants, I felt it may be useful in her case given Phoebe's unfortunate upbringing and extreme dependence on her mother. As expected, Phoebe appeared anxious in the room even with her mother present. When Phoebe's mother left the room, Phoebe became very upset and was unable to be comforted. Upon her mother's return, she cried to be picked up and then wiggled in her mother's arms, still showing signs of distress.
- 3
  - c Identify a biological, psychological and social impact that would have had a negative impact on Phoebe's development. (3 marks)
  - d Dr Drava knows that valuable information for his research can be obtained by comparing the two twins. Are twin studies more useful for studying the influence of hereditary or environmental factors? Justify your reasoning. (2 marks)
  - e Dr Drava notes that Phoebe has missed her sensitive period for language acquisition and will therefore be unable to speak in her native tongue. State whether you agree with Dr Drava's comment. Justify your answer. (2 marks)

**a** Use your understanding of Ainsworth's research to outline each of the three different attachment types. Justify which type of attachment is most evident in Phoebe. (4 marks)

**b** Dr Drava explains that the lack of comfort provided to Phoebe over time could result in her not being able to leave the company of her parents even for a brief period, including when she is hungry. Explain whether Harlow's research findings support this statement. (3 marks)

**3** Dr Drava also conducted some tests to determine Phoebe's current stage of cognitive development based on Piaget's work. Dr Drava notes that:

Phoebe recognises that an object can still exist even if it is unable to be seen, heard or touched. I tested this by hiding a toy under a blanket. Phoebe continued to intently stare at the blanket, waiting for the toy to reappear. Additionally, it is pleasing to note that Phoebe has begun to develop food and toy preferences and has developed a greater sense of self-control.

Tests also were conducted to compare Phoebe's psychological development to Clarissa's. At the same age of six years old, Clarissa has started to understand conversations. For example, Clarissa will point out that if they go outside when it is raining, they will get wet. Clarissa has also been able to recognise that the same volume of water in a drink bottle can look different when poured into another drink bottle of different size and shape.

**a** According to Piaget's theory of cognitive development, what cognitive skill has Phoebe demonstrated in the above extract? Make sure you state the stage in which this cognitive skill is assessed. (2 marks)

**b** Dr Drava is hesitant to base all his diagnosis about the twins' psychological development on Piaget's theory. Outline two criticisms of Piaget's theory of cognitive development that may be causing Dr Drava's hesitation. (2 marks)

**c** Outline a skill that Clarissa has demonstrated in her psychological testing. Use Piaget's research to explain whether this skill is expected for someone of Clarissa's age. (3 marks)

**d** Outline a skill that Phoebe has demonstrated in her psychological testing. Use Piaget's research to explain whether this skill is expected for someone of Phoebe's age. (3 marks)

**e** Explain which stage of Erikson's theory of psychosocial development Phoebe would have been considered to have completed, based on Dr Drava's statement that she had achieved a "greater sense of self-control". (2 marks)

At 20 years of age, both Phoebe and Clarissa have moved out of home. After leaving high school, Clarissa moved overseas to complete her university degree. Clarissa found it difficult to be away from home and found the work at university more challenging than she had expected. Clarissa was usually a very social person but after one month overseas, she found it difficult to socialise with others and stopped accepting invitations to go out. Clarissa started to spend extended periods of time in bed, which affected her attendance at university. She struggled to think clearly and became increasingly stressed about her ability to pass her university subjects. Eventually, Clarissa's worrying led to her no longer feeling comfortable leaving the house. Clarissa made an appointment with the university psychologist.

Phoebe did not move overseas, but instead to a flat nearby to her parents. Phoebe has been working at the local post office for a few months and enjoys the work as it allows her to talk frequently to many customers and she does not have to be quiet all the time. Her manager has noticed that Phoebe will often forget to do jobs that they remind her about. Phoebe also struggles to stand behind the counter without tapping a pen or holding onto something, and she has difficulty staying focused.

- a** Explain what an atypical behaviour is, with reference to an example from the scenario. (2 marks)
- b** Would you consider the behaviour you described in response to part a as an adaptive or maladaptive behaviour? Justify your response. (2 marks)
- c** Clarissa believes she is suffering from a mood disorder, based on her reading of the DSM-5-TR. Evaluate the use of the DSM-5-TR for diagnosing mental health disorders. (2 marks)
- d** Explain how a psychologist and a psychiatrist could assist Clarissa with her mood disorder in different ways. (2 marks)
- e** Outline how Clarissa's psychologist could use CBT to help Clarissa with her mood disorder. (3 marks)
- f** Suggest which neurodivergent condition Phoebe is displaying, referring to two different symptoms as part of your diagnosis. (3 marks)
- g** Describe why psychoeducation might be recommended to Phoebe to assist with her neurodevelopmental disorder. (2 marks)
- Now that you have completed the practice assessment for Unit 1 Area of Study 1, see how well you performed by checking your answers against a high-scoring annotated response and the marking criteria in your obook pro.

You can find the following resources for this section in your obook pro:

pro



**Annotated response and marking criteria**

Once you've completed the practice SAC use this resource to assess your response.

## Part B – Checkpoint questions

### Multiple choice

#### Question 1

In the study of psychological development, what does the term “nurture” refer to?

- A** The influence of hereditary factors on a person's psychological development
- B** The influence of environmental factors on a person's psychological development
- C** The combination of both hereditary and environmental factors on a person's psychological development
- D** The absence of both hereditary and environmental factors on a person's psychological development

#### Question 2

Which of the following is a criticism of Harlow's research involving rhesus monkeys?

- A** The sample size was too small.
- B** Only quantitative data was obtained.
- C** The research may not generalise to human beings.
- D** An independent variable was not established.

Use the following information to answer questions 3 to 6.

Four-year-old Rachel was involved in a study testing Piaget's theory of cognitive development. During the study, psychologists presented Rachel with a range of tasks to determine her current cognitive abilities and to test Piaget's theory.

**Question 3**

The first task was conducted to determine which stage Rachel was currently in, according to Piaget's theory. It involved a simple test of peek-a-boo involving Rachel's mother holding her hands over her face and then removing them. Which cognitive ability does this task test?

- A Centration
- B Sensorimotor skills
- C Goal-directed behaviour
- D Object permanence

**Question 4**

When the researcher discovered that Rachel knew her mother was still there when hiding in the previous test, they described that Rachel was in the:

- A sensorimotor stage.
- B concrete operational stage.
- C preoperational stage.
- D formal operational stage.

**Question 5**

To abide by informed consent procedures, which of the following describes the most ethical approach for the researcher to take?

- A Obtain written consent from Rachel
- B Obtain written consent from Rachel's parent/guardian
- C Obtain verbal consent from Rachel's parent/guardian
- D Obtain verbal consent from Rachel

**Question 6**

Rachel's older sister Michelle attends the study with her parents one day. When the researcher speaks to Michelle about Piaget's theory, she begins making her own predictions about the capabilities of her young sister for the researcher to test. Based on this cognitive ability, which stage (according to Piaget's theory) would Michelle be in?

- A Concrete operational
- B Preoperational
- C Formal operational
- D Structured operational

Use the following information to answer questions 7 to 9.

Dr Varma is investigating the use of a phonics-based reading program to support individuals who have been diagnosed with dyslexia. To determine the effectiveness of the program, 25 participants aged between 10 and 15 years participated in the study. The sample was divided into two groups. Group B participated in the phonics-based reading program for a period of 3 weeks, Group A did not. Both groups were required to complete a word recognition task at the end of a 3-week period.

**Question 7**

What was the dependent variable in the experiment?

- A Exposure to the phonics-based reading program
- B Performance on the word recognition task
- C The presence of a learning disorder
- D Group A and Group B

**Question 8**

Which of the following is a possible controlled variable in the experiment?

- A Age of the participants
- B Time allocated to each participant when completing the word recognition task
- C Number of participants in Group A and Group B
- D Number of questions on the word recognition task

### Question 9

It is vital that Dr Varma upholds the ethical concept of integrity. This means that:

- A Dr Varma will avoid the causation of harm.
- B Dr Varma will ensure that there is no unfair burden placed on the participants.
- C Dr Varma will report all results honestly, regardless of whether they support her prior research in this area.
- D Dr Varma will be committed to maximising the benefits of the study.

### Question 10

According to the biopsychosocial model, mental wellbeing:

- A is mainly influenced by our social interactions, with minor aspects of our genetics having an influence.
- B is influenced by the interaction of biological, psychological and social factors.
- C is influenced by biological, psychological and social factors but they do not interact.
- D is driven by internal factors that go on to have an influence on our external environment.

### Short answer

#### Question 1 (3 marks)

Distinguish between the situational and sociocultural approaches to normality. Provide examples to support your reasoning.

#### Question 2 (2 marks)

Explain why Erikson called his theory “psychosocial development”. Include one example of a crisis faced by individuals in your response.

#### Question 3 (4 marks)

Use the biopsychosocial model to describe how a Year 11 student’s wellbeing during a school day might be influenced by the interaction of biological, psychological and social factors.

#### Question 4 (5 marks)

Marie is a psychologist who is testing Piaget’s theory of cognitive development. As part of her study, she presents a model house to four-year-old Bryan. On one side of the house there is a tree and on the other side of the house there is a pool. She

shows Bryan both sides of the model. Marie sits opposite Bryan, then turns the house so that Bryan can see the side with the tree, and asks him, “What can I see on my side of the house?” Bryan replies, “A tree.”

- a Identify the stage of Piaget’s cognitive development demonstrated by Bryan. (1 mark)
- b Identify and describe the limitation being demonstrated by Bryan. (2 marks)
- c Explain how Bryan could demonstrate that he had overcome the limitation identified in part b. (2 marks)

#### Question 5 (6 marks)

Nobuko has just been diagnosed with anxiety by her doctor. Her doctor used the DSM-5-TR to assist in making the formal diagnosis. Nobuko has told a few of her colleagues about her diagnosis and feels that they are now treating her differently. She is finding it difficult to come to terms with the fact that she has anxiety.

- a Outline the importance of Nobuko seeing a psychologist to provide her with supportive assistance following her diagnosis. (2 marks)
- b Discuss how psychoeducation would be a useful strategy for Nobuko. (2 marks)
- c With reference to Nobuko’s situation, outline one limitation of using the DSM-5-TR to make a diagnosis. (2 marks)

#### Question 6 (10 marks)

Harlow looked at the role a “surrogate mother” plays in attachment.

- a Identify the independent and dependent variables in his experiment. (2 marks)
- b Explain whether Harlow’s findings with monkeys supported his original hypothesis. (3 marks)
- c Explain why Harlow implemented a controlled experiment rather than conducting fieldwork in this area of research. (2 marks)
- d Discuss how Harlow’s research can be used to understand how attachment experiences can be influenced by biological, psychological and social factors. (3 marks)

**Question 7** (13 marks)

Joel is a six-year-old boy who attends a mainstream primary school. In the classroom he displays difficulties with concentration and attention. He also experiences difficulties with listening to adult instructions, social communication and sensory regulation. These difficulties often lead to Joel's behavioural outbursts and negative responses at home and at school. He is often observed in a "flight-or-fight" state of arousal, and as a result cannot process his environment and what is expected from him when in this state. He is fully aware of those around him and seeks and enjoys social exchange. Joel has a keen interest in Doctor Who and Star Wars and will engage with these topics when he is anxious, when he is unsure of what is expected of him and when he refuses to comply in a structured environment. He enjoys playing Doctor Who games on his computer and participating in role-play related to his interests.

- a** Identify one adaptive and one maladaptive behaviour exhibited by Joel. (2 marks)
- b** Use behavioural examples from the scenario to explain why Joel could be diagnosed with ADHD and ASD. (4 marks)
- c** Describe a treatment that a mental health worker could use to assist Joel. (2 marks)
- d** Explain how CBT could be used when Joel is older and more aware of his behaviours and thoughts to assist him with his behavioural outbursts. (3 marks)
- e** Explain how Joel's experience of life provides an example of neurodivergence. (2 marks)

**Question 8** (7 marks)

Julian, a developmental psychologist, is intrigued by the work of Erik Erikson, and interested in whether Australian children who attended childcare before their first birthday would be more socially adjusted than Australian children who did not. He decides to conduct a scientific investigation to explore this, where he will collect qualitative and quantitative data.

- a** Outline which scientific methodology would best suit Julian's proposed investigation. (2 marks)
- b** Distinguish between qualitative and quantitative data. (2 marks)
- c** Provide an example of quantitative data that could be collected during the investigation. (1 mark)
- d** Explain how Julian can ensure the ethical concept of beneficence is upheld. (2 marks)

CHAPTER

# 4

## The role of the brain in mental processes and behaviour

### KEY KNOWLEDGE

- different approaches over time in understanding the role of the brain in behaviour and mental processes
- the roles of the hindbrain, midbrain and forebrain, including the cerebral cortex, in behaviour and mental processes.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

### GROUNDWORK

This chapter will build on concepts you may have come across in Year 10. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



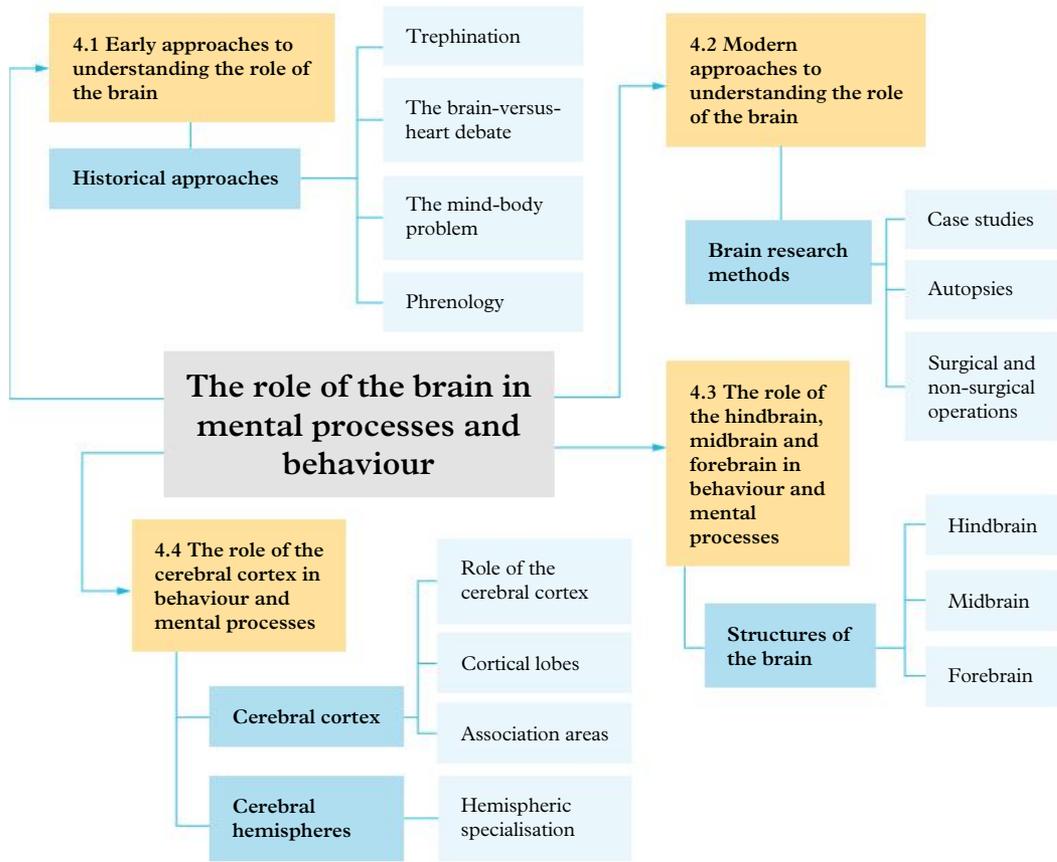
Groundwork quiz  
Chapter 4

### INVESTIGATIONS

4.4A	INVESTIGATION: MODELLING	How can we model the structure of the brain?	Page 479
4.4B	INVESTIGATION: CASE STUDY	How can damage to the frontal lobe impact our experience of emotion?	Page 480

FIGURE 1 A diffusion spectral imaging (DS) scan of white matter nerve fibres in the brain

# CONCEPT MAP



## 4.1

# Early approaches to understanding the role of the brain

## KEY IDEAS

- ✦ Several historical approaches have attempted to understand the role of the brain in mental processes and behaviour.
- ✦ Historical approaches were often conflicting, not based on empirical evidence and did not follow the scientific method.



## Historical approaches

The brain is a complex organ and humans have had a long history of and fascination with trying to uncover how it works. Modern technology has allowed researchers to analyse the brain in detail and scientifically study the brain's structure and function. For our early ancestors, this level of technology and understanding was far from their reach. Historical attempts to explain the role of the brain consisted of many differing views. Some early theories even suggested that mental difficulties were due to the possession of spirits. Barbaric procedures were often performed on the brain without a full understanding of how it worked and the damage these procedures could do. This topic will explore a range of historical approaches to understanding the brain.

### Trephination

**Trephination** was a surgical procedure that involved drilling holes into a person's skull with a sharp instrument. It was used in ancient times to treat ailments including head injuries and common pains such as headaches. Cave paintings and the remains of human skulls with trephination holes have provided archaeological evidence of the procedure's existence. Scientists also believe trephination was used to pull evil spirits from an afflicted person. Trephination is no longer used in modern treatments; however, a similar procedure called a **craniotomy** is still practised. A craniotomy involves removing part of the skull temporarily to access the brain and perform a medical procedure, often to relieve pressure and fluids.



FIGURE 1 A human skull showing five trephination holes

### The brain-versus-heart debate

You may be familiar with the sayings “think with your head not your heart” or “listen to your heart”. These sayings suggest that it is either the brain or the heart that guides our decision-making. The brain-versus-heart debate explores the historically opposing views on whether the brain or the heart is at the centre of all thoughts, feelings and intelligence.

Ancient Egyptians believed that the heart was more valuable and important than the brain. They believed that the heart was the source of all intelligence and personality.

#### trephination

a surgical procedure where holes were drilled into the skull

#### craniotomy

a surgical procedure where part of the skull is removed to expose the brain



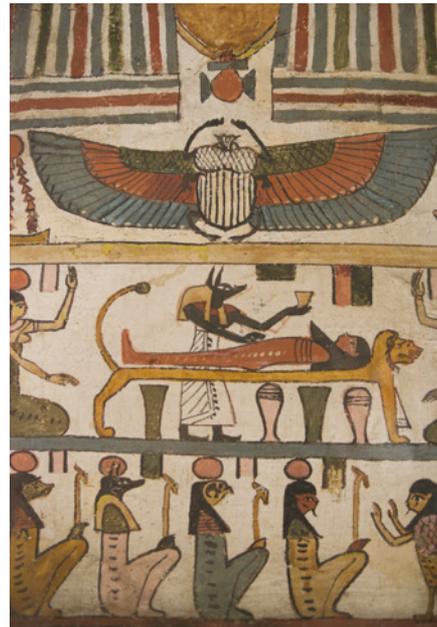
**FIGURE 2** The brain-versus-heart debate explores whether the brain or the heart is at the centre of thoughts and emotions.

During mummification, the heart was preserved and kept in the body. The brain, however, was removed through the nostrils with a hook and discarded because it was not considered important.

The brain-versus-heart debate also has origins in ancient Greek **philosophy**. Alcmaeon (500–450 BCE) is credited as the first person to suggest that the brain holds a more critical role in influencing our thoughts and actions than the heart. He argued that the brain was the source of mind, soul and logic. Alcmaeon was also interested in animal dissections. His dissections on animals led him to believe that the brain and sensory organs, such as the eye, were connected. We now know today that this is true.

Another Greek philosopher, Empedocles (490–430 BCE), held an opposing view that the heart was the centre of all mental processes. Renowned Greek philosopher Aristotle (384–322 BCE) also agreed that the heart was the most important organ and the centre of all intelligence.

Greek physician Hippocrates (460–370 BC), who is traditionally referred to as the “father of medicine”, believed the brain was responsible for thoughts and sensations. Hippocrates advanced human knowledge of the brain by performing scientific dissections on people and animals. Hippocrates also revolutionised medicine with his systematic medical treatments. He believed in using medicine to treat illness rather than following religious teachings that claimed evil spirits were responsible for making people sick.



**philosophy**  
the study of  
knowledge, reality  
and existence

**FIGURE 3** The ancient Egyptians did not value the brain and removed it during the process of mummification.



**FIGURE 4** Hippocrates is referred to as the “father of medicine”.

## The mind-body problem

Greek philosophers also debated another idea known as the mind-body problem. This idea explores the relationship between the human mind and body and questions what the mind is and where it resides. In the mind-body problem, the body refers to physical entities such as our organs, while the mind refers to our self-awareness and ability to think and reflect.

### Monism

**Monism** is the view that the mind and brain are one and the same. Materialistic monism views consciousness as the function of the brain and believes that all mental processes are a product of physiological processes controlled by the central nervous system. It states that our consciousness is the result of physical interactions between **neurons**.

### Dualism

**Dualism** is the view that the mind and body are two separate entities. French philosopher, René Descartes (1596–1650), used the scientific method to explore the philosophical

question, “How do we know we exist?”.

Descartes believed the body was physical and occupies space while the mind does not occupy space but has ideas and can think. He proposed that the mind and body, while separate, interact with each other to produce behaviour (for example, when we feel hungry, we think about and then feel the physical hunger experienced by our body).

Descartes’ dualism argued that the mind and the body had a two-way interaction.

Descartes believed the **pineal gland** in the brain was the site where the brain could communicate and interact with the body. He also suggested that the pineal gland was where all mental functions were located, and that it controlled consciousness. This theory has been rejected as we now know that the main role of the pineal gland is to regulate our internal body clock.

## Phrenology

**Phrenology**, first developed by Franz Joseph Gall (1758–1828), was a technique used to determine a person’s personality, based on the shape of their head. Gall believed that personality characteristics were controlled by the parts of the brain located on the brain’s outer surface. He suggested that the shape of the skull changed and that the more you used different mental abilities and personality characteristics, the more they would develop. This led him to believe that a phrenologist could feel the shape and size of a head to determine a person’s intelligence and personality, among many other things.

Phrenology is now considered a **pseudoscience** because it is not based on any empirical evidence. While it lacked scientific evidence, phrenology did spark more conversation around the link between various parts of the brain and their control of certain behaviours.

#### monism

the belief that the mind and the brain are the same thing

#### neuron

nerve cell in the nervous system that receives and transmits information

#### dualism

the view that the mind and the body are separate entities

#### pineal gland

a small gland in the brain responsible for secreting hormones

#### phrenology

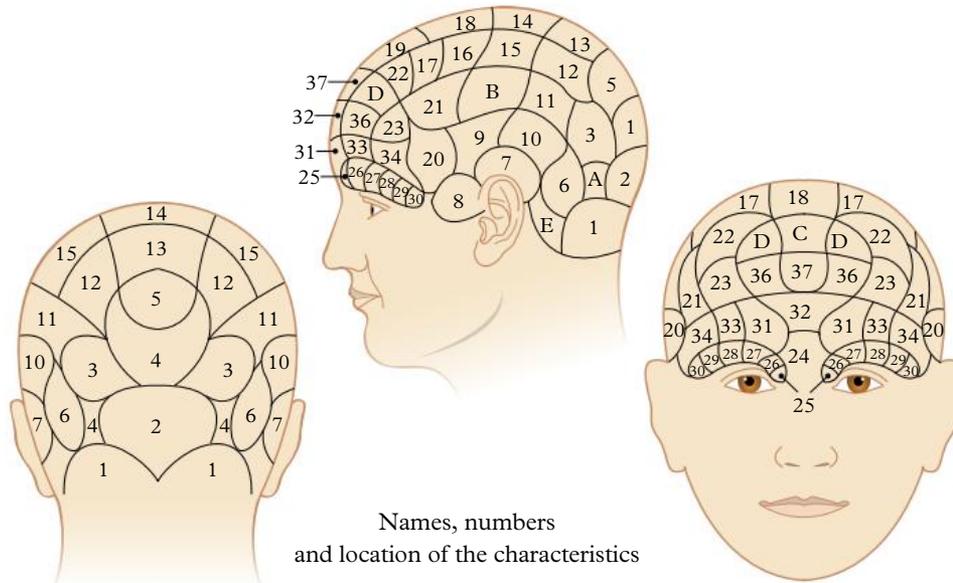
a pseudoscience based around the belief that the shape of the skull could indicate personality traits and characteristics

#### pseudoscience

beliefs and practices that claim to be scientific but are not based around the scientific method



**FIGURE 5** René Descartes believed the mind and body interacted and communicated via the pineal gland. The quote “I think, therefore I am” is attributed to Descartes.



Names, numbers and location 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 6 Phrenology proposed that areas of the skull were linked to specific characteristics.

## 4.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain how trephination was performed.
- 2 Describe the brain-versus-heart debate.
- 3 Define the term “pseudoscience”.

### Apply, analyse and compare

- 4 Compare the role of the heart and brain according to the beliefs of ancient Egyptians.

### Design and discuss

- 5 Use your understanding of the brain-versus-heart debate to argue your stance on whether the brain or the heart is the more important organ.
- 6 Discuss the differences between the views of ancient Greek philosophers regarding the brain-versus-heart debate.
- 7 “A craniotomy is a pseudoscientific procedure.” Evaluate this statement.

# 4.2

## Modern approaches to understanding the role of the brain

### KEY IDEAS

- ✦ Advances in technology have assisted in modern approaches to understanding the link between the brain, mental processes and behaviour.
- ✦ Modern approaches rely on the scientific method and use empirical evidence to support their theories.
- ✦ Case studies, autopsies and surgical and non-surgical operations have contributed to our current understanding of brain function.



### Brain research methods

Most early historical approaches to studying the brain did not use the scientific method. Instead, they relied on subjective data that was based on opinion and not supported by evidence. Modern-day approaches that use empirical evidence have provided scientists with much knowledge on the links between the brain and behaviour. Much of this knowledge has come from:

- **case studies** – in-depth investigations of a single person or group of people
- **autopsies** – surgical dissections performed on deceased persons
- **surgical** and **non-surgical procedures** – invasive and non-invasive procedures performed on patients.

### Case studies

Case studies involve gathering descriptive data on an individual or group of people. Data can be collected by techniques including direct observation, self-report questionnaires and interviews. Case studies examine and consider many aspects of a person’s life. Some notable case studies that have provided scientists with valuable insight on the relationship between the brain and behaviour will be explored in this topic.

### Phineas Gage

In 1848, railroad worker Phineas Gage was involved in an accident where a metal bar, known as a tamping iron, shot into his head and pierced the frontal lobe of his brain. Remarkably, Gage survived the accident. However, many people reported that his personality changed following the incident. Gage’s personality changed from being mild-mannered to being rude and often behaving in socially unacceptable ways. Gage’s case provided a great deal of information about the role of the frontal lobe in personality and other cognitive functions.



**FIGURE 1** Phineas Gage had a metal bar pierce the frontal lobe of his brain.

**case study**  
in-depth study of one person, a group or event

**autopsy**  
medical examination of a body after death

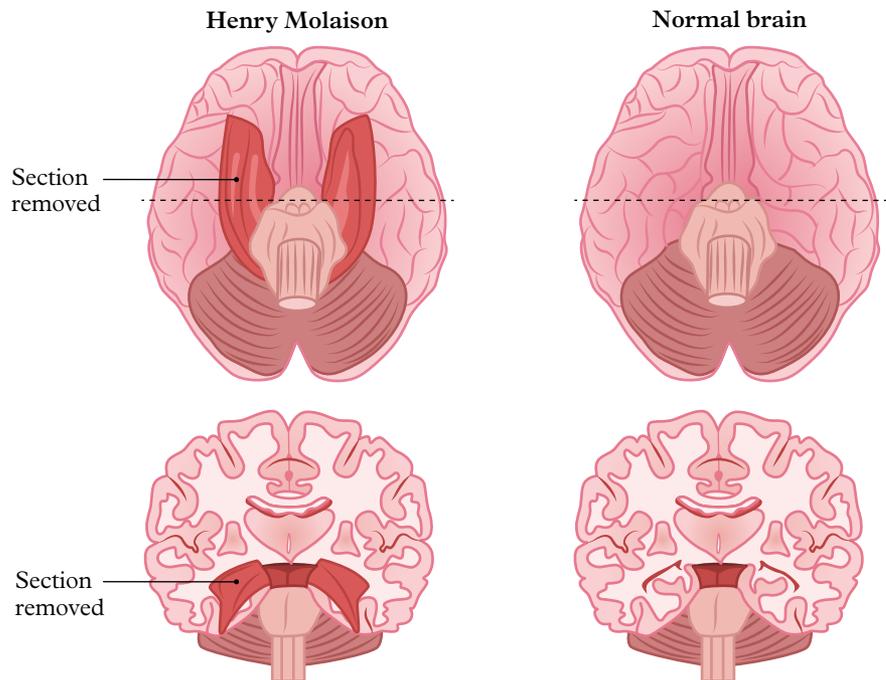
**surgical procedure**  
medical operation performed on a living human

**non-surgical procedure**  
procedure used to obtain information, usually in a non-invasive manner



## Henry Molaison

Henry Molaison was an American man who suffered from intractable epilepsy, a condition resulting in severe, uncontrollable seizures. To treat his condition, Molaison agreed to undergo an experimental surgery in which part of his brain (the medial temporal lobe) would be removed from both hemispheres. The surgery was successful in treating his epilepsy and Molaison stopped experiencing seizures. However, the surgery left Molaison with severe **anterograde amnesia**, which meant that he could not form any new memories. Molaison could, however, remember events and facts from his childhood. Molaison's case was a significant turning point in brain research, because it improved scientists' understanding of the brain's role in learning and memory, particularly the roles of the hippocampus and amygdala, which were removed in the operation on Molaison.



**FIGURE 2** Henry Molaison had the medial temporal lobe removed from both hemispheres of his brain. While the surgery was effective in treating his seizures, he was left unable to form any new memories.

### **anterograde amnesia**

a partial or complete inability to create new memories

## Autopsies

An autopsy is a surgical dissection performed on a deceased person to study the health condition of that person prior to their death. Autopsies have been carried out for centuries and are still performed today, often to determine a person's cause of death. They are also used in scientific research to study human physiology, anatomy, function and behaviour. A brain autopsy involves the brain being removed from a cadaver and studied in detail.

### **Broca's area**

brain region in the frontal lobe responsible for language production

## Paul Broca and Patient Tan

French physician Paul Broca is best known for his work on identifying the region of the brain involved in language. This region, named **Broca's area**, was discovered through an autopsy of a man named Louis Victor Leborgne. Leborgne had extreme difficulty speaking voluntarily. The closest thing to a word that Leborgne could mutter was the word "tan". Because of this, Leborgne became known as "Patient Tan". When Leborgne passed away in 1861, Broca performed an autopsy on his brain. The autopsy revealed a large lesion in Leborgne's frontal lobe. This led Broca to the discovery of Broca's area and its role in language production.



**FIGURE 3** Autopsies are surgical dissections performed on deceased persons.

## Surgical operations

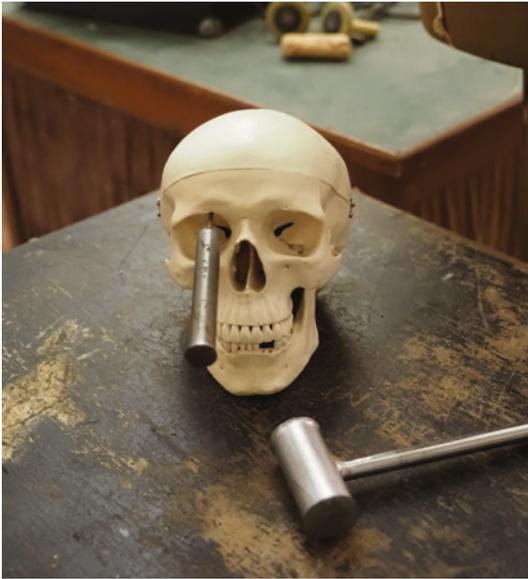
While autopsies have been invaluable to understanding the function of the brain, live brain surgery has been able to provide additional understanding of the brain. By observing differences in living patients before and after brain operations, scientists have been able to deduce valuable information about the function of different areas of the brain and how they relate to behaviour.

## Egas Moniz and lobotomies

### lobotomy

a surgery that was used to treat mental health conditions, such as mood, by causing damage to areas of the prefrontal cortex

In the 1930s, Portuguese neurologist Egas Moniz would perform a procedure known as a **lobotomy** on his violent and overly emotional patients. Patients were placed into a coma, and then Moniz would take an ice-pick-like instrument and insert it through the patient's eye socket. The instrument was then used to sever connections in various sections of the frontal lobe. Following surgery, patients would often show calmed behaviour, but drastic negative effects were also experienced. Lobotomised patients frequently lacked empathy, could not concentrate and showed minimal emotional responses.



**FIGURE 4** Modern psychology regards lobotomies as barbaric and highly unethical.

From the 1930s to 1950s, lobotomies were widely used to treat mentally ill patients and calm their behaviour. Today, the procedure is recognised as severely unethical and is illegal, because it endangers patients by damaging brain function and severely affecting patients' quality of life. Despite their unethical use, lobotomies did provide much information on the links between the brain and behaviour, particularly the role of the frontal lobe.

## Sperry and Gazzaniga and split-brain surgeries

In the 1960s, researchers Roger Sperry and Michael Gazzaniga treated epileptic patients by severing their **corpus callosum**, a thick band of nerve fibres connecting the two hemispheres of the brain. While the split-brain procedure was successful in treating the epilepsy, patients were unable to transfer information from one hemisphere of their brain to the other. Severing the corpus callosum led Sperry and Gazzaniga to discover how the left hemisphere was primarily responsible for most verbal tasks (for example, controlling speech or recognising words) and the right hemisphere for non-verbal tasks (for example, recognising visual sequences, abstract reasoning).

### corpus callosum

bundle of nerve fibres separating the left and right hemispheres of the brain



**FIGURE 5** The corpus callosum (highlighted in orange) connects the left and right hemispheres of the brain.

## Non-surgical operations

Previously, scientists relied on either surgically treating patients with brain injuries or conducting brain autopsies to study the links between the brain and behaviour. Technological advancements have given scientists a better understanding of the structure and function of the brain without using invasive surgery. This includes information on which brain structures are involved in mental processes such as thinking and experiencing emotions, and which brain structures are active when we perform behaviours such as writing our name.

### Electrical brain stimulation

**Electrical brain stimulation (EBS)** involves inserting or placing a small electrified wire (an electrode) on specific areas of the brain. The electrodes produce a low electrical impulse. When this impulse stimulates a specific area of the brain, it initiates certain bodily responses that can be monitored. EBS can also be used to block certain responses. The technique is particularly useful when trying to map the brain and determine which areas are associated with various functions. EBS is often performed when the patient is awake. This is because it allows researchers to ask you questions, get you to perform certain tasks and check that the electrodes are positioned correctly.

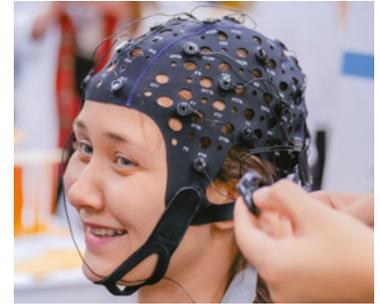
### Brain mapping

Neurons in the brain send and receive messages in the form of electrical impulses.

**Brain mapping** is a non-invasive technique that measures electrical activity in the form of brain waves through the surface of the head. A cap containing electrodes is placed on the scalp and software records electrical impulses in the brain. This process is called an **electroencephalogram (EEG)** and takes around 15 minutes. Data from the EEG is then converted into a visual brain map report. The map report can then be used to identify any problem areas.

### Neuroimaging

**Neuroimaging** techniques are non-invasive techniques used to obtain images of the brain. These images can be used to diagnose brain-related diseases and provide us with an understanding of how the brain works. Each neuroimaging technique has its own advantages and limitations for use in clinical settings. Some common neuroimaging techniques are summarised in Table 1.



**FIGURE 6** A person undergoing brain mapping

#### **electrical brain stimulation (EBS)**

a procedure that uses electrotherapy to stimulate neural pathways in the brain

#### **brain mapping**

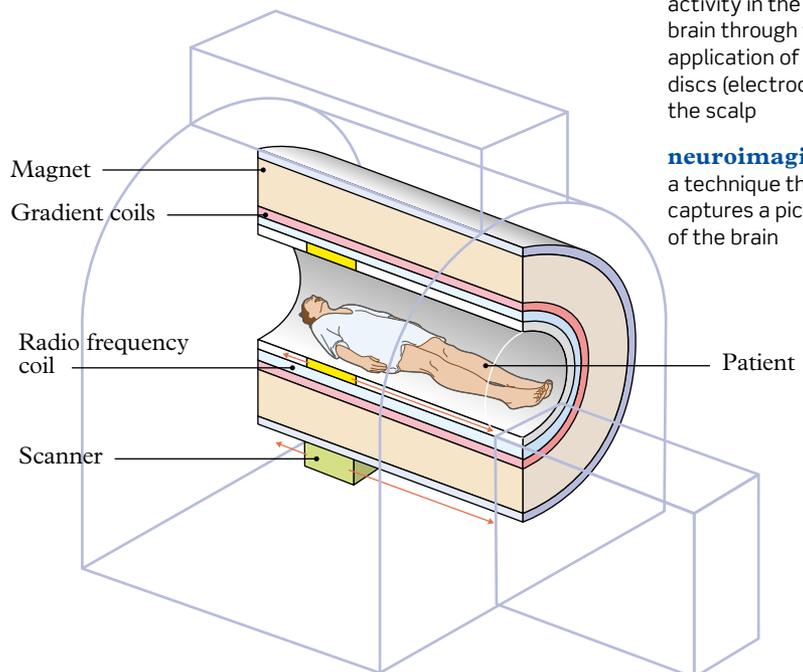
a technique that uses a combination of tools to record brain activity and create a visual map that shows information about brain functioning

#### **electroencephalogram (EEG)**

a tool that measures the electrical activity in the brain through the application of small discs (electrodes) to the scalp

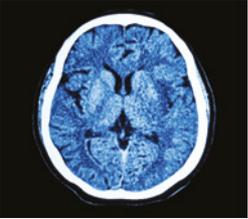
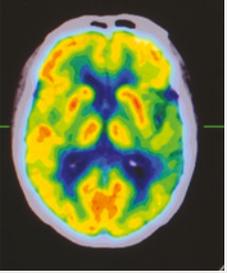
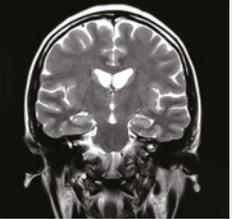
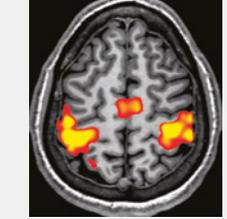
#### **neuroimaging**

a technique that captures a picture of the brain



**FIGURE 7** An MRI scanner

**TABLE 1** Summary of neuroimaging techniques used to study the brain

Name	Summary of technique	Advantages	Disadvantages
<p>Computerised tomography (CT)</p> 	<p>CT uses a series of X-rays to scan the brain from various angles. The combined images form a 2D image of a cross-section of the brain.</p>	<ul style="list-style-type: none"> <li>• Relatively safe and cost effective</li> <li>• Provides clear 2D images of brain structures</li> <li>• Used to identify location and extent of damage caused by brain tumours and stroke</li> <li>• Can identify abnormal areas in brain structures among people suffering from disorders such as Alzheimer's disease and depression</li> <li>• Quick and non-invasive procedure</li> <li>• Can be used on people who have implanted medical devices</li> </ul>	<ul style="list-style-type: none"> <li>• Does not provide detailed high-resolution images</li> <li>• Does not provide information about which parts of the brain are active during certain behaviours and mental processes</li> <li>• Uses radiation, and frequent exposure is not recommended</li> </ul>
<p>Positron emission tomography (PET)</p> 	<p>PET scans measure the volume and location of blood flow in the brain by tracking a harmless radioactive glucose injected into the patient's bloodstream before the procedure. PET tracks which parts of the brain absorb the glucose and provides a coloured image showing the activity levels of different parts of the brain.</p>	<ul style="list-style-type: none"> <li>• Provides information about the function of brain structures during motor and cognitive tasks</li> <li>• Can show areas of the brain interacting when performing a task</li> <li>• Useful to diagnose dementia</li> <li>• Useful for detecting brain tumours and other brain diseases</li> <li>• Can be used on people who have implanted medical devices</li> </ul>	<ul style="list-style-type: none"> <li>• Abnormality or damage to brain structures cannot be seen</li> </ul>
<p>Magnetic resonance imaging (MRI)</p> 	<p>Magnetic fields and radiowaves are used to create a computer-enhanced image of the brain. A detailed still 3D image provides views of different angles of the brain.</p>	<ul style="list-style-type: none"> <li>• Detailed 3D images of the brain are created</li> <li>• Unlike X-rays, magnetic fields and radio waves are harmless to the patient</li> </ul>	<ul style="list-style-type: none"> <li>• Very expensive</li> <li>• Patients who have metal devices in their body (for example, a pacemaker or steel pins) cannot use an MRI</li> <li>• Does not give information about cognitive or motor function</li> <li>• MRI chamber can be claustrophobic for patients</li> </ul>
<p>Functional magnetic resonance imaging (fMRI)</p> 	<p>fMRI records changes in blood flow to and from different parts of the brain and ongoing brain processes. The subject is usually required to carry out a task to highlight when a brain region is active.</p>	<ul style="list-style-type: none"> <li>• Produces 3D images of the brain in high resolution and quality</li> <li>• Shows blood flow and oxygen consumption in the brain</li> <li>• Provides detailed information about brain structure and function, particularly areas of the brain that are working while a patient is thinking, learning or using memory</li> </ul>	<ul style="list-style-type: none"> <li>• Very expensive</li> <li>• Only shows blood flow in the brain and not the activity of neurons</li> </ul>

## 4.2 WORKED EXAMPLE

### Evaluating neuroimaging techniques

Jaco is a 72-year-old patient worried about their brain function. Jaco's doctor wants to use neuroimaging to assess the health of Jaco's brain. Jaco's patient information includes that they:

- have a heart condition and wears a pacemaker
- have been showing symptoms of Alzheimer's disease (such as memory loss and confusion).

Use Table 1 to propose which neuroimaging technique Jaco's doctor should recommend based on the patient information available. (3 marks)

### Solution

Think	Do
Step 1: Identify whether there are any command terms in the question and determine what is required to address the command terms used (a glossary of command terms is provided in Topic 1.12).	The question uses the command term "propose", which requires you to suggest or put forward a point of view, idea, argument, diagram, plan or suggestion based on given data or stimulus material for consideration or action.
Step 2: Look at the mark allocation to determine how many pieces of information are required. Link this back to what the command term(s) are requesting.	There are three marks allocated to this question; therefore, you will need to provide three points of information. One mark for the neuroimaging technique and two marks for two pieces of reasoning.
Step 3: Highlight the key information about the patient and search the table for how this relates to different neuroimaging techniques.	Jaco has a pacemaker; therefore, he will not be able to undergo an MRI or fMRI and will need to use either a CT or PET scan. He has been showing symptoms of Alzheimer's disease; since PET scans are not effective in showing abnormality or damage to brain structures, a CT scan would be more appropriate.
Step 4: Construct your answer.	Jaco's doctor should recommend a CT scan (1 mark) as Jaco has a pacemaker and is unable to undergo an MRI or fMRI (1 mark). Additionally, Jaco is showing signs of Alzheimer's disease, which cannot be detected by PET scans as they are unable to show abnormality or damage to brain structures, but the disease can be detected by CT scans (1 mark).

## 4.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe the type of information that can be obtained from a brain autopsy.
- 2 Explain the type of descriptive data that can be obtained during a case study.
- 3 Describe the advantages of using an MRI scan over a CT scan.
- 4 Explain how a PET scan is used to show which parts of a brain are active during cognitive tasks.

### Apply, analyse and compare

- 5 Compare surgical and non-surgical brain procedures.

- 6 With reference to ethical guidelines, explain why lobotomies are no longer performed.
- 7 Marco's doctor needs to explore how two parts of his brain interact when he is performing a motor task. Which neuroimaging procedure should Marco have? Justify your response.

### Design and discuss

- 8 Discuss a reason why a surgeon may use EBS on a patient. Why is it important for a patient to be awake during this procedure?

## 4.3

# The role of the hindbrain, midbrain and forebrain in behaviour and mental processes

### KEY IDEAS



- ✦ There are three main parts of the brain: the hindbrain, midbrain and forebrain.
- ✦ The hindbrain plays a significant role in coordinating bodily functions necessary for survival. The hindbrain links the spinal cord with the rest of the brain and consists of three main parts: the medulla, pons and cerebellum.
- ✦ The midbrain plays a key role in movement, processing visual and auditory information, the sleep-wake cycle, arousal (alertness) and regulating temperature. The midbrain acts as a link between the forebrain and hindbrain and contains the reticular formation.
- ✦ The forebrain is the largest and most developed part of the brain. It is responsible for many complex brain processes. The cerebrum, thalamus and hypothalamus are found in the forebrain.

#### spinal cord

a long structure of nerves running centrally from the brain to the lower back that sends messages to and from the brain and body

#### central nervous system

the brain and spinal cord

#### hindbrain

one of the three major regions of the brain, located at the base of the brain and skull; plays an important role in coordinating bodily functions necessary for survival

#### midbrain

one of the three major regions of the brain, located between the hindbrain and the forebrain; plays a key role in movement, processing visual and auditory information, the sleep-wake cycle, arousal (alertness) and regulating temperature

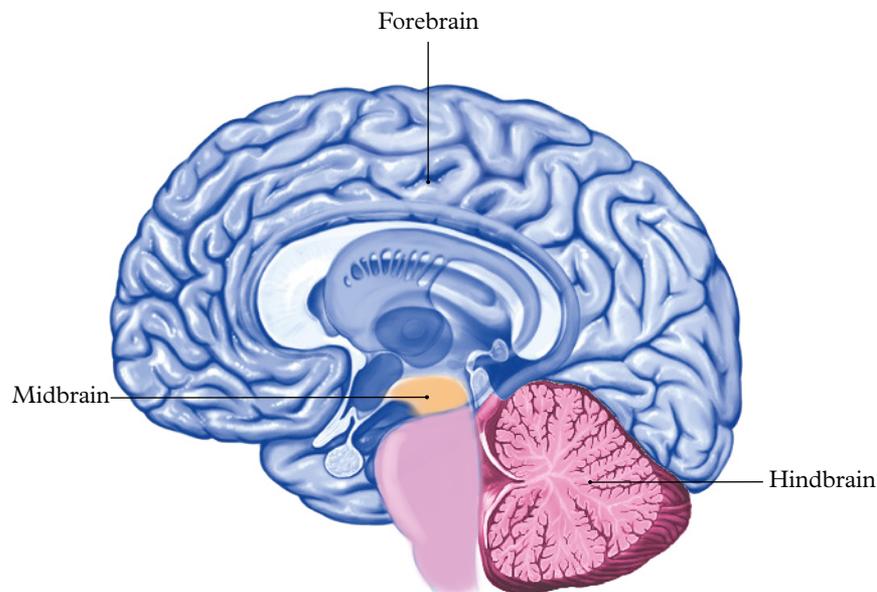
#### forebrain

one of the three major regions of the brain, located above the midbrain; where the most important brain functions happen

The brain is the central organ and command centre of the human nervous system. Along with the **spinal cord**, the brain makes up the **central nervous system**. The brain is involved in almost everything we do. An understanding of the structures and functions of the brain is critical to the study of psychology, which often seeks to understand the link between mental processes and behaviour.

## Structures of the brain

The brain consists of three main sections: the **hindbrain**, **midbrain** and **forebrain**. Each of these sections interact and work together to keep the body functioning.



**FIGURE 1** A cross-section of the brain showing the three main components: hindbrain, midbrain and forebrain

## The hindbrain

The hindbrain is located at the base of the brain and skull. The primary function of the hindbrain is to link the spinal cord with the rest of the brain. The hindbrain also plays an important role in coordinating bodily functions necessary for survival. Actions such as swallowing, coughing, breathing, digestion, heart rate, sleep and other **involuntary functions** are all coordinated by the hindbrain. The hindbrain consists of three main parts: the **cerebellum**, **pons** and **medulla**. It also includes most of the **brainstem**, a series of structures (medulla, pons and part of the midbrain) that connect the spinal cord to the brain.

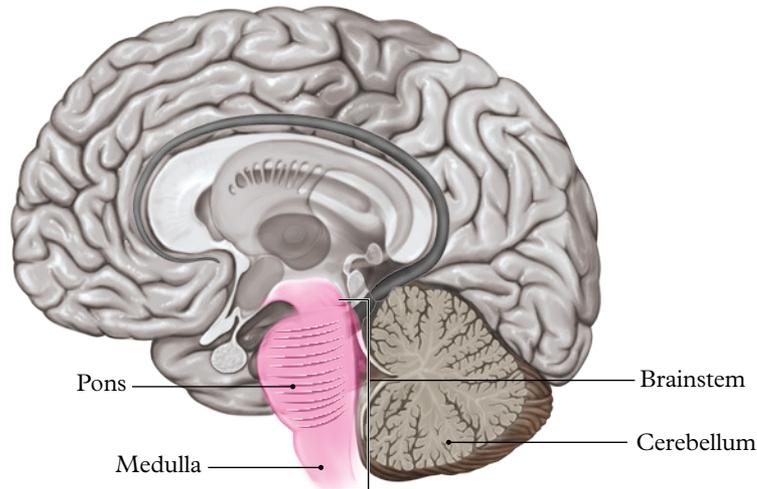


FIGURE 2 Hindbrain structures

### The medulla

The medulla is a long stem structure located at the lowest part of the brain. It plays a vital role in sending messages between the spinal cord and higher parts of the brain. The medulla controls involuntary functions essential for our survival, such as breathing, blood pressure, heart rate, swallowing, digestion, sneezing and vomiting. Damage to the medulla can result in a failure to send messages between the brain and spinal cord and an inability to perform involuntary functions.

### The pons

The pons is a structure of the brainstem located above the medulla. The pons connects the cerebellum and cerebral cortex and acts as a pathway for sensory and motor information to travel between the brain and the rest of the body. The pons also plays an important role in involuntary functions, such as the regulation of breathing, arousal, sleep, rapid eye movement during sleep, and facial expressions.

### The cerebellum

The cerebellum is a major structure of the hindbrain, located at the base of the brain. It coordinates voluntary movements, maintaining balance and posture, speech and vision. The cerebellum is also involved in **motor learning** and helps the body learn movements that require practice. For example, when you learn to catch a ball, the cerebellum will fine-tune specific motor skills through practice until the skill can be performed consistently.



### involuntary function

action performed unconsciously by the autonomic nervous system (for example, breathing, heartbeat)

### cerebellum

major structure of the hindbrain, located at the base of the brain; plays a key role in coordinating voluntary movements and maintaining balance and posture

### pons

structure on the brain stem located above the medulla; acts as a pathway for sensory and motor information to travel between the brain and the rest of the body

### medulla

long stem structure located at the lowest part of the brain that controls involuntary functions essential for survival

### brainstem

a structure of the brain (composed of the midbrain, pons and medulla) that connects the cerebrum to the spinal cord and cerebellum

### Study tip

"Pons" is Latin for "bridge" – the pons acts as a bridge to connect the medulla with the cerebellum.

### motor learning

acquiring and developing skills that require or are related to movement

### 4.3 SKILL DRILL

#### Evaluating ethics in brain investigations

##### Key science skill: Comply with safety and ethical guidelines

Dr Morgan wishes to explore the role of the cerebellum in maintaining balance. He decides the best way to further his studies is to conduct a scientific investigation that monitors people before and after experiencing damage to their cerebellum. His investigation method is summarised as follows:

- Dr Morgan gathered 20 participants from a low socio-economic area by offering participants \$100 to be a part of the research.
- Dr Morgan asked participants to perform motor activities and recorded their ability to maintain balance.
- Dr Morgan performed a surgery on participants to inflict damage on part of their cerebellum.
- Dr Morgan interviewed participants once they had recovered from surgery and asked

participants to perform the same motor activities. Participants' ability to maintain balance was recorded.

- Dr Morgan analysed the results.

The findings from Dr Morgan's research indicated that the cerebellum played a significant role in maintaining balance.

##### Practise your skills

- 1 Suggest whether Dr Morgan's findings adhere to the ethical concept of beneficence. Justify your response.
- 2 Suggest whether Dr Morgan's findings adhere to the ethical concept of non-maleficence. Justify your response.
- 3 Suggest whether Dr Morgan's findings adhere to the ethical concept of justice. Justify your response.

Need help complying with safety and ethical guidelines? Go to Topic 1.4 in your Psychology toolkit.

#### Study tip

The cerebellum is often referred to as the "little brain" because it has a wrinkled appearance like the cerebral cortex and looks like a small brain. When locating the cerebellum on a diagram it can be helpful to look for a "little brain"-like structure.

#### reticular formation

a network of neurons that plays a significant role in filtering sensory information and selecting the valuable information to enter consciousness

#### The midbrain

The midbrain is located between the hindbrain and the forebrain. It plays a key role in movement, processing visual and auditory information, the sleep-wake cycle, alertness, regulating temperature and motor control. The midbrain links the forebrain and hindbrain and contains the **reticular formation**.

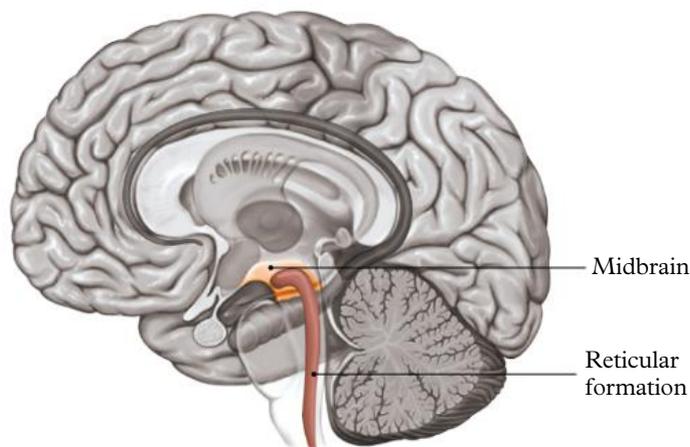


FIGURE 3 Midbrain structures



## The reticular formation

The reticular formation is a network of neurons that is part of both the hindbrain and midbrain. It filters sensory information (such as sights, sounds and smells) and selects the valuable information to enter consciousness. It acts as the sensory gatekeeper so that the brain does not become overwhelmed or overloaded with the constant sensory information it receives daily. This filtering process ensures that only important information gets through. The reticular formation also controls physiological arousal (for example, triggering a spike in blood pressure or suddenly feeling more awake), attention and alertness and has a vital role in the sleep–wake cycle and muscle control.

## The forebrain

The forebrain is the largest, most developed and most visible part of the brain. It is found above the midbrain and is the site of most of our cognitive brain functions. The forebrain is responsible for complex mental processes such as voluntary movement, integration of sensory information, learning, memory, speech, emotions and personality. The forebrain is comprised of upper-level brain structures, including the **cerebrum**, **hypothalamus** and **thalamus**.

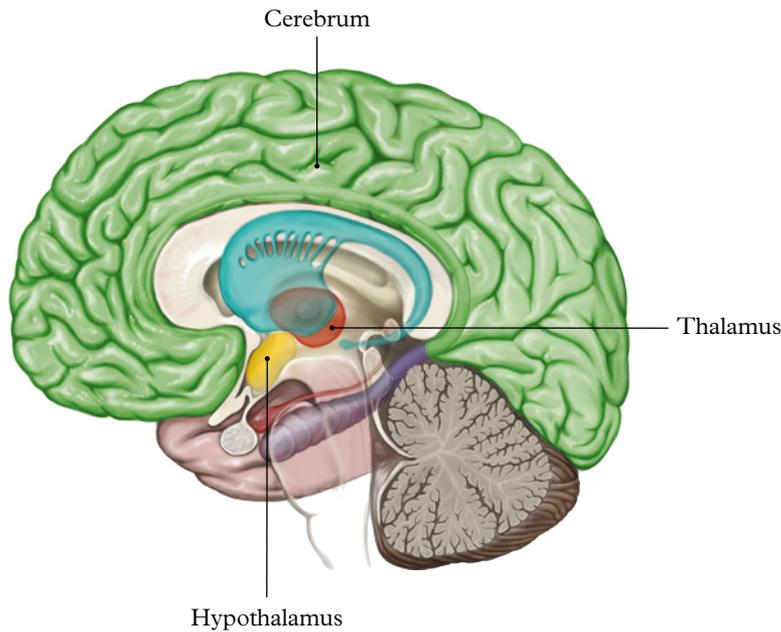


FIGURE 4 Forebrain structures

### **cerebrum**

the biggest part of the forebrain and where most of the important brain functions happen, such as higher cognitive functions like thinking, planning, learning and reasoning

### **hypothalamus**

a small structure which, despite its size, plays a crucial role in controlling basic survival actions such as sleep, thirst, hunger, sex drive and the regulation of body temperature and the sleep–wake cycle

### **thalamus**

a small structure that sits just above the brain stem, responsible for acting as the control centre of the brain for sensory information

### **cerebral cortex**

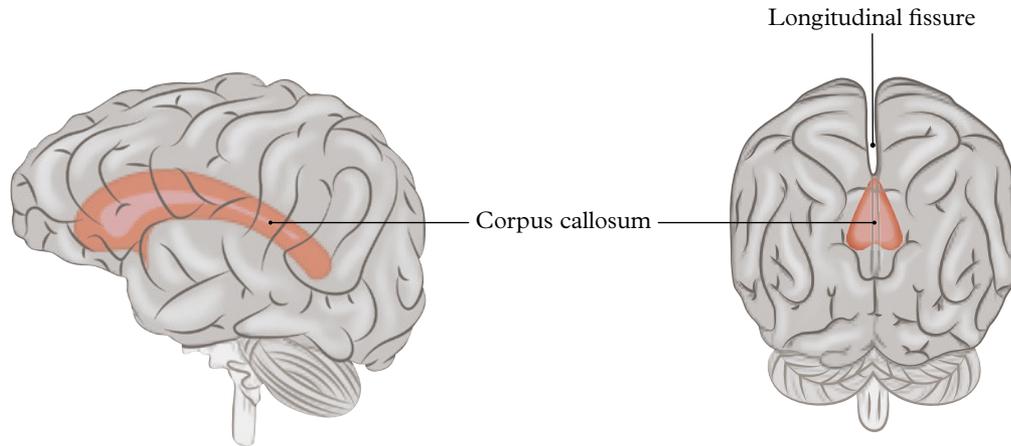
the outer layer of the cerebrum

### **longitudinal fissure**

a deep groove that separates the two cerebral hemispheres of the brain

## The cerebrum

The cerebrum is the largest part of the forebrain. It is the site of most of our higher cognitive functions, such as thinking, planning, learning and reasoning. Other mental processes that occur in the cerebrum include voluntary movement, personality, emotions, interpreting touch, vision and hearing. The outer layer of the cerebrum is called the **cerebral cortex** and it is divided into the left and right cerebral hemispheres. The two hemispheres of the brain are almost symmetrical and are separated by a deep groove called the **longitudinal fissure**. Communication between the two hemispheres occurs through the corpus callosum, a large bundle of nerve fibres connecting the hemispheres together.



**FIGURE 5** The longitudinal fissure separates the left and right cerebral hemispheres and the corpus callosum connects the hemispheres together.

## The hypothalamus

The hypothalamus is a small structure that plays a crucial role in controlling basic survival actions such as sleep, thirst, hunger, sex drive, regulation of body temperature and the sleep–wake cycle. The hypothalamus is located just above the **pituitary gland** and directs this gland to secrete hormones. The hypothalamus also connects the body’s **endocrine system** with the nervous system.

The endocrine system is a messenger system made up of glands and organs that secrete hormones into the bloodstream to help the body maintain a stable physiological state. The hypothalamus helps regulate the endocrine system to ensure that the body’s internal processes are balanced; this balanced state is known as **homeostasis**. For example, when a person feels stressed, a stress hormone known as cortisol is released. This hormone can help energise the body to deal with the stressful event. Once the stressful event has finished, the hypothalamus will direct the pituitary gland to stop releasing cortisol and the body can return to its normal state of functioning.

### **pituitary gland**

a pea-sized gland attached to the base of the brain that acts as the body’s major endocrine gland, controlling the growth and function of other endocrine glands

### **endocrine system**

the body’s network of glands and organs that regulate bodily functions through producing hormones

### **homeostasis**

self-regulating processes that keep the body performing at optimal levels

## 4.3 CHALLENGE

### Assessing the nature of the hypothalamus

The autonomic division of the central nervous system is self-governing and performed without conscious awareness. Explain whether you believe the hypothalamus is self-governing or whether we need to make a conscious decision to release hormones. Justify your answer.

## The thalamus

The thalamus is a small structure that sits just above the brainstem. It is divided into two parts with one part located in each hemisphere. The primary role of the thalamus is to act as the brain’s control centre for sensory information. The thalamus allows us to process the sensory information that has been detected by sensory organs such as the ears, eyes and skin (all senses except smell).

Once the thalamus receives sensory information it relays this to the relevant part of the cerebral cortex, where it can be processed into meaningful information. For example, when you go to the beach you may hear the waves, feel the sand beneath your feet and see the sun shining on the water. All this sensory information is first relayed to the thalamus, then relayed to the relevant parts of the cerebral cortex and finally relayed back to the thalamus. This process occurs so that the sensory information can be registered, processed and integrated to help form a perception of what it is like to go to the beach. The thalamus also plays a role in determining which incoming sensory information is important for us to pay attention to and which parts to ignore.

### 4.3 CHECK YOUR LEARNING

#### Describe and explain

- 1 Describe the location and function of the cerebellum.
- 2 Explain the role of the reticular formation in the control of arousal.
- 3 Identify three involuntary functions that the pons regulates.
- 4 Define the term “homeostasis” and identify the part of the brain that is involved with maintaining homeostasis.
- 5 Explain why the cerebellum is called the “little brain”.

#### Apply, analyse and compare

- 6 Jesse has sustained significant damage to their medulla. Apply your understanding of the function of the medulla to suggest what changes might occur in Jesse in response to the damage.

- 7 Timothy hears his mobile phone ring and reaches out to answer it. Analyse which parts of the brain would be active in this experience and describe how they would allow Timothy to perform these behaviours.

#### Design and discuss

- 8 Draw a labelled diagram of the brain including the following components: cerebellum, pons, brainstem, medulla, reticular formation, forebrain, cerebrum, hypothalamus, thalamus and corpus callosum. Under each labelled component write a brief description of the role or function of that component.



**FIGURE 6** Sensory information, like the sound of waves and the feel of sand beneath your feet, is sent to the thalamus.



# 4.4

## The role of the cerebral cortex in behaviour and mental processes

### KEY IDEAS



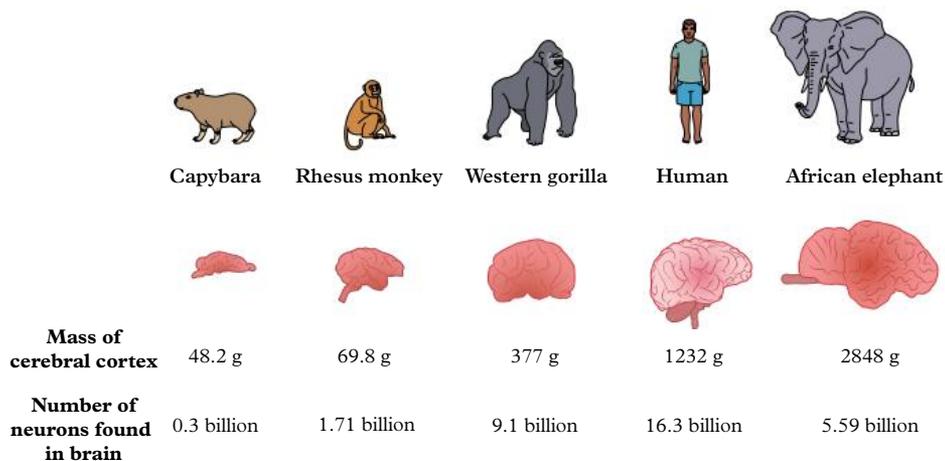
- ✦ The cerebral cortex is divided into two hemispheres: the right hemisphere and the left hemisphere.
- ✦ The two hemispheres work together but also have specific functions; this is referred to as hemispheric specialisation.
- ✦ Each hemisphere contains four distinct lobes that have specialised functions.
- ✦ The frontal lobe is responsible for higher cognitive functions such as memory, emotions, language, problem-solving, planning, and initiating body movement.
- ✦ The parietal lobe is responsible for processing bodily sensations and somatosensory information, such as touch, temperature and pressure.
- ✦ The occipital lobe is responsible for processing vision and visual information.
- ✦ The temporal lobe is responsible for processing auditory information.

### The role and structure of the cerebral cortex

As you learnt in Topic 4.3 the brain is comprised of three main parts: the forebrain, midbrain and hindbrain. The largest part of the forebrain is the cerebrum, and its outer layer is called the cerebral cortex. The cerebral cortex completely covers both cerebral hemispheres and is involved in higher order processes, such as thinking, emotion and language.

### The role of the cerebral cortex

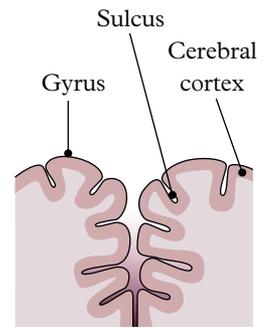
The cerebral cortex is the largest part of the brain and plays a crucial role in building who we are and influencing how we interact with the world. It is responsible for many higher-order brain functions, such as performing sequences of motor behaviours, as well as forming and understanding language. The cerebral cortex allows us to perform both simple tasks, such as picking up a pen or detecting the heat from a hot cup of coffee, and complex tasks, such as answering exam questions or making important life decisions. Humans have the largest cerebral cortex in proportion to body mass compared to any other animal. This is a main point of difference between humans and other animals in terms of intelligence.



**FIGURE 1**  
Comparison of cerebral cortex size of humans and animals

## Structure of the cerebral cortex

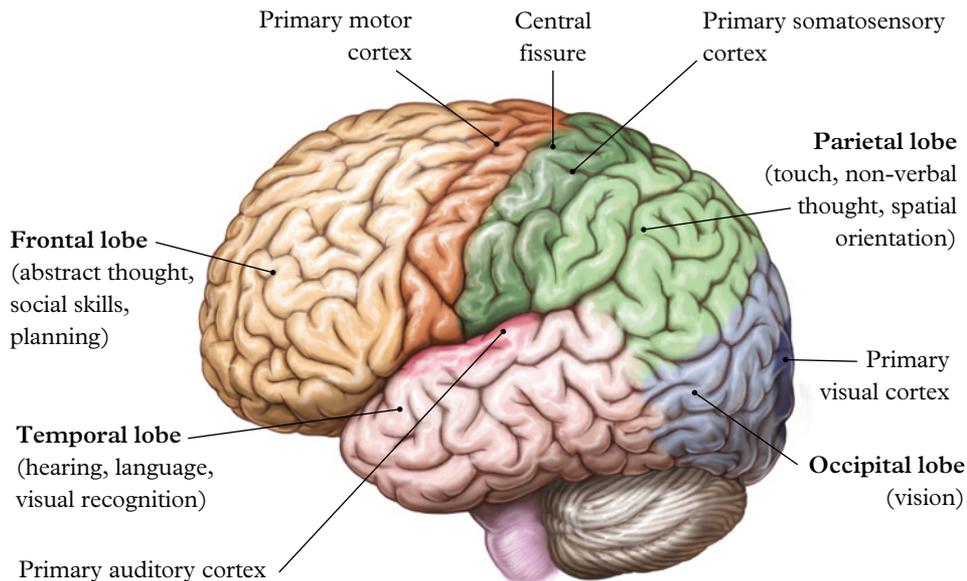
The cerebral cortex is a very thin layer of **grey matter** containing billions of neurons. It has a highly convoluted appearance with many folds, grooves and valleys. Grooves of the cerebral cortex are called gyri (singular: gyrus) and valleys are called sulci (singular: sulcus). The amount of gyri and sulci allow the surface area of the cerebral cortex to be large enough to contain billions of neurons while remaining compact enough to fit inside our heads. Think about a flat piece of A4 paper. If you rest it on your hand it will sit beyond the confines of your palm. However, if you scrunch the paper up, it becomes small enough to fit inside your palm even though the overall surface area and volume of the paper has not changed.



**FIGURE 2** Structure of the cerebral cortex

## Lobes of the cerebral cortex

Each hemisphere of the cerebral cortex is divided into four **cortical lobes**: the frontal lobe, parietal lobe, occipital lobe and temporal lobe. Several specific functions are associated with each of these lobes and together they allow us to perform a range of different functions. Cortical lobes also contain either motor or sensory cortices, which are areas dedicated to detecting and responding to specific motor or sensory information.



**FIGURE 3** Lobes of the cerebral cortex

**grey matter**  
neural tissue of the brain and spinal cord

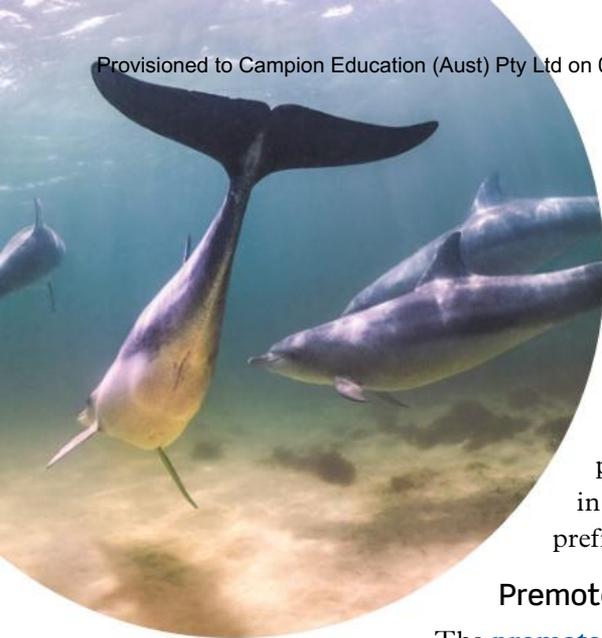
**cortical lobes**  
the major identifiable regions of the cerebral cortex that are each associated with specific functions



## Frontal lobe

The **frontal lobe** is the largest lobe of the cerebral cortex and is located near the front of the head. It is responsible for higher cognitive functions such as memory, emotions, language, problem-solving, planning and initiating body movement. The frontal lobe is regarded as the centre of behaviour and cognition, and the root of our personality. Evidence shows that humans have a more developed frontal lobe than other animals and have more neurons in the association areas located in the frontal lobe. While all mammals have a frontal lobe, more social animals such as dolphins and primates have more developed frontal lobes compared to other mammals. Studying the size of the frontal lobe of these mammals has provided evidence for the role it plays in social interactions and intelligence. The frontal lobe has three main areas that allow it to perform a variety of functions, including the prefrontal cortex, premotor cortex and primary motor cortex.

**frontal lobe**  
largest lobe of the cerebral cortex, responsible for higher-order functions



**FIGURE 4** Social mammals such as dolphins have more developed frontal lobes.

**prefrontal cortex**  
an area of the brain that modulates higher-order cognitive processes

**premotor cortex**  
an area of the brain that processes and controls the movement of voluntary muscles

**supplementary motor cortex**  
part of the motor cortex that prepares the body for voluntary movement

**primary motor cortex**  
an area in the frontal lobe responsible for movement of the body

**contralateral organisation**  
where the arrangement of an area is responsible for controlling the opposite side

### Prefrontal cortex

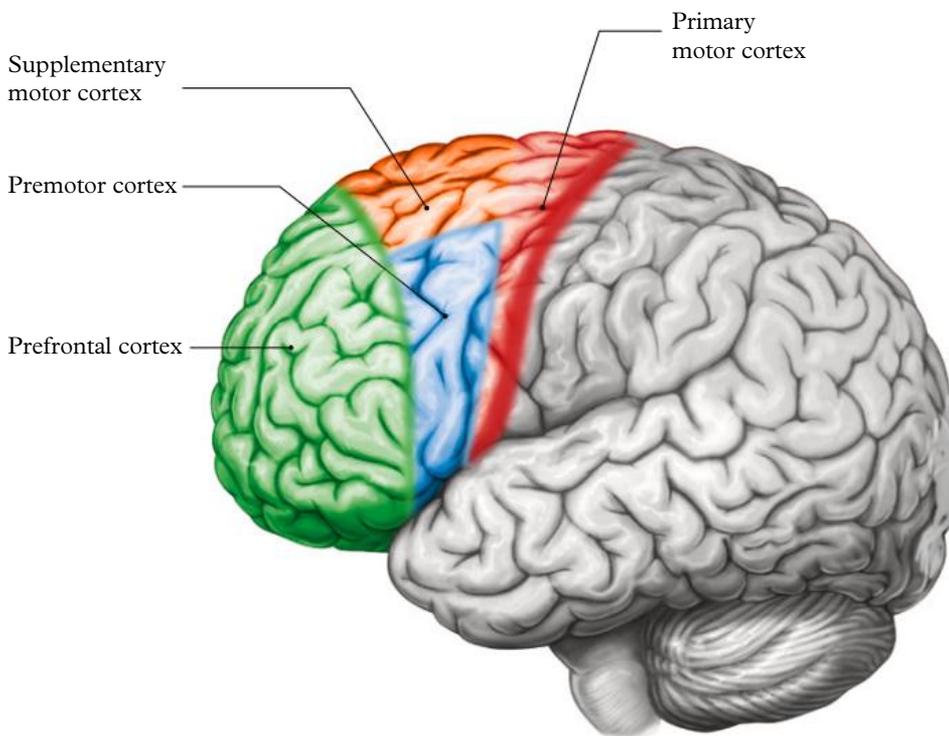
The **prefrontal cortex** sits at the front of the frontal lobe and is involved with planning motor sequences (for example, deciding how to move your arm to pick up an item), reasoning and solving problems. The prefrontal cortex is also involved in regulating and modifying emotions and executive functioning (high-order cognitive skills, such as multitasking, using memory and decision-making). The underside of the prefrontal cortex is associated with and connects brain regions involved in emotional processing. After a motor sequence has been planned by the prefrontal cortex, it is then directed to the premotor cortex.

### Premotor cortex

The **premotor cortex** is an area of the frontal lobe involved with controlling motor sequences. The premotor cortex processes which movements are required to perform an action planned by the prefrontal cortex and then relays this information onto the primary motor cortex so a movement can be executed. The premotor cortex also contains the **supplementary motor cortex**, which prepares the body for movement.

### Primary motor cortex

Situated at the rear of each frontal lobe is a **primary motor cortex**. The primary motor cortices are responsible for the body's skeletal muscle movement and voluntary movement. The left primary motor cortex is responsible for movement of the right side of the body and the right primary motor cortex is responsible for movement of the left side of the body. This is called **contralateral organisation**. Damage to either the right or left primary motor cortex will result in a person being unable to move certain parts of their body.



**FIGURE 5** Locations of the prefrontal cortex, premotor cortex, supplementary motor cortex and primary motor cortex in the frontal lobe

The structure of the primary motor cortex allows different parts of the cortex to control specific parts of the body. The area responsible for movement of the toes is located at the top of the cortex, while the area for movement of the lips is located at the bottom. The amount of cortex that is devoted to moving each of these areas is in proportion to the number of neurons required to move each part. Therefore, the body parts that are used to execute fine motor movements (such as clicking your fingers) have a larger area of the cortex dedicated to them, compared to those that execute gross motor movements (such as bending your knee).

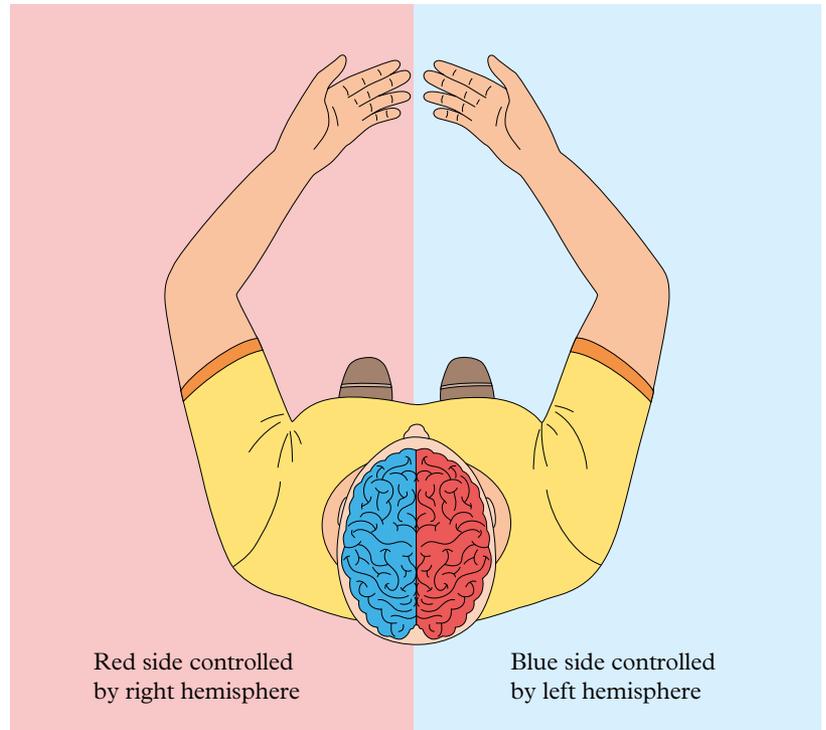
### Effects of damaging the frontal lobe

The effects of damaging the frontal lobe will vary depending on the severity and location of damage. People with damage to their frontal lobe may struggle to make decisions, experience sudden changes in behaviour or experience a decline in intelligence or memory loss. Age can also influence the effects experienced from damage. This is because the frontal lobe is the last area of the brain to fully develop, which typically happens in a person's mid-20s. This means a person is more susceptible to effects if their frontal lobe is damaged when young. If the right primary motor cortex is damaged, a person will have trouble with movements on the left side of their body. If the left primary motor cortex is damaged, a person will have trouble moving the right side of their body. Damage to the left frontal lobe can also lead to problems producing and forming speech.

### Parietal lobe

The **parietal lobe** is located at the top of the cerebral cortex behind the frontal lobe. It is responsible for processing bodily sensations and somatosensory information such as touch, temperature and pressure. The parietal lobe integrates and interprets sensory information to help us understand what we are experiencing internally in our bodies and externally in our environment. Situated at the rear of each parietal lobe is a strip of neurons that lies next to the primary motor cortex. This area is known as the **primary somatosensory cortex** and it is responsible for processing sensory information from our body's sensory receptors.

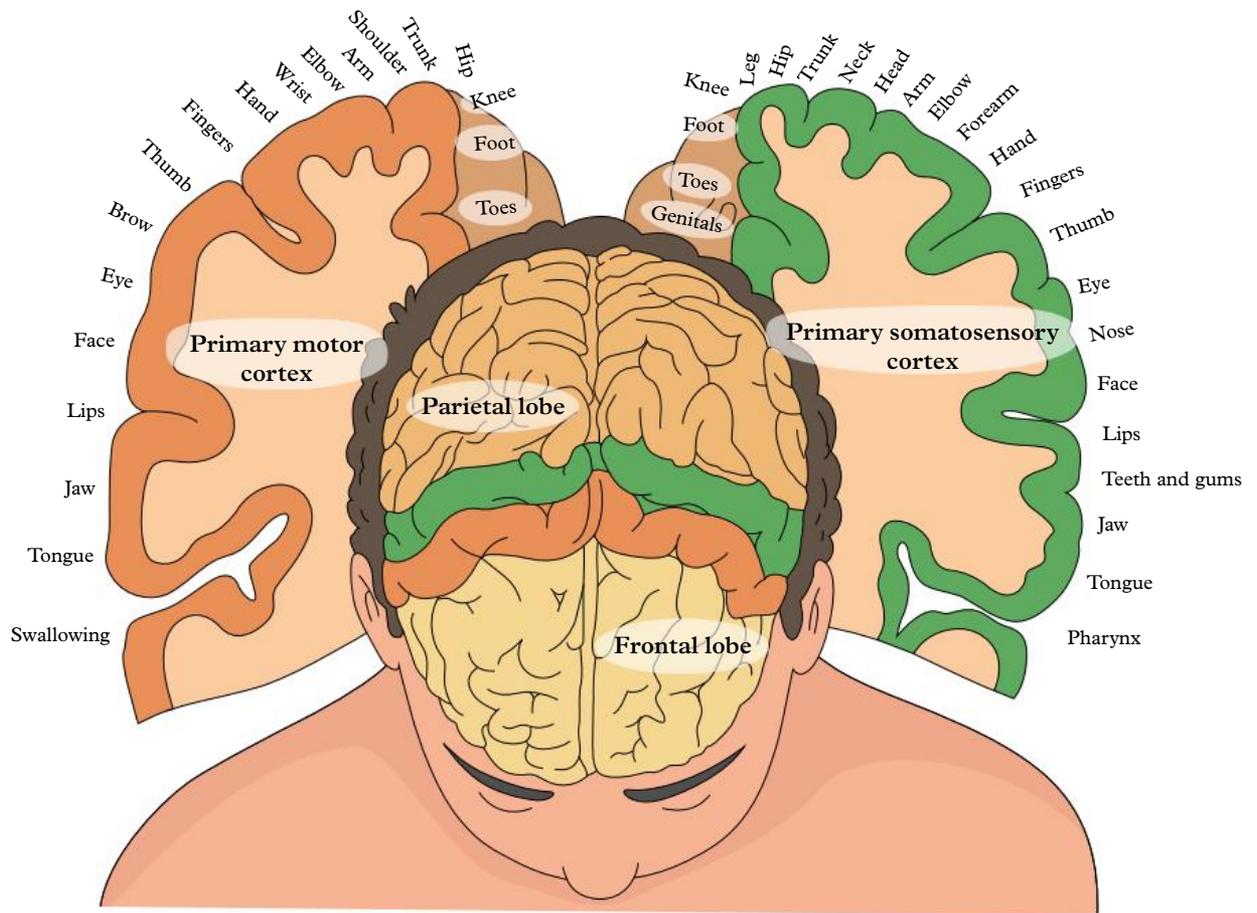
The right somatosensory cortex processes sensations on the left side of the body and the left somatosensory cortex processes sensations on the right side. The primary somatosensory cortex is also arranged so that it receives information from specific areas of the body. More sensitive areas of the body, such as the lips and fingers, take up a greater area than less sensitive areas, such as the torso. The more sensitive the area, the more sensory receptors are found there, and the greater the allocation of the somatosensory cortex. Figure 7 shows the locations of the primary motor and primary somatosensory cortices in the brain.



**FIGURE 6** The contralateral organisation of the brain means that movement on the right side of your body is controlled by the left hemisphere and movement on the left side of your body is controlled by the right hemisphere.

**parietal lobe**  
lobe of the cerebral cortex responsible for processing bodily sensations

**primary somatosensory cortex**  
an area in the parietal lobe that receives information from sense receptors in the skin



**FIGURE 7** Location and structure of the primary motor cortex and primary somatosensory cortex

## Occipital lobe

The **occipital lobe** is located at the back of each cerebral hemisphere and is responsible for processing vision and visual information. It is the smallest of the four cortical lobes.

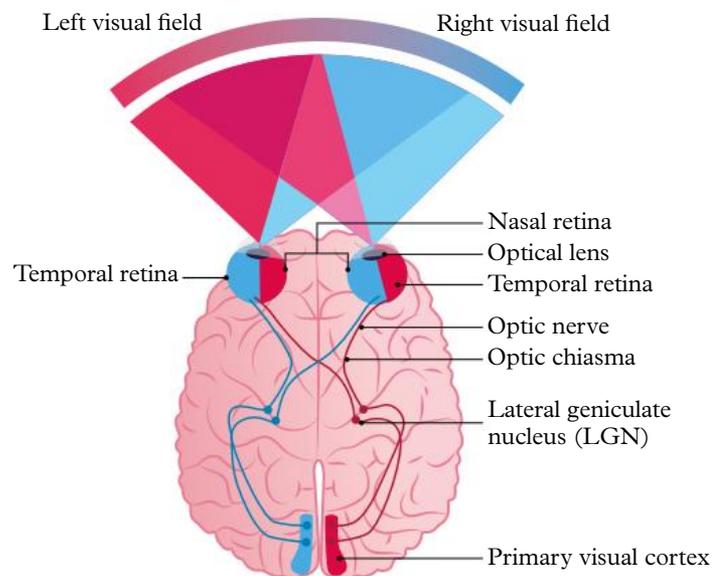
Each occipital lobe interprets information from the eyes. Information from the left side of each retina is processed in the left occipital lobe and information from the right side of each retina is processed in the right occipital lobe. A **primary visual cortex** sits within each occipital lobe; these visual cortices are responsible for processing different types of visual stimuli (for example, colour or brightness). Sensory information detected by the retina is sent to the primary visual cortex where visual stimuli is processed to form our perception.

### occipital lobe

lobe of the cerebral cortex responsible for processing visual information

### primary visual cortex

an area in the occipital lobe responsible for processing different types of visual stimuli



**FIGURE 8** Visual pathways from the eyes to the brain

## Temporal lobe

The **temporal lobes** are located along the sides of the brain near the ears. They are responsible for processing auditory information. The temporal lobes of each hemisphere receive information from the ears and allow us to interpret the sounds we hear. The **primary auditory cortex** is an area in the temporal lobe that is responsible for our ability to hear and process sounds. The left temporal lobe contains Wernicke's area, believed to play a significant role in language comprehension.

## Association areas of the cerebral cortex

Complex and higher-order mental functions will often require the brain to integrate information between motor and sensory areas. **Association areas** are regions of the cerebral cortex that are not a part of somatosensory or motor cortices but have a role in integrating information between motor and sensory areas.

## Broca's area

Broca's area is a small region of the brain located in the frontal lobe of the left hemisphere. It is located near the primary motor cortex and the proximity of these two areas enables the necessary muscle movement to produce meaningful speech. The area was first identified by Paul Broca, who conducted his research by examining case studies of people who experienced language difficulties or impairments.

Broca discovered a particular language impairment that is now known as **Broca's aphasia**. This occurs when a person experiences damage to Broca's area. Because Broca's area coordinates the movement of body parts, such as the lips and tongue, to produce words, damage to this area results in difficulty producing language. People with Broca's aphasia usually experience difficulties producing speech, reading and writing. However, the comprehension of language or ability to understand language is not affected.

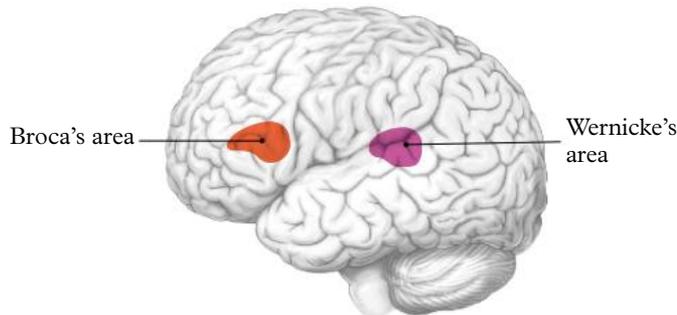


FIGURE 9 The locations of Broca's and Wernicke's areas

## Wernicke's area

**Wernicke's area** is a region in the brain located in the left temporal lobe, close to the primary auditory cortex. It is responsible for language comprehension; specifically, the comprehension of speech and sounds. Wernicke's area is involved in choosing the words needed for speech so that language makes sense and can be understood. Wernicke's area was discovered in 1876 by German neurologist Carl Wernicke. Damage to this area results in a condition called **Wernicke's aphasia**. People with Wernicke's aphasia have trouble stringing together coherent sentences that others can understand and trouble understanding the language of others.

**temporal lobe**  
lobe of the cerebral cortex responsible for processing auditory information

### Study tip

A good way to remember the lobes of the brain is to remember the acronym **FPOT** (frontal, parietal, occipital and temporal).

### primary auditory cortex

an area in the temporal lobe responsible for the ability to hear

**association area**  
part of the cerebral cortex that receives inputs from multiple areas

**Broca's aphasia**  
a language disorder that occurs when Broca's area is damaged and patients cannot produce clear speech

**Wernicke's area**  
brain area in the temporal lobe responsible for language comprehension

**Wernicke's aphasia**  
a language disorder that occurs when Wernicke's area is damaged and patients experience difficulty with language comprehension

# Cerebral hemispheres

## cerebral hemisphere

one of the two major parts of the cerebrum; left and right hemispheres of the brain

The cerebral cortex is divided into two **cerebral hemispheres**, the right and the left. The corpus callosum connects the two hemispheres and allows them to communicate with each other. The two hemispheres are mirror images of each other and contain all four lobes, but there are some differences between the two. Although most of our functions rely on both hemispheres, some only take place in one hemisphere.

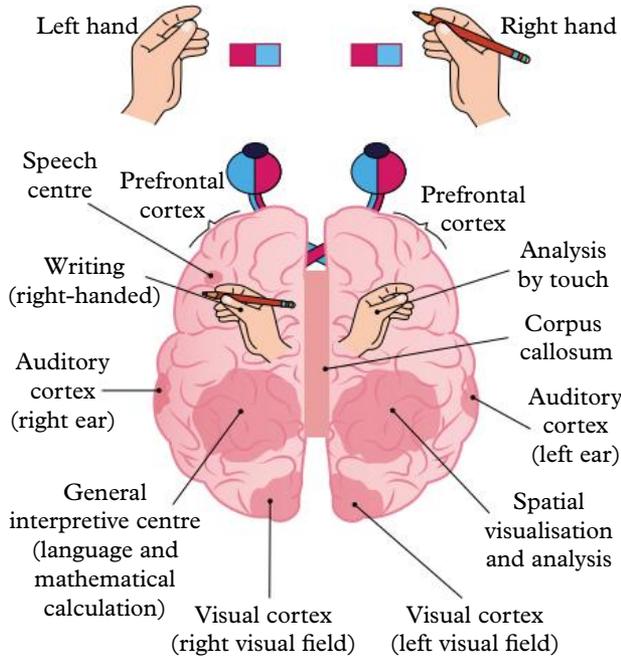


FIGURE 10 Lateralisation functions in the brain

## hemispheric specialisation

the different role the left and right hemispheres have in processing information and behaviour

## lateralised

controlled by one cerebral hemisphere

## white matter

neural tissue in the form of densely packed bundles of myelinated (insulated) nerve fibres

## Hemispheric specialisation

**Hemispheric specialisation** refers to the different role the right or left hemisphere has in certain tasks or behaviours. Each hemisphere is responsible for controlling the opposite side of the body. For example, the primary motor cortex in the left hemisphere controls the right side of the body and the primary motor cortex in the right hemisphere controls the left side of the body. Sensations are also processed by the opposite hemisphere. The right somatosensory cortex processes sensory information from the left side of the body and the left somatosensory cortex processes information from the right side of the body.

Some brain functions are **lateralised**, which means they only take place in either the left or right hemisphere (not both). Additionally, each hemisphere is also specialised or dominant in some behaviours, as outlined in Table 1.

TABLE 1 Dominance in the left and right hemisphere

Left hemisphere dominance	Right hemisphere dominance
<ul style="list-style-type: none"> <li>• Language</li> <li>• Analytical functions</li> <li>• Mathematics</li> <li>• Problem-solving</li> <li>• Judging time</li> <li>• Speech production</li> <li>• Comprehension</li> </ul>	<ul style="list-style-type: none"> <li>• Geometric patterns</li> <li>• Facial recognition</li> <li>• Non-language sounds</li> <li>• Music</li> <li>• Spatial skills</li> <li>• Imagination</li> <li>• Creativity</li> <li>• Interpretation of emotions</li> </ul>

## Corpus callosum

The corpus callosum is a bundle of nerve fibres separating the two cerebral hemispheres. It is a wide neural bridge made of **white matter** that ensures the two hemispheres can communicate and send signals to one another. If the corpus callosum is damaged or severed, the two hemispheres will no longer be able to communicate. People with a damaged or cut corpus callosum will appear to have normal functioning; however, it would only be after specialised experiments that the real effects of this damage could be seen.

## 4.4 REAL-WORLD PSYCHOLOGY

### Split-brain patients

Roger Sperry was a neuroscientist who studied patients that had a severed corpus callosum. Sperry presented visual information using a **tachistoscope** to participants who had one eye covered. Participants were shown an object in their right eye or right visual field. This information is processed in the left hemisphere, therefore participants were able to name the object. When participants were shown an object in their left eye or left visual field, this information was processed in the right hemisphere and participants were unable to name the object, but could draw it with their left hand. Sperry's experiments provided evidence of the corpus callosum's role in allowing the hemispheres to communicate and for hemispheric specialisation.

**tachistoscope**  
an instrument used to briefly expose the eye to visual stimuli

### Apply your understanding

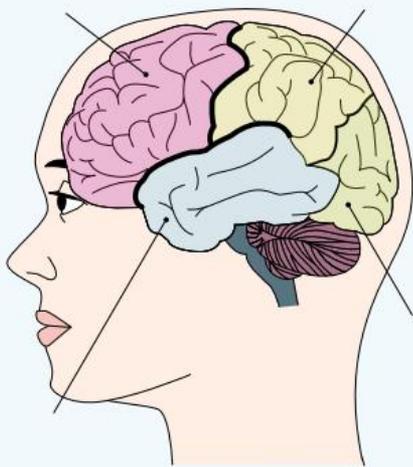
- 1 Explain why participants were unable to use language to describe the object they had seen when it was displayed in their left visual field.
- 2 Explain why participants were able to draw the image they saw in their left eye. Why could they only draw the object with their left hand and not their right?
- 3 Based on Sperry's experiments, what conclusions can be made about hemispheric specialisation?

## 4.4 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain how the two hemispheres of the cerebral cortex communicate with each other.
- 2 Describe the specialised function of the primary motor cortex.
- 3 Copy the diagram and label each lobe of the brain.



- 4 Describe the function of each cortical lobe.

### Apply, analyse and compare

- 5 Compare the primary somatosensory cortex and the primary motor cortex.
- 6 Suggest what change in behaviour may occur for someone who has experienced damage to their left primary auditory cortex. Justify your response.
- 7 The primary somatosensory cortex has a smaller area dedicated to the forearm than the primary motor cortex. Discuss why areas dedicated to body parts (such as the forearm) differ between the two cortices.

### Design and discuss

- 8 Discuss the role of association areas in the cerebral cortex with an example.
- 9 Design your own experiment to test the communication of the hemispheres without severing the corpus callosum as Roger Sperry did.

## Chapter summary

- 4.1** • Several historical approaches have attempted to understand the role of the brain in mental processes and behaviour.
- Historical approaches were often conflicting, not based on empirical evidence and did not follow the scientific method.
- 4.2** • Advancements in technology have assisted modern approaches to understanding the link between the brain and mental processes and behaviour.
- Modern approaches rely on the scientific method and use empirical evidence to support their theories.
- Case studies, autopsies and surgical and non-surgical operations have contributed to our current understanding of brain function.
- 4.3** • There are three main parts of the brain: the hindbrain, midbrain and forebrain.
- The hindbrain plays a significant role in coordinating bodily functions necessary for survival. The hindbrain links the spinal cord with the rest of the brain and consists of three main parts: the medulla, pons and cerebellum.
- The midbrain plays a key role in movement, processing visual and auditory information, the sleep-wake cycle, arousal (alertness) and regulating temperature. The midbrain acts as a link between the forebrain and hindbrain and contains the reticular formation.
- The forebrain is the largest and most developed part of the brain. It is responsible for many complex brain processes. The cerebrum, thalamus and hypothalamus are found in the forebrain.
- 4.4** • The cerebral cortex is divided into two hemispheres, the right hemisphere and the left hemisphere.
- The two hemispheres work together but also have specific functions; this is referred to as hemispheric specialisation.
- Each hemisphere contains four distinct lobes that have specialised functions.
- The frontal lobe is responsible for higher cognitive functions such as memory, emotions, language, problem-solving, planning and initiating movement of the body.
- The parietal lobe is responsible for processing bodily sensations and somatosensory information such as touch, temperature and pressure.
- The occipital lobe is responsible for processing vision and visual information.
- The temporal lobe is responsible for processing auditory information.

## Revision questions

### Multiple choice

- 1 Identify which of the following procedures was used to treat headaches by drilling a hole into the brain.
  - A Phrenology
  - B Craniotomy
  - C Trephination
  - D Lobotomy
- 2 \_\_\_\_\_ is the view that the mind and brain are distinct and able to be separated.
  - A Dualism
  - B Monism
  - C Philosophy
  - D Autopsy
- 3 Which of the following is a neuroimaging technique that creates a coloured 3D image of the brain used to detect whether a person has a brain tumour?
  - A CT scan
  - B PET scan
  - C MRI
  - D EBS
- 4 Oliver has sustained damage to his brain and is having trouble understanding spoken words. It is likely that Oliver sustained damage to his:
  - A right temporal lobe.
  - B left temporal lobe.
  - C right frontal lobe.
  - D left frontal lobe.
- 5 Which of the following is involved in controlling movements of the left side of the body?
  - A Right primary motor cortex
  - B Left primary motor cortex
  - C Right primary somatosensory cortex
  - D Left primary somatosensory cortex
- 6 The medulla, pons and cerebellum can be found in which region of the brain?
  - A Forebrain
  - B Hindbrain
  - C Midbrain
  - D Cerebral cortex
- 7 Which statement about the role of the hypothalamus is correct?
  - A The hypothalamus is the communication centre of the brain.
  - B The hypothalamus plays an important role in controlling basic survival functions.
  - C The hypothalamus is the biggest part of the forebrain.
  - D The hypothalamus processes sensory information necessary for interacting with our environment.
- 8 Winston is experiencing trouble producing clear speech. It is likely that Winston will be diagnosed with:
  - A Wernicke's aphasia.
  - B Broca's aphasia.
  - C split brain.
  - D convoluted organisation.
- 9 Which of the following is a limitation of the CT scan?
  - A It will show a limited view of the health of the brain when performing various functions.
  - B It will only detect brain tumours when they are large enough to view.
  - C A patient must be injected with a radioactive substance.
  - D It can only show brain structure and not brain function.



- 10** The role of association areas in the cerebral cortex is to:
- A** allow for the planning and execution of visual information.
  - B** allow for the communication between the left and right hemispheres.
  - C** integrate incoming messages to allow for complex processing.
  - D** integrate information after brain injury has been sustained.

### **Short answer**

#### **Describe and explain**

- 11** Define the term “hemispheric specialisation”.
- 12** Describe the structure of the cerebral cortex.
- 13** A patient has a brain injury that has resulted in an inability to sense information on the right side of their body. Identify the most likely part of the brain that has been damaged.
- 14** Describe the role of the medulla in involuntary functions, such as sneezing.
- 15** Identify all the structures that form and describe the main function(s) of:
- a** the midbrain
  - b** the hindbrain
  - c** the forebrain.
- 16** Explain why the primary somatosensory cortex devotes more area to more sensitive parts of the body.
- 17** Describe the main function and location of:
- a** the temporal lobe
  - b** the frontal lobe
  - c** the parietal lobe
  - d** the occipital lobe.

#### **Apply, analyse and compare**

- 18** In terms of the mind-body problem, differentiate between monism and dualism.
- 19** Compare positron emission tomography (PET) and computerised tomography (CT).
- 20** Classify the following as either right-hemisphere or left-hemisphere specialisations.
- a** Creativity
  - b** Appreciation of art and music
  - c** Logical reasoning
  - d** Speech production
  - e** Recognising emotions
- 21** Compare the primary motor cortex to the primary somatosensory cortex.
- 22** Evaluate the use of neuroimaging as a technique to study brain structure and function.
- 23** Compare Broca’s aphasia and Wernicke’s aphasia.

#### **Design and discuss**

- 24** A person is involved in a car accident and sustains an injury to their brain. After the injury the person can no longer produce clear speech and has trouble coordinating movement on the right side of their body. Based on the person’s injury, suggest which areas of the brain suffered damage. Justify your response.
- 25** Discuss the role of the cerebral cortex in higher-order cognitive functions.
- 26** Prior to Sperry’s split-brain experiments, severing the corpus callosum was believed to have no adverse effects on patients. Discuss the findings of these experiments and how they relate to the role of the corpus callosum.

- 27 “The heart is the source of all wisdom” was a belief held by many ancient Egyptians. Based on your understanding of the brain and its function, discuss the extent to which you agree or disagree with this statement.
- 28 A student makes the following claim: “CT scans are the best neuroimaging technique to examine activity of the brain while a person is performing a cognitive function.” Discuss whether you agree or disagree with the student’s claim. Justify your answer.
- 29 Draw a labelled diagram of the brain showing all four cortical lobes, primary cortices, Broca’s area and Wernicke’s area.
- 30 Discuss the importance of the case of Phineas Gage in understanding the link between brain and personality.

You can find the following resources for this section in your obook pro:

pro

### Quizlet

Compete in teams or against yourself to test your knowledge.



### Chapter quiz

Test your understanding of key knowledge in this chapter.



### Chapter checklist

Rate your understanding of key knowledge in this chapter.

CHAPTER

# 5

## Brain plasticity and brain injury

### KEY KNOWLEDGE

- the capacity of the brain to change in response to experience and brain trauma, including factors influencing neuroplasticity and ways to maintain and/or maximise brain functioning
- the impact of an acquired brain injury (ABI) on a person's biological, psychological, and social functioning
- the contribution of contemporary research to the understanding of neurological disorders
- chronic traumatic encephalopathy (CTE) as an example of emerging research into progressive and fatal brain disease.

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### GROUNDWORK

This chapter will build on concepts you will have come across in Chapter 4. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



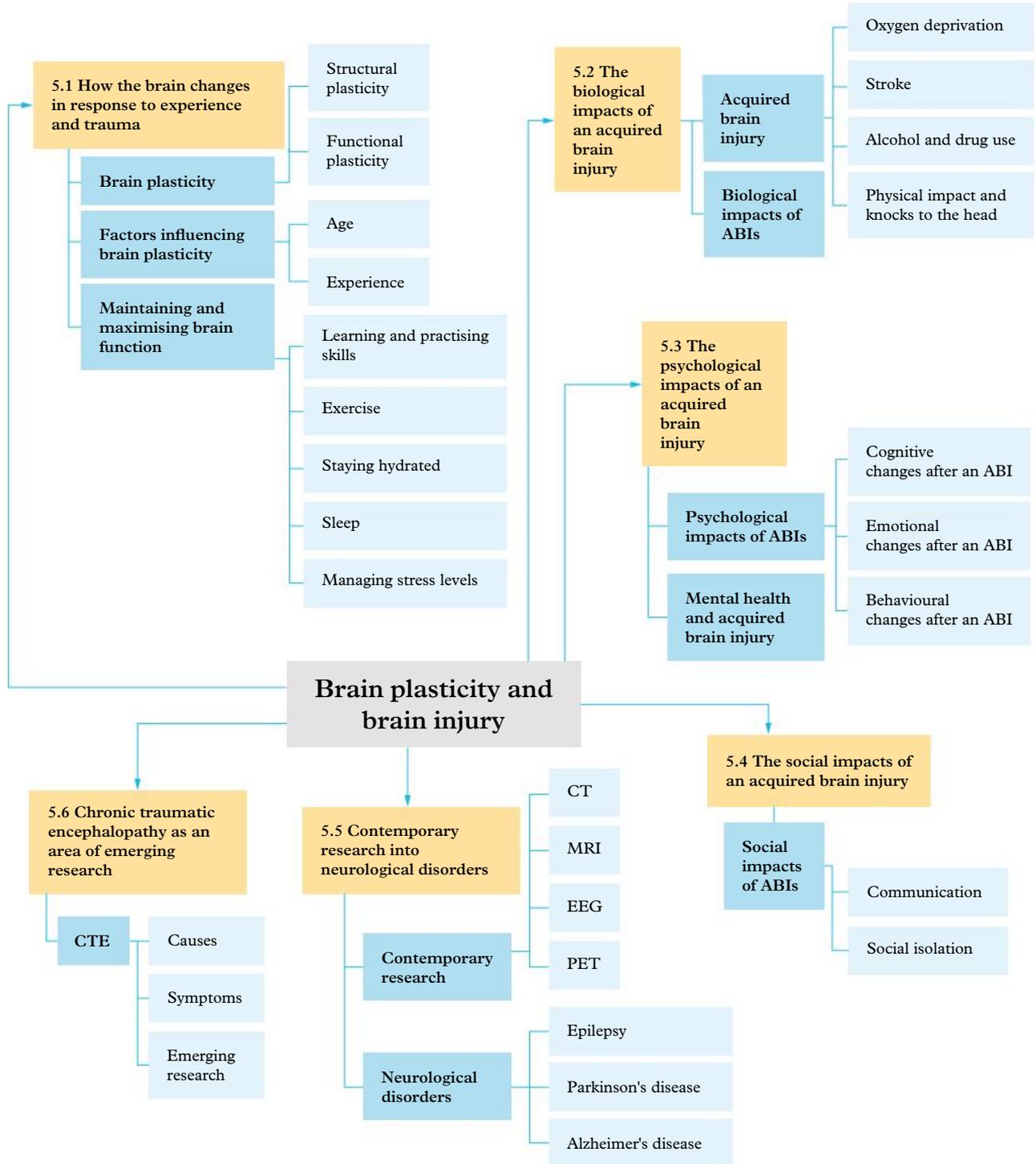
Groundwork quiz  
Chapter 5

### INVESTIGATIONS

5.1	INVESTIGATION: LITERATURE REVIEW	What strategies are effective in maximising brain plasticity and function?	Page 482
5.6	INVESTIGATION: PRODUCT, PROCESS OR SYSTEM DEVELOPMENT	How can we minimise head injuries in contact sports?	Page 483

**FIGURE 1** Injury to the brain can result in biological, psychological and social changes. Hard hats are worn to minimise the risk of head injury on work sites.

# CONCEPT MAP



# 5.1

## How the brain changes in response to experience and trauma

### KEY IDEAS

- ✦ Brain plasticity, also known as neuroplasticity, is the brain's ability to change in response to experiences, newly learnt information and injury or trauma.
- ✦ Brain plasticity happens throughout the life span with both structural and functional changes.
- ✦ Age, experience and injury influence neuroplasticity.
- ✦ Lifestyle changes can be used to improve neuroplasticity and maximise brain function.



Scientists once thought the brain was hard-wired from birth and did not change. We now know that the brain can and does change throughout our lives. Every time we do, think or feel anything we create a neural connection in our brain. These neural connections become stronger the more we practise or perform certain behaviours.

### Brain plasticity

Brain plasticity, also known as **neuroplasticity**, refers to the brain's ability to change in response to experience. The term "neuroplasticity" is comprised of "neuro" referring to neurons, which are the building blocks in the central nervous system, and "plasticity", which means flexible or easily shaped. Neuroplasticity is a critical component of our development from infancy to adulthood and helps us recover functionality after injury.

Brain plasticity includes two forms of plasticity:

- **structural plasticity** – the brain's ability to change its physical structure in response to learning and experiences
- **functional plasticity** – the brain's ability to alter the location of functions to compensate for damage after a brain injury or trauma.

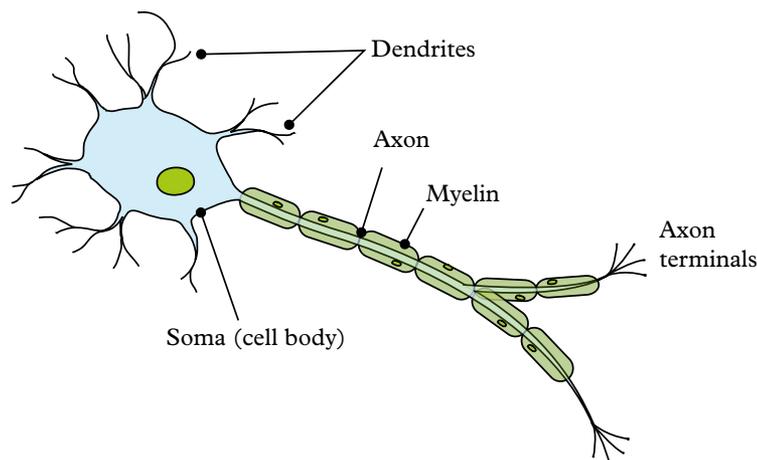


FIGURE 1 Structure of a neuron

**neuroplasticity**  
the brain's ability to change in response to experience

**structural plasticity**  
the brain's ability to change in physical structure because of experiences throughout life

**functional plasticity**  
the brain's ability to change after brain trauma has occurred to compensate for damage

## Structural plasticity

Brain plasticity would not be possible without the ability of neurons to form new pathways and connections. Many structural changes occur in the brain in response to experiences and learning. Processes involved with structural plasticity include neurogenesis, synaptogenesis, synaptic pruning, synaptic plasticity, neural migration, myelination, sprouting and rerouting.

### Neurogenesis

**Neurogenesis** is the formation of new neurons in the brain. The majority of neurogenesis happens between embryonic development and infancy. However, some regions of the brain will continue to create neurons after infancy through to the end of our life span.

**neurogenesis**  
the growth and development of new neurons

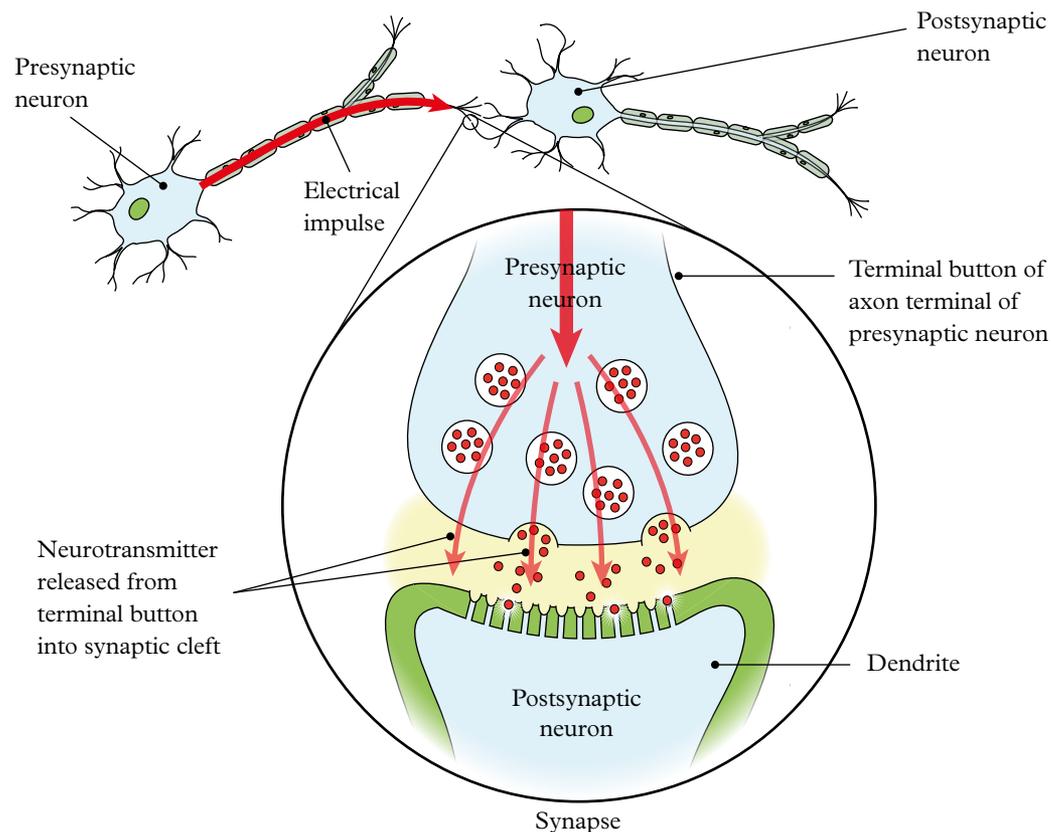
### Synaptogenesis

A synaptic gap is a small gap that sits between neurons and the site where neurotransmitters (chemical messengers) are released to allow two neurons to communicate. The site or location where communication between two neurons takes place is called a **synapse**. A single neuron can have thousands of synapses, allowing that neuron to communicate with thousands of other neurons. The process of forming new synapses is called **synaptogenesis**.

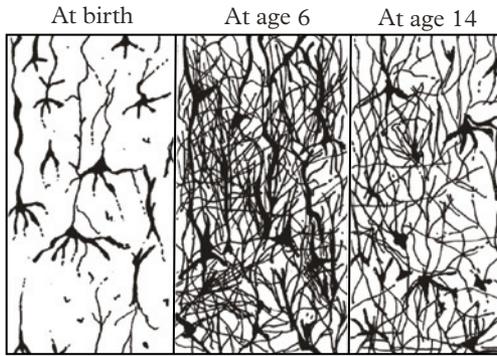
**synapse**  
the small space between neurons where neurotransmitters are released to allow neurons to communicate with one another

Synaptogenesis involves a rapid growth of synapses occurring in response to our experiences and interactions. Synaptogenesis plays an important role in learning and memory formation. When we form a memory or learn a new skill, we form a new synaptic connection (a connection between two neurons). Although synaptogenesis occurs across the life span, neural connections grow rapidly during early brain development.

**synaptogenesis**  
the formation of synapses between neurons in the nervous system



**FIGURE 2** A synapse is the site where neural communication takes place.



**FIGURE 3** Synaptic connections at different stages of life

**synaptic pruning**  
the brain's process of eliminating extra synapses

**synaptic plasticity**  
the ability of synapses to strengthen or weaken over time

**long-term potentiation (LTP)**  
the long-term strengthening of synapses that increases signal transmission between neurons

**long-term depression (LTD)**  
the long-term weakening of synapses that decreases signal transmission between neurons

**neuronal migration**  
the process of neurons migrating from their site of formation to another location in the nervous system

## Synaptic pruning

**Synaptic pruning** is a process that reduces or eliminates unused synaptic connections in the brain to make way for new synaptic connections. This process usually occurs between birth until a person's mid-20s and is determined by experience. Figure 3 shows images of the number of synaptic connections at different stages of life. From six to 14 years of age many synaptic connections have been pruned to make the brain more efficient.

## Synaptic plasticity

**Synaptic plasticity** is the ability of synapses to strengthen or weaken over time. Synaptic plasticity occurs through two processes, **long-term potentiation (LTP)** and **long-term depression**

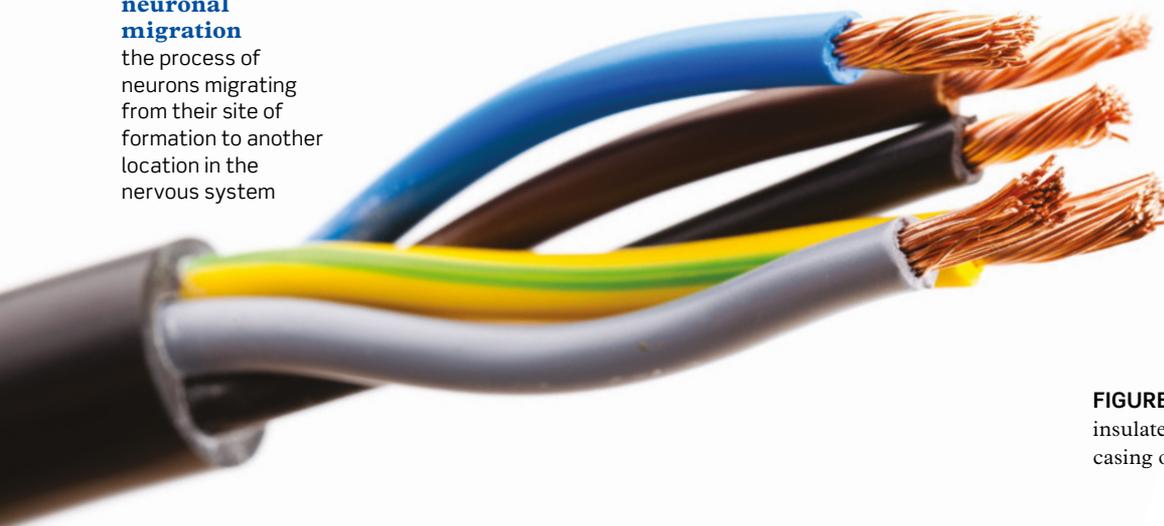
**(LTD)**. LTP is the persistent strengthening of a synapse that improves signal communication between two neurons when a synapse is frequently activated. For example, if you practise playing an instrument regularly over several years, the synapses that communicate to allow you to play the instrument strengthen and become more effective at communicating. LTD is when synapses weaken and become less effective at communicating, often because connections are not activated regularly. For example, if you played an instrument regularly for two weeks and then stopped playing it for a year, the synapses that communicate to allow you to play the instrument might lose their effectiveness at communicating. You will learn more about LTP and LTD in Units 3 and 4.

## Neuronal migration

**Neuronal migration** is the process in which neurons move from their original place at birth to their final position in the nervous system. The function of each neuron will be determined by the final location it moves to in the nervous system.

## Myelination

Myelin is a white fatty insulating substance that forms around neurons. It protects the neuron so that it can transmit an electrical impulse without disruption. Myelination is an important process that happens when the axon of a neuron becomes insulated or covered in myelin. This ensures that the neuron can efficiently send messages throughout the nervous system.



**FIGURE 4** Myelin is a substance that insulates neurons, much like the rubber casing on electrical wires.

## Sprouting and rerouting

**Sprouting** is when a neuron experiences growth that allows it to make a connection with another neuron. Sprouting can often occur after injury to establish connections that may have been severed or are no longer effective following damage (Figure 5).

**Rerouting** is when a healthy neuron forms a new connection with another existing neuron. Rerouting often occurs after injury to create new pathways for communication if existing pathways were damaged (Figure 6). Sprouting and rerouting are two key structural processes that allow functional plasticity to occur.

**sprouting**  
when a neuron forms new branches

**rerouting**  
when a neuron removes some existing connections and forms new connections to other neurons

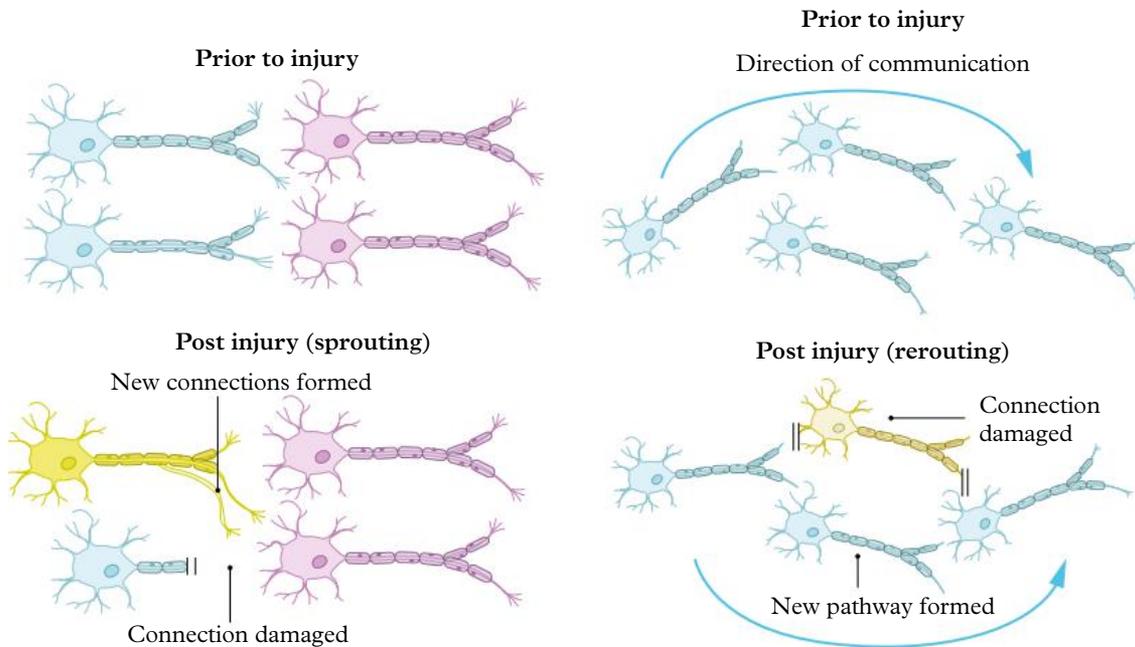


FIGURE 5 Sprouting after a neural connection is damaged

FIGURE 6 Rerouting after a neural connection is damaged

## Functional plasticity

In the event of an injury or trauma, the brain will try to adapt to the damage and overcome any loss of function. It will alter its structure to move functions associated with the now-damaged part of the brain to an undamaged part (Figure 7). Moving the site of brain functions from one area of a brain to another area is called functional plasticity.

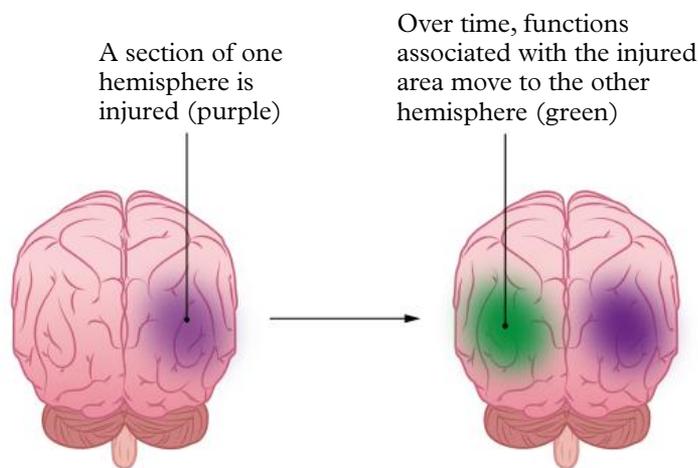


FIGURE 7 An example of functional plasticity

## 5.1 REAL-WORLD PSYCHOLOGY

### The hole in Helen Santoro's brain

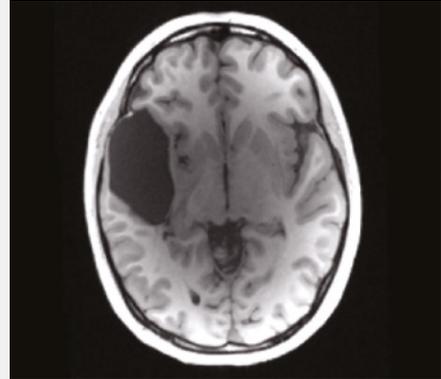
Helen Santoro was born with a large section of her left temporal lobe missing. The injury to her brain was caused by a perinatal stroke, a brain bleed that occurred while she was still in her mother's uterus. Helen's parents were told that she would never be able to speak and that she would need to be institutionalised.

Surprisingly, as Helen grew older she did not experience any cognitive, psychological or emotional irregularities. Helen's development from childhood to adulthood seemed completely unaffected, despite the absence of a large mass of her temporal lobe. This is due to the sprouting and rerouting that took place after her injury. Given her unique situation, Helen was often researched as a subject across different brain studies. She would often end up as an outlier because her ability to engage with language was unusual for someone missing a large part of their left temporal lobe.

When her brain was studied in adulthood, scans showed that Helen was still processing language in her left hemisphere even without a left temporal lobe. Dr Fedorenko, who studied Helen's brain, suggested that because the brain injury took place during infancy (when brain plasticity is highest) and because the site of the lesion was located near the front of the left hemisphere, Helen's brain had enough space to reroute her language system to the back of the left hemisphere.

### Apply your understanding

- 1 Describe why Helen was still able to speak despite missing a large section of her left temporal lobe. What type of plasticity does this demonstrate?
- 2 Use your understanding of the role of the cortical lobes and hemispheric specialisation to discuss how Helen's life might have been affected, had her brain not compensated for her injury.



**FIGURE 8** An MRI of Helen's brain

## Factors influencing brain plasticity

The genes inherited from our biological parents provide the basic neural framework that we are born with. However, our neuroplasticity is not dependent on genetics alone. Instead, neuroplasticity is influenced by a multitude of factors, including age and experience.

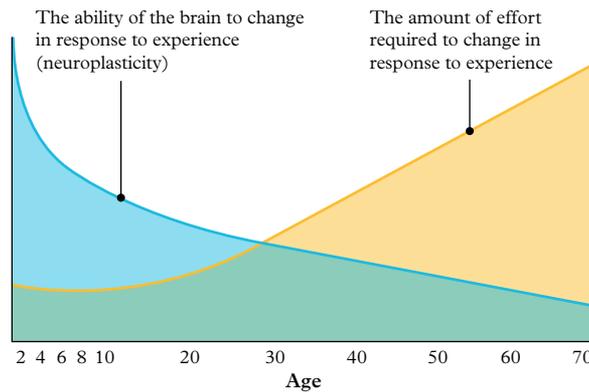
### Age

Age is one factor that influences brain plasticity. Changes to our neural connections happen throughout our life, but the most rapid changes in development occur within the first few years of life. Generally, infants' and children's brains have more plasticity than adult brains. During infancy and childhood, the brain is more sensitive and responsive to change and has more capacity to develop neural connections compared to its capacity during adulthood. At birth the average cerebral cortex has approximately 2500 synapses; by the age of three this has grown to approximately 15,000 synapses.

It was previously believed that at 25 years old, the brain would reach its full maturation and that neuroplasticity would stop after this point. Fortunately, modern research has clarified that this is not accurate. While our brains do tend to lose neural connections and plasticity as we age, adult brains are still able to form new neural connections and even create new neurons.



**FIGURE 9** Neuroplasticity is typically higher in children and infants than in adults.



**FIGURE 10** Neuroplasticity over the human life span

## Experience

The brain is responsive to different stimuli – this means the experiences we go through from our earliest stages of development up to the end of our life all play a role in shaping our neural connections. The influence of experience on the brain’s plasticity can be divided into two main categories.

**Experience-expectant plasticity** describes the development of neural connections in response to experiences that are universal to that species. For example, after a human infant is born you would expect it to:

- be visually exposed to light through sunshine and darkness at night
- be exposed to some sort of verbal communication (language) and different sounds
- practise controlling its limbs and motions so it can move around.

These, among other critical experiences, are so central to human life and development that our brains have developed to expect that they will occur. When the brain is exposed to these critical experiences, it will respond and form connections as it intended.

If an individual is deprived of a key experience, this can stunt or stop the development of critical neural connections. For example, young finches need to hear the songs of adult finches before they can sing to themselves. If a young finch is deprived of hearing adult finches singing, the young finch’s ability to sing to itself may be stunted or never develop, despite it having the neural framework and capacity to do so when it was born.

**Experience-dependent plasticity** describes the development of neural connections in response to experiences that are unique to each person. Unlike experience-expectant plasticity, the brain does not expect that these experiences will occur and instead responds to these events by creating and organising neural connections. For example, a professional violinist is likely to have more cortical development in areas of the brain that control the left hand than a person who does not play violin.

### experience- expectant plasticity

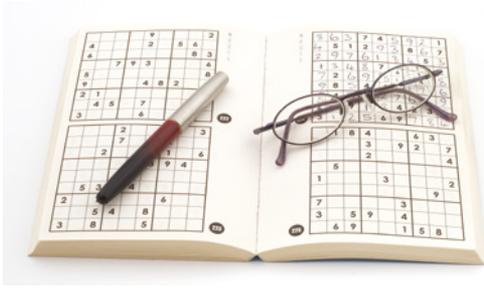
the development of neural connections as a result of common “expected” experiences



**FIGURE 11** A zebra finch’s ability to sing to itself relies on its exposure to hearing other adult songs at a young age.

### experience- dependent plasticity

the development of neural connections in response to personalised experiences



**FIGURE 12** Stimulating your brain by learning or practising new skills helps strengthen and create neural connections in the brain.

## Maintaining and maximising brain function

As we age, our brain (especially the frontal cortex) shrinks in size. This shrinkage can lead to a slowing of our cognitive functions. Changes to the brain are a normal part of ageing, but a decline in brain function is not an inevitable part of growing old. In fact, changes to our cognitive abilities can be greatly affected by our lifestyle. The adaptive nature of our brain means that there are many things we can do to maximise our brain function as we age.

The brain needs to be strengthened to continue to work at its best. Neuroplasticity is all about creating change; therefore, to maximise the functioning of our brain we must look to maintain, create and strengthen neural pathways that lead to positive changes in our lifestyle. Luckily, there are many ways to maximise the brain's functioning. These include learning new skills, exercising, staying hydrated, getting enough sleep and managing stress levels.



**FIGURE 13** Regular exercise improves blood flow and oxygen supply to the brain.

### Learning and practising skills

When we learn and practise skills, our brain makes changes to the strength of synaptic connections that are linked with understanding and executing the skills.

Activities that stimulate different regions and

cognitive processes in the brain, such as playing instruments, learning a language, completing puzzles and playing video games, can not only improve our cognitive abilities but also lead to structural changes in the brain. For example, learning a second language in adulthood has been shown to increase the density of grey matter in areas of the brain associated with language processing.

### Exercise

Exercising provides us with several benefits, including maintaining and maximising our brain function. The brain requires a steady supply of oxygen to metabolise glucose into energy for optimal functioning. Exercise enhances blood flow and oxygen intake, which increases the available energy and improves brain function. Additionally, exercise promotes the release of beta-endorphins or “happy hormones”, which improve moods and reduce stress levels. Research has also shown that exercise can enhance brain plasticity by increasing growth factors that aid in creating new neural connections.

### Staying hydrated

Approximately 75 per cent of brain mass comes from water. Our brains therefore need an adequate amount of water to function at full capacity. Even slight dehydration is shown to reduce cognitive ability and function. By keeping hydrated, we can allow our brains to operate at full capacity.



**FIGURE 14**

Dehydration reduces our brain's ability to perform cognitive tasks, so remember to keep that H<sub>2</sub>O high!

## Sleep

Sleep has a critical role in maintaining and maximising brain function. During sleep, the brain processes and consolidates information acquired throughout the day, leading to better memory retention and recall. Sleep also helps remove metabolic waste products, such as beta-amyloid proteins, which can contribute to Alzheimer’s disease.

In addition to these processes, sleep is essential for regulating important physiological functions, such as hormone secretion, immune responses and metabolism, each of which affect brain function. Different stages of sleep, including REM and non-REM sleep, are associated with distinct brain functions, such as memory consolidation, learning and emotional regulation. REM sleep in particular helps restore neurotransmitter levels and maintain neural pathways.

Lack of sleep can reduce the brain’s ability to function at full capacity, causing a decrease in attention, memory and decision-making abilities. Chronic sleep deprivation can also increase the risk of developing various health conditions, such as depression, anxiety, obesity and cardiovascular disease, each of which can adversely affect brain functioning.

## Managing stress levels

Studies have shown that long-term (chronic) exposure to stress can impair decision-making and even reduce the volume of our prefrontal cortex. Even short-term (acute) episodes of stress have been shown to cause reduced cognitive function. While stress and the stress response are natural processes our body engages in to enhance our survival, reducing unnecessary stressors in our life can be good for our cognitive function. If stressors cannot be removed or reduced, other effective strategies that can be used to help manage stress include controlled breathing, exercise and meditation.

### 5.1 CHECK YOUR LEARNING



#### Describe and explain

- 1 Define the term “neuroplasticity”.
- 2 Identify and describe two key processes that help facilitate functional plasticity.
- 3 Explain how age influences neuroplasticity.

#### Apply, analyse and compare

- 4 Compare experience-dependent plasticity with experience-expectant plasticity.
- 5 Distinguish between neurogenesis and synaptogenesis.

#### Design and discuss

- 6 A student claims that learning a new skill can alter the physical structure of the brain. Evaluate whether this claim is accurate or inaccurate. Justify your answer.

- 7 Holly is a doctor who works long, stressful shifts that require a lot of decision-making and a range of cognitive and motor skills. During her shifts she often forgets to drink enough water and when she comes home, she struggles to get a full night’s sleep in before her next shift.
  - a Identify and explain three factors of Holly’s lifestyle that may be negatively affecting her brain function.
  - b Explain how Holly’s current lifestyle could affect her performance at work.
  - c Propose three strategies or lifestyle changes Holly could implement to help maximise her brain function.

## 5.2

# The biological impacts of an acquired brain injury

### KEY IDEAS

- ✦ Acquired brain damage refers to any damage to the brain that occurs after birth.
- ✦ The biological impacts of acquired brain injury refer to any disruption to the body's physiological processes resulting from damage.



### acquired brain injury (ABI)

injury to the brain that occurs after birth

## Acquired brain injury

**Acquired brain injury (ABI)** refers to any damage to the brain that occurs after birth. These injuries are often referred to as hidden disabilities, because even though you might not always be able to see the physical signs of damage, the effects can have a significant impact on a person's life. The brain is a complex organ that plays a vital role in everything we think, feel and do. Therefore, damage to the brain can have significant consequences biologically, psychologically and socially for a person's functioning.

The brain can be damaged in many ways. Common brain injuries include:

- oxygen deprivation (hypoxic or anoxic injury)
- stroke
- alcohol and drug use
- physical impact or knocks to the head.

## Oxygen deprivation

Healthy brain functioning relies on a steady supply of oxygen. This is because oxygen is needed to break down (metabolise) the sugar glucose into a form of energy that can be used by the brain's neurons. Approximately 20 per cent of the body's total oxygen supply is solely used to metabolise glucose. If the body's oxygen supply is interrupted, this can cause damage to the brain. **Hypoxic brain injury** occurs when the brain receives less oxygen than what is required, and **anoxic brain injury** occurs when there is no oxygen supply to the brain.

There are several ways the brain can become deprived of oxygen, including:

- suffocation
- drowning
- cardiac arrest
- smoke inhalation
- carbon monoxide poisoning
- drug overdose
- stroke.

The long-term consequences of hypoxic brain injury depend on many factors, including how long the brain was without oxygen, which parts of the brain were damaged and the extent of the damage.

**FIGURE 1** Smoke inhalation can deprive the brain of oxygen.

### hypoxic brain injury

injury to the brain caused by a reduction of oxygen supply

### anoxic brain injury

injury to the brain caused by cutting off oxygen supply

## Stroke

A **stroke** is a brain injury that occurs due to an interruption of blood supply to the brain. Strokes are one of the most common causes of ABI. There are two different types of strokes:

- **ischaemic strokes** – these happen when a blockage inside a blood vessel causes insufficient blood flow to the brain. When blockages result in reduced or complete deprivation of blood flow, the brain cells close to the vessel become deprived of oxygen, causing them to lose function and eventually die off.
- **haemorrhagic strokes** – these happen due to a blood vessel in the brain bursting and flooding blood onto nearby brain tissue. These strokes can be due to physical impact to the brain or from the rupturing of an **aneurysm**, a swollen bulge in a weakened area of an artery or blood vessel.

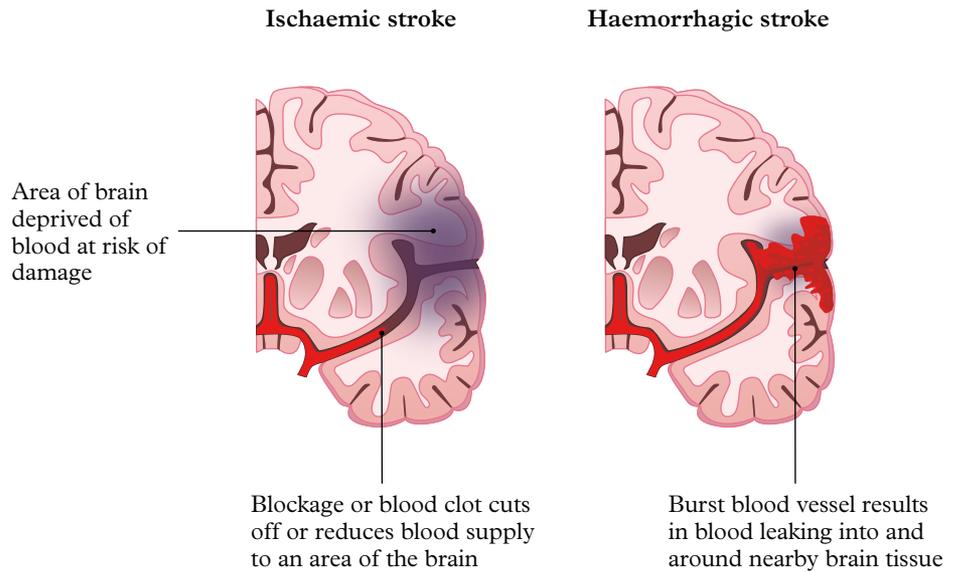


FIGURE 2 Ischaemic and haemorrhagic strokes

## Alcohol and drug use

Alcohol and drug use is a common cause of injury to the brain. Drugs such as alcohol, heroin, amphetamines, marijuana, opioids, inhalants and cocaine can have **neurotoxic** and destructive effects on brain cells. Acute or prolonged use of these substances can result in a range of different short-term and long-term effects on the brain.

Alcohols and opioids belong to a class of drugs called **depressants**. When a person takes a depressant, it reduces or “depresses” communication between the central nervous system and peripheral nervous system. This impairs the body’s ability to send messages via neurons. Depressants slow down messaging between the brain and body. The effects include lowered coordination, memory problems, difficulty making decisions, slowed breathing, loss of consciousness and even death.

## Physical impact and knocks to the head

**Traumatic brain injury** is a type of ABI that occurs when physical impact or a blow to the head results in injury or damage to the brain. Motor accidents, violence, falls and contact sports are the most common causes of serious impact to the head. When the head is knocked, impact force can shake the brain inside the skull. This may cause bruising on the brain, broken blood vessels or nerve damage, or create an open wound that exposes the brain.



FIGURE 3 Alcohols belong to a class of drugs called depressants; they slow the activity of the central nervous system.

**stroke**  
injury to the brain caused by disruption of blood flow

**ischaemic stroke**  
stroke caused by reduced or interrupted blood supply to a section of the brain

**haemorrhagic stroke**  
stroke caused by a rupturing of blood vessels in the brain

**aneurysm**  
an abnormal bulge in the wall of a blood vessel

**neurotoxic**  
damaging to the nervous system

**depressant**  
a class of drug that slows down the messages in the nervous system

**traumatic brain injury**  
a type of acquired brain injury caused by blows or jolts to the head



The symptoms experienced after a traumatic brain injury will depend on the severity of the injury. Common symptoms include headaches, dizziness and memory problems. Some traumatic brain injuries such as a once-off mild concussion can be recovered from and might not have a great impact on a person's functioning and behaviour. More severe injuries, such as Phineas Gage's accident (Topic 4.2), can lead to permanent brain damage and completely change a person's behaviour and function.

**FIGURE 4** Contact sports, such as boxing, can cause serious impact to the brain.

## 5.2 SKILL DRILL

### Analysing injury data

#### Key science skill: Analyse and evaluate data and investigation methods

The following data was collected from a profile of patients with severe traumatic brain injury in Victoria from 2006 to 2014, by age group and cause of injury.

**TABLE 1** Severe traumatic brain injury statistics, 2006 to 2014

	0 to 4 years	5 to 15 years	15 to 34 years	35 to 64 years	65+ years	All
<b>Unintentional events</b>						
Transport-related:						
• Motor vehicle crashes	17	22	345	123	26	533
• Motorcycle crashes	0	10	94	55	3	162
• Cyclist	0	10	24	34	9	77
• Pedestrian	12	23	84	63	57	239
• Other transport related	0	2	8	1	4	15
Falls:						
• Low ( $\leq 1\text{m}$ )	13	5	29	95	303	445
• High ( $\geq 1\text{m}$ )	0	6	50	59	61	176
<b>Intentional events</b>						
• Interpersonal violence	17	0	110	60	5	192
• Self-harm	0	2	44	50	8	104
<b>Outcomes</b>						
• In-hospital mortality	24	16	231	225	381	877

Source: Beck et al. (2016)

#### Practise your skills

- 1 Is the data presented in Table 1 qualitative or quantitative? Justify your response.
- 2 Identify the unintentional event that was the largest cause of severe traumatic brain injury in the 65+ years age group.
- 3 Identify the event that was the largest cause of severe traumatic brain injury across all age groups.
- 4 The data above shows that the 0 to 4 years age group had no severe traumatic brain injuries caused by motorcycle crashes. Suggest a plausible reason why this might be the case.

Need help analysing and evaluating data and investigation methods? Go to Topic 1.7 in your Psychology toolkit.

## Biological impacts

In Chapter 2 you learnt that biological factors are those relating to our physiological processes and functions. Acquired brain injury can cause a range of different biological impacts. While ABIs encompass many different situations rather than just one specific disease or condition, there are often commonalities in the biological impacts that people experience after an ABI, regardless of the type of injury sustained. These biological impacts can range from having minor to dramatic effects on the lifestyle and health of sufferers. Some common biological impacts are given in Table 2.

**TABLE 2** Common biological impacts of ABIs

Common biological impacts of ABIs	Description
Difficulties with movement and coordination	A person may move very slowly or have difficulty with balance. Depending on the severity of injury, injured individuals may require a wheelchair or mobility aids.
Incontinence	ABIs can disrupt the messages between the brain, bladder and bowel muscles, leading to an inability to control the bladder and/or bowel.
Seizures	Damage to the brain tissue during an ABI may predispose a person to suffering from seizures. Seizures are sudden and abnormal electrical activity in the brain.
Hormone regulation	ABIs resulting in damage to the hypothalamus can cause disruption to the part of the brain responsible for hormone regulation. Increased or decreased release of hormones disrupts the body's ability to maintain a stable internal environment.
Fatigue	Fatigue or excessive tiredness is a common problem after an ABI. This fatigue can be mental, physical or both.
Sensory changes	An ABI can disrupt the sensory processing of any of the five senses. A person may experience changes to how they interpret any information coming from these senses.

### 5.2 CHECK YOUR LEARNING



#### Describe and explain

- 1 Explain what is meant by the term “acquired brain injury”.
- 2 Identify three different causes of acquired brain injury.
- 3 Describe how depressant drugs affect the body.

#### Apply, analyse and compare

- 4 Compare haemorrhagic strokes with ischaemic strokes.

- 5 Kaydence has just consumed an excessive amount of alcohol. Discuss the biological impacts Kaydence may experience.
- 6 Distinguish between anoxic and hypoxic brain injury.

#### Design and discuss

- 7 Discuss how the symptoms of incontinence and fatigue could negatively impact a person's day to day functioning following an ABI.

## 5.3

# The psychological impacts of an acquired brain injury

### KEY IDEAS

- ✦ The psychological impacts of acquired brain injury include cognitive, emotional and behavioural changes.
- ✦ The severity of psychological impacts will depend on the location and impact of injury to the brain.
- ✦ Survivors of acquired brain injury are more at risk of developing mental health conditions.



## Psychological impacts

Damage inflicted on the brain during an acquired brain injury can cause a variety of psychological impacts. These psychological impacts can include changes to cognition, emotions and behaviour. Psychological impacts can range from mild to severe and may affect a person's mental health. Some psychological impacts faced after an ABI can be difficult for a person to adapt to and recover from, and may result in lifelong changes to that person's quality of life.

**FIGURE 1** The psychological impacts of an ABI may negatively affect a person's mental health.

## Cognitive changes

An acquired brain injury can alter how a person thinks, learns and remembers. Since different cognitive processes are linked to different areas of the brain, the cognitive effects experienced after an ABI will depend on the location and severity of the damage inflicted on the brain. Some people may experience mild changes in cognitive ability after an ABI, while others can face severe and drastic changes to cognition.

Common cognitive changes experienced after an ABI include:

- memory problems (a loss of memory surrounding the event that caused the injury or problems with **short-term memory** and **long-term memory** in general)
- loss of focus and attention
- difficulty making decisions
- reduced ability to process new information
- impaired reasoning
- difficulty understanding language (Wernicke's aphasia)
- difficulty expressing messages in words (Broca's aphasia).

### short-term memory

the capacity to hold a small amount of information for a short period of time

### long-term memory

the storage of information indefinitely

Since execution of cognitive tasks forms an essential part of our day-to-day lives, cognitive impairment can drastically alter how a person interacts with the world around them. In severe cases, cognitive impairment can have negative social impacts, including loss of autonomy and the inability to sustain relationships. These, among other social impacts, will be explored later in Topic 5.4.

### Improving memory after an ABI

There are many strategies a person can use after a brain injury to compensate for memory difficulties. Writing down information can help with the consolidation of new memories, as can asking people to slow down and repeat information. Using checklists and journals can also be a helpful way to keep track of information. Other strategies include breaking down tasks into smaller ones and focusing on one task at a time.



**FIGURE 2** Memory loss from an acquired brain injury can make day-to-day tasks, such as remembering which key to use to open the door, difficult.



**FIGURE 3** Writing down checklists can help with memory difficulties experienced after an ABI.

### Emotional changes

An acquired brain injury can also affect the way a person experiences or expresses emotion. These emotional changes can result from neurological damage to areas of the brain associated with emotions, for example, the frontal cortex, hippocampus and amygdala. Emotional changes may also stem from the other impacts of an ABI, such as changes to cognition, loss of autonomy and trying to cope with major life changes caused by the injury.

Common emotional changes experienced after an ABI include:

- mood swings
- emotional numbness or lack of emotional response
- emotional dysregulation
- loss of confidence
- anxiety
- depression
- anger and outbursts
- feelings of loss/grieving.

## 5.3 SKILL DRILL

### Controlled breathing and anxiety

#### Key science skill: Plan and conduct investigations

After an acquired brain injury, a person may start to feel anxious more frequently and have trouble relaxing. During feelings of anxiousness and stress, the body seeks to take in more oxygen, so breathing becomes rapid and shallow. Learning how to control breathing and increase the amount of oxygen going into the body can lower the effects of anxiety and help with relaxation.

### Practise your skills

- 1 Outline an investigation design that could be used to test whether practising controlled breathing can lessen feelings of anxiety.
- 2 Describe the type of data that would be obtained from your study.
- 3 Research the effects of controlled breathing on anxiety. Use your research to make a prediction on the sort of results you would expect to see from your study. Justify your prediction.

Need help planning and conducting investigations? Go to Topic 1.3 in your Psychology toolkit.

## Behavioural changes

Behavioural changes are common after acquired brain injury. Some behavioural changes are the direct result of neurological damage to the brain. Damage inflicted on areas such as the frontal lobes and their associated neuronal networks can often cause a person to lose or become unable to control their behaviour.

Not all changes to behaviour after an ABI stem from neurological damage. Changes to behaviour can also result from other life changes. The cognitive and emotional impacts a person experiences after an ABI can lead to life becoming more frustrating or difficult for an injured person – this can greatly influence how a person behaves in different scenarios.

Common behavioural changes after an ABI include:

- increased irritability
- increased aggression
- overactivity
- reduced ability to tolerate frustration
- low social judgment
- verbal outbursts
- lack of motivation
- impulsivity.



FIGURE 4 An ABI can result in increased aggression.

## Mental health and acquired brain injury

When a person begins to realise the extent to which their life has changed after their acquired brain injury, it is normal for them to experience a range of negative emotions. However, prolonged negative feelings can adversely affect the mental health of an ABI survivor. People who have experienced an acquired brain injury are more likely to develop a mental health condition, such as depression or anxiety, compared to the general population. Acquired brain injury can be a life-changing event that affects many areas of life. If a person has difficulty adjusting to these life changes, it can adversely affect their quality of life. Seeking help is important to assist a person's recovery and this can be done by talking to a trained psychologist or psychiatrist.

Factors that may negatively influence an ABI survivor's mental health include:

- cognitive, emotional and behavioural effects of neurological damage
- difficulty acknowledging and coming to terms with the long-term life adjustments that come after injury
- negative emotions after loss of capability and competency
- social changes (for example, changes to relationships or working life).

### 5.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Identify the emotional changes a person may experience after an ABI.
- 2 Identify the cognitive changes a person may experience after an ABI.
- 3 Identify one area of the brain that if damaged during an ABI could lead to a person experiencing emotional changes.
- 4 Explain a strategy that may be used to help a person improve their memory after an ABI.

#### Apply, analyse and compare

- 5 Provide an example of how a cognitive change after an ABI can also lead to a behavioural change.

#### Design and discuss

- 6 A student claims that any emotional changes experienced after an ABI purely result from neurological damage to brain areas associated with emotional processing. Evaluate this claim as true or untrue. Justify your response.
- 7 Discuss why the prevalence of mental health conditions, such as anxiety and depression, are higher in those who have experienced an ABI compared to those who have not.

# 5.4

## The social impacts of an acquired brain injury

### KEY IDEAS

- ✦ The social impacts of an acquired brain injury refer to how a person interacts and engages with others after injury.
- ✦ A person who has experienced an acquired brain injury may have trouble with communication due to the damage the brain has sustained.
- ✦ Biological and psychological impacts can contribute to survivors of acquired brain injury becoming socially isolated.



### Social impacts



In Topics 5.2 and 5.3 you learnt about the biological and psychological effects a person may experience after an acquired brain injury. These effects can prevent individuals from interacting with others in the same way they did prior to the injury. For example, an ABI can cause language and cognitive difficulties, which can lead to communication and socialisation difficulties. If an ABI survivor feels frustration and loneliness as a result of their injury, this can also lead to isolation from others and low self-esteem. These impacts can affect how a person interacts socially and change their social relationships.

Common social impacts of an ABI include:

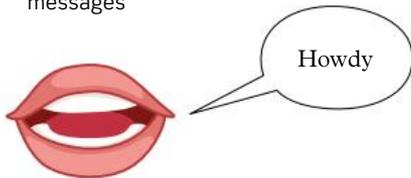
- changes to intimate relationships and friendships
- social isolation
- changes to the recreational and vocational activities a person engages in
- changes to workplace roles and relationships.

**FIGURE 1** An acquired brain injury can change the dynamics of personal relationships.

### Communication

The cognitive difficulties a person experiences after an ABI may result in difficulty with verbal and/or non-verbal communication. This can affect the way a person behaves in social situations. Being able to modify communication according to the situation a person finds themselves in is a key component of appropriate social communication. Without this skillset, a person may experience further social and emotional challenges.

**verbal communication**  
communication that relies on speech to convey and exchange messages



Verbal communication



Non-verbal communication

### Verbal communication

**Verbal communication** is the process of using speech or written words to pass information on to others. After an ABI, a person may have difficulty with a range of verbal skills, so they may act inappropriately in social situations. Changes that may be observed include talking too much or too little, difficulty maintaining a conversation, excessive swearing, and reduced turn-taking in a conversation.

**FIGURE 2** An acquired brain injury can alter a person's ability to engage in verbal and/or non-verbal communication.

## Non-verbal communication

**Non-verbal communication** involves passing information through emotions, gestures and body language. After an ABI a person may have trouble maintaining eye contact, difficulty perceiving personal space, reduced facial expressions, lack of awareness of the dynamics of a conversation and have trouble interpreting social situations correctly.

**non-verbal communication** communication that conveys and exchanges messages without using spoken words (such as eye contact or hand gestures)

## Social isolation

Social isolation is commonly experienced after an ABI. As individuals try to cope with the psychological and biological impacts of their ABI, the way they interact with others can change. For example, a person with an ABI may experience difficulties with their memory, so they may find it difficult to maintain and follow conversations. Emotional impacts of an ABI can cause individuals to feel more irritable and make them quicker to respond with anger. Established relationships with friends, family, partners and co-workers can break down if people feel it is too difficult to adjust to the changes in their family member or friend's behaviour and actions after an ABI. The psychological and biological impacts of an ABI can also make it challenging for a person to make new friends. Strain on existing relationships, as well as difficulty creating new relationships, may lead a person to social withdrawal.

## How to get help

Having an acquired brain injury can be an isolating experience, and connecting with others who have also suffered an ABI can help people feel less alone. Support groups allow individuals to share experiences and build connections with others. For those close to an ABI survivor, practising patience, understanding and empathy are key to helping. Learning about the biological and psychological impacts an ABI survivor is experiencing is a start to ensuring the survivor can be provided with adequate support to communicate with others. Family, friends and support people should also seek to limit an ABI survivor's experience of social isolation because this can lead to feelings of depression and poor self-worth.



**FIGURE 3** Support groups can help survivors of ABI build connections with people experiencing similar challenges.

### 5.4 CHECK YOUR LEARNING

#### Describe and explain

- 1 Identify four common social impacts that can occur as a result of an ABI.
- 2 Describe two different communication difficulties that may result after an ABI and explain how these can affect social relationships.
- 3 Explain why social isolation is common among sufferers of ABI.

#### Design and discuss

- 4 Discuss how the psychological and biological impacts of an ABI can affect social functioning and relationships. Use examples in your response.

- 5 Yindi has suffered an ABI and now struggles to read social cues, communicate effectively and express emotions as she once did. Yindi's friends report that she is no longer the same person after her injury and they start to spend less and less time with Yindi.
  - a Discuss how the changes in Yindi's friendships could affect her.
  - b What advice would you give to Yindi's friends so they can help support Yindi following her ABI?

# 5.5

## Contemporary research into neurological disorders

### KEY IDEAS

- ✦ Neurological disorders are conditions that affect nervous system function.
- ✦ Contemporary research and neuroimaging techniques have improved the diagnosis and treatment of neurological disorders including epilepsy, Parkinson's disease and Alzheimer's disease.



## Understanding neurological disorders

### neuroscience

the scientific study of the nervous system and its functioning

### neurology

a branch of medicine that focuses on the diagnosis and treatment of nervous system disorders

### neurological disorder

condition that affects the regular functioning of the nervous system

### epilepsy

a neurological condition that leads a person to experience repeated seizures

### Parkinson's disease

a neurological condition that disrupts motor functioning

### Alzheimer's disease

a progressive neurological condition that leads to brain atrophy and the decline of mental function

**Neuroscience** is the scientific study of the nervous system, its functions and factors that influence its function. Neuroscientists study the nervous system and conduct research into the brain to uncover how the brain and nervous system work. They also study irregular functioning of the nervous system, including how injury and disease can have an impact on the brain. **Neurology** is a medical area of neuroscience that seeks to understand the biology and physiology of **neurological disorders** (conditions that affect the brain and nervous system). Neurology also includes the study and application of treatments, preventions and cures for neurological conditions.



FIGURE 1 Neuroscientists study the brain.

## Neurological disorders

Neurological disorders are disorders that affect the nervous system. Neurological disorders typically affect the brain, spinal cord and the nerves that connect them and can have a significant impact on the life of sufferers. **Epilepsy**, **Parkinson's disease** and **Alzheimer's disease** are all examples of neurological disorders. A summary of these neurological disorders is given in Table 1. Chronic traumatic encephalopathy is another example of a neurological disorder that you will learn more about in Topic 5.6.

**TABLE 1** Summary of neurological diseases epilepsy, Parkinson’s disease and Alzheimer’s disease

Neurological disorder	Description	Causes	Symptoms	Treatments available
Epilepsy	A neurological disorder characterised by recurrent seizures due to abnormal electrical activity in the brain. Seizures can manifest in different ways depending on the area of the brain affected.	<ul style="list-style-type: none"> <li>• Head trauma</li> <li>• Infectious diseases of the brain</li> <li>• Stroke</li> <li>• Genetics</li> <li>• Brain abnormalities at birth</li> <li>• Loss of oxygen</li> </ul>	<ul style="list-style-type: none"> <li>• Seizures</li> <li>• Loss of consciousness</li> <li>• Abnormal behaviour</li> </ul>	<ul style="list-style-type: none"> <li>• Medication</li> <li>• Surgery</li> <li>• Dietary adjustments</li> <li>• Deep brain stimulation</li> </ul>
Parkinson’s disease	A disease of the nervous system that causes dopamine levels to drop and results in uncontrollable movement.	<ul style="list-style-type: none"> <li>• Damage to nerve cells in basal ganglia (an area of the brain that controls movement and produces dopamine)</li> <li>• Genetic and environmental factors</li> </ul>	<ul style="list-style-type: none"> <li>• Tremors</li> <li>• Slowed movement</li> <li>• Stiff muscles</li> <li>• Lack of coordination and balance</li> <li>• Speech changes</li> <li>• Difficulty writing</li> </ul>	<ul style="list-style-type: none"> <li>• Medication (dopamine promoters, antidepressants, cognition-enhancing medication, anti-tremor medication)</li> </ul>
Alzheimer’s disease	A neurodegenerative disease that is characterised by a progressive decline of brain neurons, resulting in loss of brain function.	<ul style="list-style-type: none"> <li>• Abnormal build-up of proteins around brain cells</li> <li>• Genetic factors</li> <li>• Age</li> </ul>	<ul style="list-style-type: none"> <li>• Memory loss</li> <li>• Poor judgment and decision-making</li> <li>• Decreased ability to plan, problem-solve and use logic</li> <li>• Language and comprehension difficulties</li> <li>• Lack of motivation</li> <li>• Changes to behaviour and personality</li> </ul>	<ul style="list-style-type: none"> <li>• Medication</li> </ul>

People who experience a neurological disorder experience a dysfunction in one or more areas of the nervous system. The impact the disorders have on the person affected depends on the location and severity of the damage. Some neurological disorders are **congenital**, meaning that they were present at birth. Other neurological disorders are **acquired**, meaning they developed after birth.

**congenital**  
a disease or condition present at birth

**acquired**  
a disease or condition that develops after birth

**TABLE 2** Causes of neurological disorders

Examples of congenital causes of neurological disorders	Examples of acquired causes of neurological disorders
<ul style="list-style-type: none"> <li>• Change in chromosome number (Down syndrome)</li> <li>• Genetic abnormalities (cystic fibrosis)</li> </ul>	<ul style="list-style-type: none"> <li>• Postnatal infections (meningitis)</li> <li>• Traumatic brain injury (head trauma)</li> </ul>

## Contribution of contemporary research to understanding neurological disorders

Our understanding of the nervous system and neurological disorders has drastically improved in the last few decades, thanks to contemporary research and evolving technologies. Research and application of many of the neuroimaging techniques that were explored in Chapter 4 have improved our ability to understand, diagnose and treat neurological disorders.

### Computerised tomography (CT)

Computerised tomography (CT) uses a series of X-rays to scan the brain from various angles. The CT scan can be particularly useful in identifying bleeding in the brain and is often used to identify structures of the brain that have been damaged. A CT scan is fast and widely available, which means it is frequently used first to diagnose suspected brain injuries. CT scans are also used after a person has sustained an injury or been diagnosed with a disease to monitor their progress and detect when any further damage or change to the brain has occurred.

CT scans can be used to:

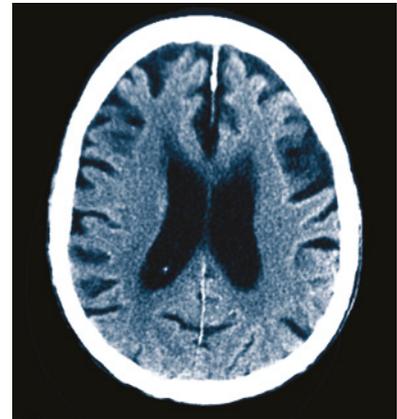
- look for abnormalities in the brain (for example, tumours or cysts) that may be causing seizures in people with epilepsy
- identify and rule out conditions that mimic Alzheimer's disease, such as tumours, brain bleeds and strokes
- detect some rare forms of Parkinson's disease that show presentable features
- detect loss of brain mass linked with Alzheimer's disease
- identify the site of damage in brain injuries.

### Magnetic resonance imaging (MRI)

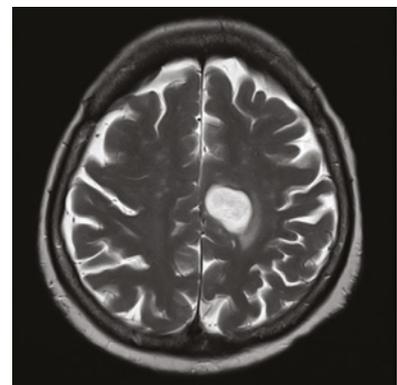
Magnetic resonance imaging (MRI) is a powerful diagnostic tool that uses magnetic fields to detect abnormalities in the brain. MRIs can provide high-resolution images of the brain, examine blood flow in the brain and measure brain tissue health.

An MRI can be used to:

- identify physical injury or abnormalities in the brain that may be causing epileptic seizures
- rule out other potential diagnoses in people with Parkinson's disease
- detect brain abnormalities and predict whether patients with mild cognitive impairment might develop Alzheimer's disease
- monitor any sign of decreasing brain size in Alzheimer's disease patients.



**FIGURE 2** CT scan of an 84-year-old male with Alzheimer's disease, where the black areas show brain atrophy (loss of neurons)



**FIGURE 3** MRI scans can be used to identify abnormalities that may cause epileptic seizures, like the brain tumour (white globular mass) shown above.

## 5.5 REAL-WORLD PSYCHOLOGY

### Emerging diagnostic techniques

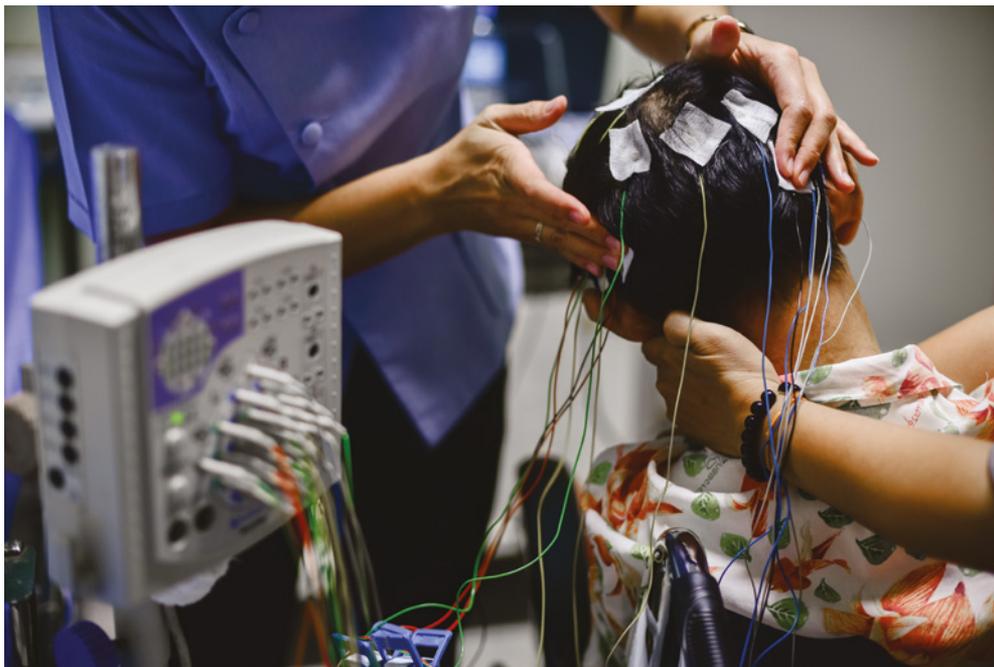
CT scans and MRIs are often used on Parkinson's disease (PD) patients, not to diagnose the condition but to check and rule out other neurological conditions that could be affecting the patient. Currently, neither scan is able to confirm diagnosis of Parkinson's disease. Researchers at Oxford University tested whether a variation of fMRI called "resting-state fMRI" could be used as a diagnostic tool for PD. During the resting-state fMRI, patients remain still while the scanner examines how connected the neural networks of the basal ganglia (the area affected by PD) are. Results of the study showed that 11 of 13 early-stage Parkinson's disease patients were able to be correctly diagnosed using resting-state fMRI.

### Apply your understanding

- 1 Use your understanding of fMRI from Chapter 4 to compare a standard MRI, fMRI and resting-state fMRI.
- 2 The results of the study showed that 11 of the 13 patients were able to be correctly diagnosed with Parkinson's disease. Present the accuracy of diagnosis as a percentage.

### Electroencephalogram (EEG)

An electroencephalogram (EEG) is used to detect, amplify and record the electrical activity of the brain. Tiny electrodes that measure the electrical signals coming from the brain are placed on the scalp. When a person has a seizure the electrical activity in their brain changes; this change is known as epileptiform brain activity. Some people will experience epileptiform brain activity even when they do not appear to be having a seizure. Running EEGs can help diagnose these people by identifying an unusual electrical behaviour. If an EEG reading does not pick up any unusual activity it does not mean that a person does not have epilepsy, it just means that they were not experiencing any unusual activity at the time of the recording.



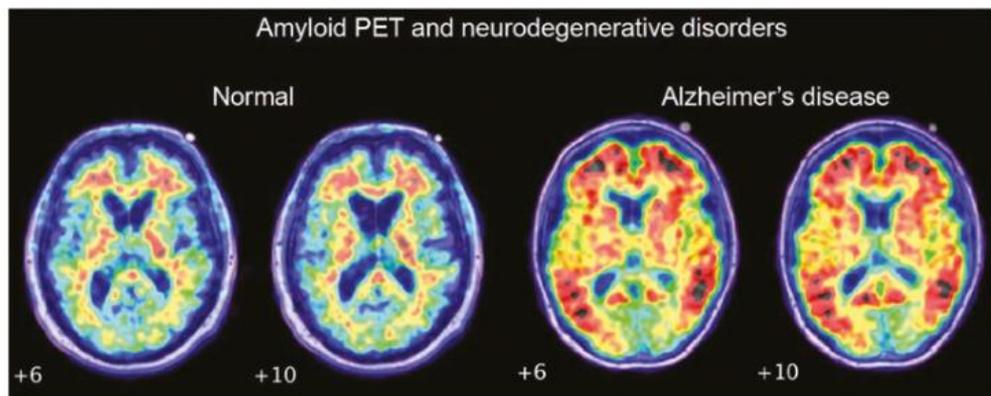
**FIGURE 4** EEG electrodes being placed on a person's head

## Positron emission tomography (PET)

Positron emission tomography (PET) measures the movement and concentration of certain molecules in the brain. PET involves tracking a ligand, which is a radioactive molecule injected into the patient's bloodstream before the procedure. The ligand is selected to attach to a particular molecule of interest – when the ligand attaches to the molecule it emits a small amount of radiation that the PET scanner can detect. The PET scan can then help to determine the concentration and movement of certain molecules in the brain.

PET scans can be used to:

- locate parts of the brain that may be causing seizures
- assess the function and activity of different brain regions in Parkinson's disease patients
- detect tumours and brain diseases
- identify the amount of amyloid protein in the brain (a key feature of Alzheimer's disease).



**FIGURE 5** Amyloid PET scans of a normal brain and the brain of a person with Alzheimer's disease. The greater intensity of the red and orange in the Alzheimer's scans are due to the ligand emitting radiation by attaching to a greater concentration of the amyloid protein.

### 5.5 CHECK YOUR LEARNING



#### Describe and explain

- 1 Describe what is meant by the term “neurological disorder”.
- 2 Select a neurological disorder described in this chapter.
  - a Give a brief description of what the disorder is.
  - b Identify two potential causes of the disorder.
  - c Identify two symptoms of the disorder.
  - d Identify the treatments available to help manage symptoms of the disorder.

#### Apply, analyse and compare

- 3 Distinguish between congenital and acquired neurological disorders.
- 4 Compare the use of CT scans and MRI for diagnosing neurological disorders.

#### Design and discuss

- 5 Create a dichotomous key (a series of statements with two choices in each step that leads you to a correct option) to help you determine when a neuroimaging technique should be used.

# 5.6

## Chronic traumatic encephalopathy as an area of emerging research

### KEY IDEAS

- ✦ Chronic traumatic encephalopathy is a progressive and fatal neurodegenerative brain condition that is associated with repeated head trauma and concussions.
- ✦ Chronic traumatic encephalopathy can only be diagnosed during an autopsy, but typical symptoms before death include problems with cognition, mood, behaviour and mental health.
- ✦ Emerging research suggests that there is a correlation between head injuries from sports and chronic traumatic encephalopathy.



## Chronic traumatic encephalopathy (CTE)

### chronic traumatic encephalopathy (CTE)

a progressive brain condition associated with repeated head trauma and concussion

### concussion

a brain injury caused by a bump, blow or jolt to the head



ClickView  
Concussion

### Chronic traumatic encephalopathy (CTE)

is a progressive and fatal brain disease that is associated with repeated head trauma and **concussions**. The condition was first recognised in boxers in 1928 by Dr Harrison Martland, who described the condition as “punch drunk syndrome”. After performing a series of autopsies, Dr Martland noted a link between small brain bleeds and boxers who experienced neurological symptoms after head trauma. He published a paper that detailed the symptoms and titled it “Punch drunk” (“punch” referring to the boxers it affected and “drunk” referring to symptoms that had similarities to those displayed when a person is intoxicated).

The condition is now understood to occur most frequently in athletes of contact sports (for example, boxing, Australian Rules football, rugby, mixed martial arts or gridiron) who are at risk of experiencing multiple head injuries over the course of their lives. The condition describes the **degeneration** of the brain and its functioning that stems from repeated brain injury. CTE is not a newly discovered condition, but emerging research aims to educate people about the risks of repeated head trauma in areas such as boxing, football, soccer and many other contact sports.

### degeneration

the process of declining or deteriorating



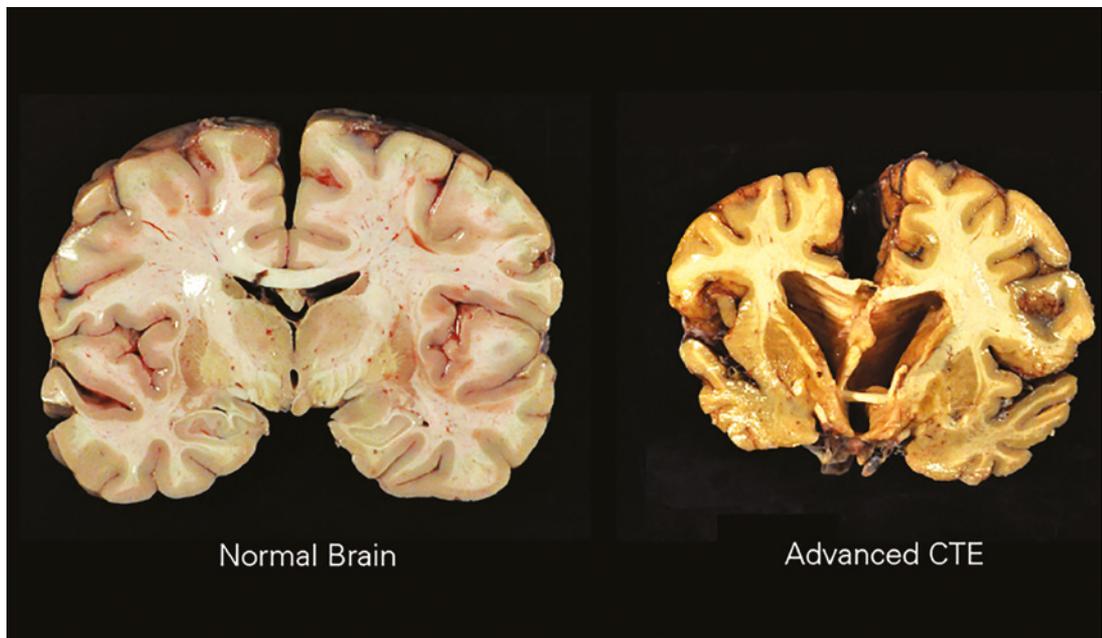
FIGURE 1 Dr Martland describing “punch drunk syndrome” to a class



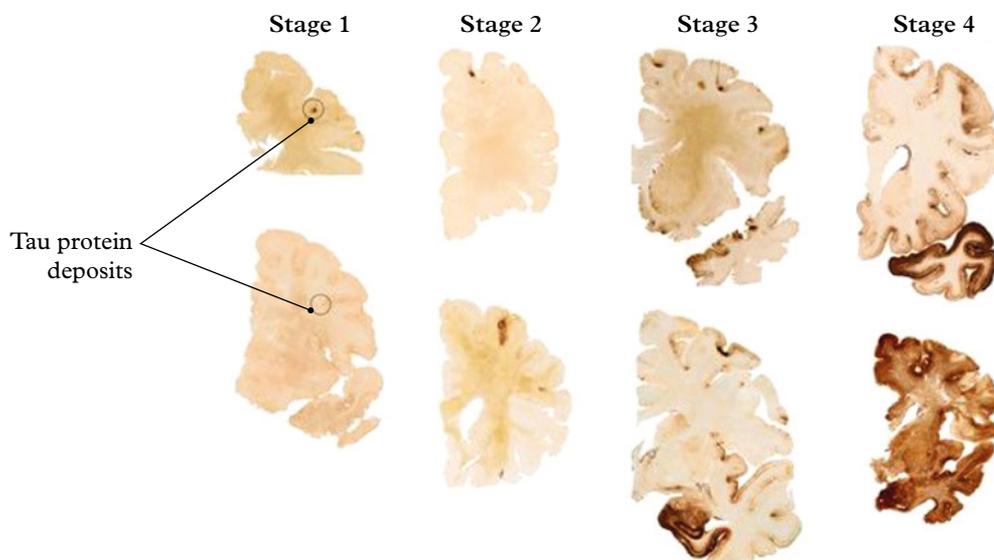
FIGURE 2 Athletes of contact sports are at a higher risk of developing CTE.

## Causes of CTE

CTE cannot be diagnosed while a patient is alive; instead, it must be confirmed during an autopsy after death. While research has shown that there is a relationship between head traumas and CTE, experts are still trying to understand how these head traumas contribute to the change in the brain that results in CTE. What has been established is that repeated brain traumas trigger a degeneration of brain tissue. This includes the build-up of a protein known as “tau” around the blood vessels in the brain. As the tau protein builds, it interferes with neural functioning and triggers neural degeneration. The number and severity of head traumas necessary to lead to CTE remains unknown. It is also not known why some people who experience repeated head traumas do not develop CTE at all.



**FIGURE 3** Comparison of a normal brain and a brain with advanced CTE



**FIGURE 4** Tau protein deposition across different stages of CTE. In stage one, tau first appears in small, isolated deposits. By stage four, tangles and deposits of the tau protein densely cover the brain’s cortex.

**5.6 WORKED EXAMPLE**

**Assessing claims with evidence**

Comorbidity is a term that describes when a person experiences more than one condition simultaneously. A student has claimed that most confirmed cases of CTE are comorbid with other neurological disorders, such as motor neurone disease, Alzheimer’s disease and more. Use the data from the table below to assess whether the student’s claim is accurate. (2 marks)

**TABLE 1** Comorbidity data from 142 neuropathologically confirmed cases of CTE at the VA-BU-SLI CTE Brain Bank

Comorbidity	Percentage of confirmed CTE cases
CTE and motor neurone disease	11%
CTE and Alzheimer’s disease	11%
CTE and Lewy body disease	7%
CTE and frontotemporal lobar degeneration	3%
CTE and multiple neurological disorders	5%
CTE and other neurological disorders	2%
CTE only (no comorbidity)	63%

Source: McKee et al. (2015)

Think	Do
Step 1: Identify whether there are any command terms in the question and determine what is required to address the command terms used (a glossary of command terms is provided in Topic 1.12).	The question uses the command term “assess”, which requires you to make a judgment about the quality of the claim.
Step 2: Look at the mark allocation to determine how many pieces of information are required. Link this back to what the command term/s are requesting.	There are two marks allocated to this question, therefore you will need to provide two pieces of information. One mark for a judgment on whether the claim is accurate or not and one mark for using the data presented to support or explain your reasoning.
Step 3: Examine the data presented in the table and how this relates to the student’s claim.	Data in the table shows that while some confirmed cases of CTE from this sample are comorbid with neurological disorders, the majority of confirmed CTE cases are not comorbid with other neurological disorders. This contradicts the student’s claim.
Step 4: Construct your answer.	The student’s claim is inaccurate (1 mark) as data from the table shows that the majority of confirmed CTE cases from the sample (63%) are not comorbid with neurological disorders (1 mark).

## Symptoms of CTE

Symptoms of CTE include problems with cognition (thinking), emotions, behaviour and physical/motor difficulties. Symptoms of CTE do not present immediately after head trauma – in most instances, symptoms will present themselves progressively, several years to decades after injury. Common symptoms of CTE are summarised in Table 2.

**TABLE 2** Cognitive, behavioural, emotional and motor symptoms of CTE

Cognitive symptoms	Behavioural symptoms	Emotional symptoms	Motor symptoms
<ul style="list-style-type: none"> <li>• Short-term memory loss</li> <li>• Confusion</li> <li>• Difficulty paying attention</li> <li>• Impaired judgment</li> </ul>	<ul style="list-style-type: none"> <li>• Violent outbursts</li> <li>• Impulsive behaviour</li> </ul>	<ul style="list-style-type: none"> <li>• Depression</li> <li>• Emotional instability</li> <li>• Mood changes</li> </ul>	<ul style="list-style-type: none"> <li>• Parkinson's disease</li> <li>• Motor neurone disease</li> </ul>



## Emerging CTE research

Emerging research has suggested that exposure to repeated mild head injuries during contact sports may be linked to a greater chance of developing chronic traumatic encephalopathy. While postmortem observations have suggested a correlation between repeated head trauma and CTE, no causation has been established. Despite technical advancements in medical imaging, CTE can only be diagnosed after death. Therefore, CTE research is limited to case studies and evaluations of brains that have been donated to science. New research is being conducted to help understand the impact of sport-related concussions on the human nervous system. The aim of this research is to develop tests that can diagnose living CTE sufferers and effective treatment options.

In 2023, former AFLW player Heather Anderson became the first female professional athlete to be diagnosed with CTE. Anderson, who sadly took her life at the end of 2022, grew up playing contact sports such as rugby and AFL. She played seven games of AFLW for the Adelaide Crows and would wear a helmet when she played. Anderson's brain was donated by her family to the Australian Sports Brain Bank (ASBB) who, when examining the brain, noticed multiple CTE lesions and abnormalities, confirming early-stage CTE. Research has shown that women are twice as likely to experience concussion in sports than men. Anderson's diagnosis, which was reported as indistinguishable from CTE cases seen in men, is an important step in understanding the long-term effects that contact sport can have on female athletes.

### 5.6 CHALLENGE

#### Correlation versus causation

Current research on CTE recognises that while there is a correlation between repeated head injuries and development of CTE, causation has not been established.

- 1 Distinguish between correlation and causation.
- 2 Suggest what type of research and data would be required to confirm causation between repeated brain injury and CTE.

## 5.6 REAL-WORLD PSYCHOLOGY

### AFL and CTE

In 2020, Australian Rules footballer Shane Tuck passed away. The postmortem conducted on Tuck discovered that he had suffered from chronic traumatic encephalopathy. Throughout his playing career, Tuck had sustained repeated knocks to the head and concussions. After retiring from football, Tuck also had a short career as a boxer. Prior to his death Tuck was reported to have experienced confusion, motor function difficulties and poor mental health. Tuck's family donated his brain to science to help further the research into CTE.

### Apply your understanding

- 1 Describe the link between head injuries and chronic traumatic encephalopathy.
- 2 Identify each of the symptoms associated with CTE that Shane Tuck was reported to experience. Classify each of these symptoms as cognitive, behavioural, emotional or motor.
- 3 Suggest why CTE can only be diagnosed after a person's death.

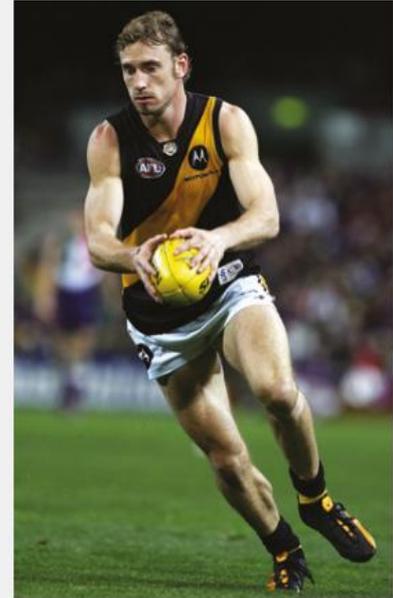


FIGURE 5 Shane Tuck

## 5.6 CHECK YOUR LEARNING



### Describe and explain

- 1 Identify the year that chronic traumatic encephalopathy was first recognised.
- 2 Describe why CTE was first called “punch drunk syndrome”.
- 3 Explain the role of the tau protein in CTE progression.
- 4 Describe when symptoms of CTE present in affected individuals.
- 5 Identify two motor conditions that CTE can contribute to.
- 6 Describe the link between repeated head injuries and CTE.

### Apply, analyse and compare

- 7 Distinguish between the cognitive and behavioural symptoms of CTE.

### Design and discuss

- 8 Select a contact sport linked with CTE.
  - a Describe what attributes of the sport might lead to higher incidents of CTE.
  - b Propose how the sport could be adjusted to minimise the risk of CTE.
- 9 There are conflicting arguments on whether helmets can be used in sport to reduce CTE. One view is they can minimise and reduce impact and should be used, other views suggest they cannot always prevent concussion from occurring and may encourage a false sense of security, leading to more injuries. Research both sides of the helmet debate and suggest whether you believe helmets can reduce the impact force of concussions and incidence of CTE. Justify your argument.
- 10 Design a subjective test that can help to determine whether a person is experiencing symptoms of CTE.

## Chapter summary

- 5.1** • Brain plasticity, also known as neuroplasticity, is the brain's ability to change in response to experiences and injury/trauma.
  - Brain plasticity occurs throughout the life span with both structural and functional changes occurring.
  - Age, experience and injury influence neuroplasticity.
  - Lifestyle changes can be used to improve neuroplasticity and maximise brain function.
- 5.2** • Acquired brain injury refers to any damage to the brain that occurs after birth.
  - The biological impacts of acquired brain injury refer to any disruption to the body's physiological processes that result from damage.
- 5.3** • The psychological impacts of acquired brain injury include cognitive, emotional and behavioural changes.
  - Severity of psychological impacts will depend on the location and impact of injury to the brain.
  - Survivors of acquired brain injury are more at risk of developing mental health conditions.
- 5.4** • The social impacts of acquired brain injury refer to how a person interacts with others and engages with others following their injury.
  - A person who has experienced an acquired brain injury may have trouble with communication due to the damage the brain has sustained.
  - Biological and psychological impacts can contribute to survivors of acquired brain injury becoming socially isolated.
- 5.5** • Neurological disorders are conditions that affect nervous system functioning.
  - Contemporary research and neuroimaging techniques have improved the diagnosis and treatment of neurological disorders including epilepsy, Parkinson's disease and Alzheimer's disease.
- 5.6** • Chronic traumatic encephalopathy is a progressive and fatal neurodegenerative brain condition that is associated with repeated head trauma and concussions.
  - Chronic traumatic encephalopathy can only be diagnosed during an autopsy, but typical symptoms before death include problems with cognition, mood, behaviour and mental health.
  - Emerging research suggests that there is a correlation between head injuries from sports and chronic traumatic encephalopathy.

## Revision questions

### Multiple choice

- 1 Plasticity of the brain is thought to occur:
  - A only in children.
  - B only in response to medication.
  - C as a result of head injury.
  - D throughout life.
- 2 Which term best describes the process of the brain compensating for loss of function in response to an injury?
  - A Neurogenesis
  - B Functional plasticity
  - C Myelination
  - D Structural plasticity
- 3 Which of the following techniques to improve brain functioning helps improve blood flow and increase oxygen supply?
  - A Meditation
  - B Learning a new skill
  - C Exercising
  - D Sleep
- 4 Which of the following is an example of an acquired brain injury?
  - A Down syndrome
  - B Cerebral palsy
  - C Hypoxic brain injury
  - D All of the above
- 5 Which of the following is an example of a biological impact of an acquired brain injury?
  - A Emotional instability
  - B Seizures
  - C Relationship problems
  - D Social isolation
- 6 Jai has been consuming excessive amounts of alcohol over a long period of time. Which of the following is a psychological impact that Jai is likely to experience due to alcohol consumption?
  - A Memory problems
  - B Coordination problems
  - C Inability to interpret facial expressions
  - D Slurred speech
- 7 One advantage of using an MRI scan over a CT scan is that:
  - A MRIs have a higher degree of resolution and therefore produce clearer images.
  - B MRIs can be done more frequently than a CT scan.
  - C MRIs are a faster test than CT scans.
  - D MRIs are cheaper than CT scans.
- 8 Researchers use several neuroimaging techniques to assist in studying acquired brain injuries. Which of the following would be helpful to diagnose a fractured skull?
  - A MRI
  - B CT
  - C EEG
  - D PET
- 9 Flora was diagnosed with chronic traumatic encephalopathy after her death. Which of the following is not a symptom of CTE?
  - A Impaired judgment
  - B Impulse control
  - C Dementia
  - D Good mental health
- 10 Which of the following is true of chronic traumatic encephalopathy?
  - A It is caused by repeated head injuries.
  - B It can only be diagnosed after death.
  - C Symptoms of CTE often present immediately after a head injury.
  - D Only sporting athletes can be diagnosed with CTE.



### Short answer

#### Describe and explain

- 11 Explain the physical changes that take place in the brain when learning occurs.
- 12 Describe how an acquired brain injury can occur.
- 13 Outline one neuroimaging technique used to study acquired brain injuries.
- 14 Describe the changes that occur in the cerebral cortex between birth and three years of age.
- 15 Explain how excessive alcohol consumption can affect the brain.



FIGURE 1 Excessive alcohol consumption

- 16 Tereza has an acquired brain injury. Outline three biological, psychological and social impacts she may experience.
- 17 Zoran is a 24-year-old man diagnosed with autism. Over the course of his life Zoran has experienced violent fits where he self-injures by banging his head on different surfaces. Over time Zoran has sustained mild damage to his frontal cortex.
  - a Identify two cognitive impacts that might have resulted from Zoran's ABI.
  - b Explain why Zoran might be at risk of developing CTE.

- 18 Explain one implication Heather Anderson's confirmed diagnosis of CTE has on the world of sport and why this implication is important.

#### Apply, analyse and compare

- 19 Distinguish between functional and structural plasticity.
- 20 Contrast synaptic pruning and synaptogenesis.
- 21 Compare two different neuroimaging techniques.
- 22 Compare experience-expectant plasticity and experience-dependent plasticity.
- 23 Compare the benefits of using a CT scan and MRI scan for the diagnosis of an acquired brain injury.

#### Design and discuss

- 24 Discuss three factors that influence neuroplasticity.
- 25 Discuss the importance of CTE research in relation to contact sports.



FIGURE 2 AFL is a contact sport.

- 26** Ornella is a 72-year-old woman who wants to improve her neuroplasticity.
- a** Suggest three activities Ornella could introduce into her lifestyle to improve her neuroplasticity.
  - b** Explain how each suggestion given in response to part a works to improve the brain's neuroplasticity.
- 27** Using examples, discuss how the biological and psychological impacts of an acquired brain injury can affect a person's social functioning.
- 28** Prepare a "Helpful tips" brochure for someone who has just been diagnosed with an acquired brain injury to assist them with adapting to changes in their lifestyle.

- 29** As an expert in neuroscience, you have been asked to write a safety protocol for athletes returning to sport after experiencing a concussion. Consider the risks of CTE when designing your safety protocol.



**FIGURE 3** An athlete being examined after a concussion

- 30** Discuss the physical changes the brain undergoes as CTE progresses.

You can find the following resources for this section in your [obook pro](#):

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

## AREA OF STUDY 2

### UNIT

# 1

# Checkpoint

## Part A – Assessment support for Unit 1 Area of Study 2

In Unit 1 Area of Study 2, you will be required to complete **one** task from the following options:

- analysis and evaluation of an experiment or case study
- a data analysis of generated primary and/or collated secondary data
- reflective annotations of a logbook of practical activities
- media analysis of one or more contemporary media texts
- a literature review
- response to a psychological issue or ethical dilemma
- a modelling or simulation activity
- problem-solving involving psychological concepts, skills and/or issues
- a report of a scientific investigation, including the generation, analysis and evaluation of primary data.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

The assessment support provided in this section models one way of approaching the following task for Outcome 2:

- response to a psychological issue or ethical dilemma.

### Important notice to students

Your teacher may select one of the other task options above for you to complete as assessment for this Outcome. If so, refer to the table of contents to find the assessment support related to that task.

**The advice, sample assessment and sample response provided should be used as an example and should not be completed as part of your formal assessment. Instead, your teacher will create a new task for your class to complete.**

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### Overview of Assessment 2 – Response to a psychological issue

In this sample assessment for Unit 1 Area of Study 2, you will be required to respond to a psychological issue. This task is designed to assess your understanding of different structures of the brain and their respective functions. It will also assess your understanding of the impact of acquired brain injury, research into neurological disorders and the brain's capacity to change in response to brain trauma.

## A step-by-step guide to completing Assessment 2

The information provided in this section is designed to help you prepare and practise for Assessment 2. The tips and advice included are broad and should help you successfully complete a response to a psychological issue, regardless of the specific requirements of the task your teacher or school has created.

### Step 1: Carefully read the requirements of the task and understand how you will be assessed

The best way to set yourself up for success on Assessment 2 is to complete the Chapter review questions for Chapters 4 and 5. Be sure to read through and complete any Real-world psychology sections from these chapters to practise your comprehension and writing skills in response to a scenario.

### Step 2: Justify your diagnoses with evidence

Ensure that you justify any diagnosis in psychology with evidence. In this area of study, you explored neurological disorders and their associated symptoms and behaviours. It is important that you link your diagnosis with the symptoms and behaviours discussed in the scenario.

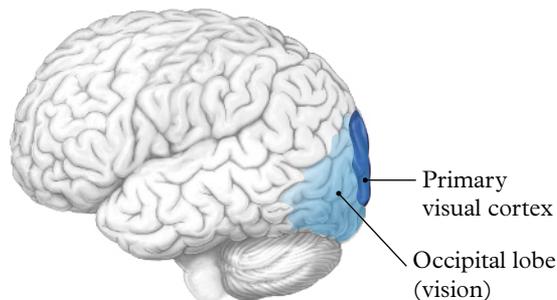
### Step 3: Discuss the impacts of brain damage associated with specific areas of the brain

Brain function and brain trauma were also explored in this area of study. With this knowledge you may be expected to predict specific impacts associated with damage to the brain. When answering questions related to a scenario where someone has sustained brain damage, be sure that you can reference what changes or impacts could occur as a result of this brain damage.

### Step 4: Be specific when discussing areas of the cerebral cortex

When referencing a lobe within the cerebral cortex always try to be as specific as possible. For example, if you are answering a question about processing vision, it is important to not only reference the occipital lobe but also make links to the primary visual cortex located within the occipital lobe.

Now that you have learned about some of the key steps to follow to achieve success on Assessment 2, it is a good time to practise putting this theory into action.



**FIGURE 1** Make sure to link processes with the correctly sections of the brain.

## Sample Assessment 2

The following excerpt has been adapted from the original. Read through the excerpt and answer the questions.

### Players who retired from concussion excluded from landmark AFL study

By Wendy Carlisle

29 April 2022

[F]ormer AFL players Dean Kemp (retired 2001) and Chad Rintoul (retired 2002) were two of 61 concussion cases claimed to have been dumped from a 2009 study by Dr Michael Makdissi, who is now the AFL's chief medical officer.

Despite this, the study was used by the league at the time to justify its concussion policy of returning players to the field based on individual clinical assessment.

But three academics have raised concerns about the study because of the sheer number of concussions excluded, and because the study did not examine the long-term effects of the players' injuries.

Makdissi's study followed all players in the 2000–03 seasons, counting 199 concussions in 157 players. The study was published in the peer-reviewed *American Journal of Sports Medicine* produced by the American Orthopedic Society for Sports Medicine ... Of the 138 concussions analysed, 127 (92 per cent) did not miss a game and the remaining 11 concussed players missed one game. The study is up-front in stating it “did not address the issue of long-term outcomes following concussive injury.”

...

Using cognitive and injury data, the former Hawthorn club doctor concluded players were “safely and appropriately” returned to the game under the AFL's concussion protocols of that time. He also reported players were returned to play with “no persistent deficits in cognitive function”.

The study excluded concussed players if they returned to a lower grade, had concurrent injuries, or had not played a game before their concussive injury. Others were excluded if they were concussed in their final or first games of the season because



FIGURE 2 Chad Rintoul

this meant player performance before and after concussion could not be measured. Makdissi's study concluded that player performance, measured by disposals [number of times players touched the ball], was not significantly affected by concussion.

Kemp and Rintoul were excluded because they did not play after their concussions, triggering the “inadequate follow-up” clause.

... [A] second set of cognitive tests for Makdissi's thesis, which related to 16 of the 138 concussions, found deficits in reaction times, attention and working memory in concussed players who were returned to play, but these results were not published in the study.

...

Professor Evelyne de Leeuw, a public health expert from the University of NSW, claimed the retirements of Kemp and Rintoul ought to have been the “crux” of the paper as it purported to be about the safe return of players to competition after concussion.

De Leeuw suggested the study ought to have followed players for a longer time because concussion has long-term effects and it “didn’t go there”. She questioned how the study could conclude concussed players were being safely returned to play when the effects of concussion were known to evolve over the long term.

“What they say is if someone gets concussion, they are allowed to come back on. It’s safe to come back to the sport for one game but doesn’t look beyond that.

The conclusion [that players are being safely returned to play] is not warranted,” she claimed.

Other players concussed during the study period ... were also excluded. All later retired due to, or partly because of, repeated concussions.

Makdissi’s study reported that one player retired because of “persistent headaches”, and the player had been excluded because of “insufficient baseline”, meaning they had not played before their concussion. It raises the possibility that another unidentified player retired from concussion during the period of the study.

Dr Franco Impellizzeri, an expert in sports medicine at the University of Technology in Sydney, claimed this potentially raised the issue of “selective reporting”.

“Considering the clinical relevance of the issue, before saying something is safe, more caution is needed,” Impellizzeri said.

Rintoul told *The Age* he spent months in bed after his concussions, experiencing migraines, dizziness, nausea, and depression.

In 2001, Kemp could only finish two of the eight games he started after three concussions. Both [Kemp and Rintoul] were cleared to return to competition under the league’s concussion protocols, which were the subject of the study.

... Kemp, who experienced numbness in his fingers, was told he risked permanent memory loss and blindness if he kept playing.

Rintoul retired in 2002 after back-to-back concussions in rounds two and three. Recalling the debate around concussion at the time of his retirement, Rintoul said: “People fobbed it [concussion] off for other symptoms like migraine.

I saw everyone from neurologists to doctors to chiropractors, everyone, to try and work out what I could do to help me out, but I got not too many answers.

“I was working out that the more concussions you get the easier it is to get a concussion and the worse the effects are. So, it’s like a big snowball.”

...

Last year, after former Richmond player Shane Tuck was posthumously diagnosed with chronic traumatic encephalopathy (CTE) by researchers at the Australian Sports Brain Bank, the AFL radically altered its approach to concussion management, introducing mandatory 12-day stand-downs for concussed players ...

At the time of Tuck’s CTE diagnosis, the safety of the AFL’s concussion protocols was under increased scrutiny from independent experts including the Australian Sports Brain Bank’s Victorian director, Associate Professor Allan Pearce, who argued evidence showed players needed 30 days to recover from a concussion.

After the AFL announced that it was doubling the mandatory time out for a concussed player from six to 12 days, the NRL followed suit with an 11-day stand-down.

Neither code has provided scientific evidence to support their claim that these stand-downs are safe. Before this, 80 per cent of concussed players were returned to competition the following week, according to calculations from statistics published in the AFL’s injury reports.

Rintoul urged the AFL to do more research into the long-term effects of concussion and to follow up on players like him.

Source: *The Age*

- 1 Referencing your understanding of mental health and neuroscience, discuss whether the concussion protocol of players returning to play the following week in the early 2000s or the new policy of a minimum 12-day “stand-down” is more suitable. (5 marks)
- 2 During the study, symptoms identified for some concussed players were “deficits in reaction times, attention and working memory”, as well as “numbness in [the] fingers, memory loss and potential blindness”.
  - a Evaluate two brain research methods that could be used to identify further symptoms, behaviours, or evidence of concussion on the brain. (6 marks)
  - b Explain the functions of three brain structures that could be linked to the symptoms/impacts listed above. (6 marks)
- 3 Former AFL player Shane Tuck was diagnosed with CTE after his death. To contribute to the growing awareness around concussion, discuss CTE, addressing the causes, diagnosis and different types of symptoms. (5 marks)
- 4 Recall the type of acquired brain injury that concussion is, and discuss how this can affect someone’s biological, psychological and social functioning. (4 marks)
- 5 Some people believe that athletes in their 20s and 30s who play sport that involves head trauma will be able to recover and not show any long-term impacts. Evaluate the accuracy of this statement, referring to plasticity and maximising brain function. (6 marks)
- 6 Use evidence from this article and your understanding of psychological concepts to discuss the relevancy of children between the ages of 12 and 16 wearing helmets when playing AFL, compared to adults. (4 marks)

You can find the following resources for this section in your obook pro:

pro



**Annotated response and marking criteria**

Once you’ve completed the practice SAC use this resource to assess your response.

## Part B – Checkpoint questions

### Multiple choice

#### Question 1

One advantage of using MRI is that:

- A it is cheaper to operate than most other imaging techniques.
- 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 is very quiet.

#### Question 2

Which of the following neuroimaging devices is the most effective in detecting and tracking activity in the brain in action in real time?

- A PET
- B MRI
- C CT
- D X-ray

#### Question 3

A researcher investigating the brain used information from a scientific journal that detailed Henry Molaison's surgery and the outcomes. (Henry Molaison underwent experimental brain surgery and was the subject of comprehensive studies.) Which scientific investigation methodology best describes this investigation?

- A Controlled experiment
- B Case study
- C Fieldwork
- D Correlational study

#### Question 4

Dr Davey conducted a controlled experiment that involved deception. On completion of the experiment, participants were informed that deception was used. Identify the ethical guideline that was adhered to by Dr Davey.

- A Confidentiality
- B Informed consent
- C Voluntary participation
- D Debriefing

#### Question 5

Understanding incoming sensory information allowing us to pay attention to specific stimuli and ignore other stimuli is coordinated by which brain structure in the forebrain?

- A Hypothalamus
- B Reticular formation
- C Cerebellum
- D Thalamus

#### Question 6

Which of the following is located in the hindbrain?

- A Frontal lobe
- B Medulla
- C Reticular formation
- D Thalamus

*Use the following information to answer questions 7 to 9.*

Dr Youssef was interested in the effect of regular exercise on recall ability. They gathered 24 participants to take part in the study and randomly assigned them into two groups. Group A did not complete any exercise for three weeks and Group B engaged in five hours of aerobic exercise each week for three weeks. After three weeks had passed, all participants completed a 20-question recall test. The score of this test was compared with the results of a similar 20-question recall test that participants completed at the commencement of the study.

#### Question 7

What was the independent variable in the study?

- A Regular exercise
- B Recall ability
- C The 20-question recall test
- D The type of exercise completed

#### Question 8

What type of data was collected in this study?

- A Secondary, qualitative data
- B Primary, qualitative data
- C Secondary, quantitative data
- D Primary, quantitative data

**Question 9**

Dr Youssef calculated the percentage change for the exercise group to be 70%. This means:

- A** participants achieved a score of 70% on the recall test at the end of the three-week period.
- B** participants performed better on the recall test at the end of the three-week period compared to the beginning of the three-week period.
- C** participants performed worse on the recall test at the end of three-week period compared to the beginning of the three-week period.
- D** participants achieved a score of 70% on the recall test at the start of the three-week period.

**Question 10**

Plasticity of the brain is thought to occur:

- A** only in children.
- B** only in response to medication.
- C** as a result of head injury.
- D** throughout our lifetime.

**Short answer**

**Question 1** (6 marks)

Phineas Gage sustained severe damage to his brain because of a railroad accident. His injury has been documented via case studies.

- a** Identify one biological and one social change that occurred in Gage because of his accident. (2 marks)
- b** Outline one strength and one limitation of case studies. (2 marks)
- c** Using an example, describe one other way acquired brain injury can occur. (2 marks)

**Question 2** (10 marks)

- a** Copy and complete the following table. (6 marks)

Area of brain	One structure located in this area	One function for the identified structure
	Hypothalamus	
Midbrain		This structure is responsible for controlling all of the body's vital functions, such as heart rate.

- b** Distinguish between Wernicke's and Broca's areas, identifying the lobes of the brain they are located in and the impacts faced when each area is damaged. (4 marks)

**Question 3** (15 marks)

Parkinson's disease is a neurodegenerative disease that results in the presence of motor and non-motor symptoms. A researcher is investigating a new medication which has been thought to reduce motor symptoms of individuals who have been living with Parkinson's disease for longer than ten years.

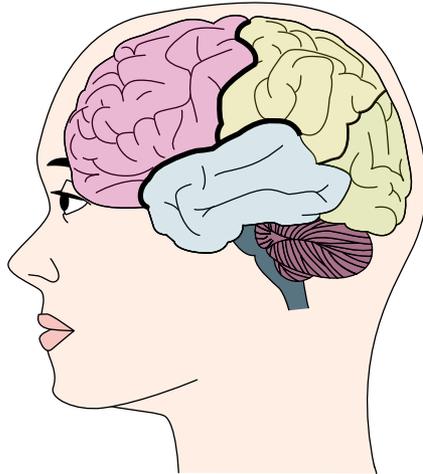
- a** Identify one motor symptom and one non-motor symptom of Parkinson's disease. (2 marks)
- b** With specific reference to Parkinson's disease, explain why neurodegeneration is considered a brain injury. (3 marks)
- c** Outline what type of neuroimaging technique a PET scan is, and how this makes it an appropriate technique for researching Parkinson's disease. (3 marks)
- d** Describe the informed consent procedures that should be used by researchers when conducting this investigation. (3 marks)
- e** The researcher decides to use a between-subjects design to investigate the effectiveness of the new medication. Explain how the researcher will employ this design. (4 marks)

**Question 4** (12 marks)

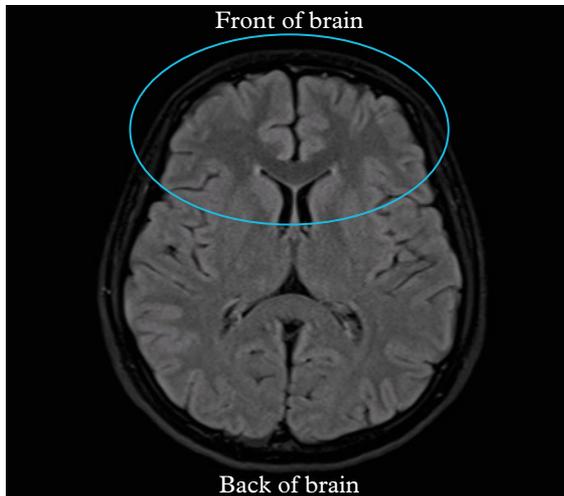
A study is conducted on participants who have experienced seizures and had surgery to separate the two hemispheres of their brain. The researcher wishes to investigate the effects of the surgery on the communication between the lobes in the brain. The following tests are completed by participants: a puzzle-solving activity, a number memory test, a visual-spatial test, a visual illusions test and a reading comprehension test. Twenty participants underwent the surgery before completing the tests. Another 20 participants completed the same tests without having undergone surgery. The average results for each test are calculated and then compared.

- a** Identify the independent variable in the study. (1 mark)

- b** The tests used in this experiment required participants to execute the following cognitive processes: processing of visual information, reading comprehension, memory, and problem-solving. Label the image to show the location of each process and identify the cortical lobe in which it would take place. (4 marks)



- c** Identify a structure and explain a process that would be affected if damage was sustained to the lobe highlighted in the image due to impact to the head. (2 marks)



- d** Identify the name of the bridge of nerve fibres that connects the left and right hemispheres. Explain what function this area of the brain serves. (2 marks)

- e** List **two** functions that would be affected, and **one** function that would not be affected by severing the area described in part d. (3 marks)

**Question 5** (7 marks)

A researcher is investigating the prevalence of CTE in a range of sports including American football, soccer, rugby, kickboxing and ice hockey. As part of their investigation, they examine the case studies and medical information of 10 former athletes from each sport. Findings from their investigations are shown in Table 1.

**TABLE 1** Summary of findings taken from case study analysis

Sport	Number of athletes diagnosed with CTE (out of 10)
American football (gridiron)	9
Soccer	4
Rugby	8
Kickboxing	9
Cricket	0

- a** Explain one reason why the researcher needed to collate their CTE data from case studies for this investigation rather generating their own primary data through a controlled experiment. (2 marks)
- b** Draw a bar graph to represent the data shown in Table 1. (3 marks)
- c** Calculate the percentage of rugby players studied that had CTE. (1 mark)
- d** Suggest why cricket had the lowest number of CTE cases compared to the rest of the sports. (1 mark)

CHAPTER

# 6

## Response to an investigation

### KEY KNOWLEDGE

#### Scientific evidence

- the distinction between primary and secondary data
- the nature of evidence and information: distinction between opinion, anecdote and evidence, and between scientific and non-scientific ideas
- the quality of evidence, including uncertainty, validity and authority of data and sources of possible errors or bias
- methods of organising, analysing and evaluating secondary data
- the use of a logbook to authenticate collated secondary data.

#### Scientific communication

- psychological concepts specific to the investigation: definitions of key terms; and use of appropriate psychological terminology, conventions and representations
- the characteristics of effective science communication: accuracy of psychological information; clarity of explanation of scientific concepts, ideas and models; contextual clarity with reference to importance and implications of findings; conciseness and coherence; and appropriateness for purpose and audience
- the use of data representations, models and theories in organising and explaining observed phenomena and psychological concepts, and their limitations
- the influence of sociocultural, economic, legal and political factors, and application of ethical understanding to science as a human endeavour
- conventions for referencing and acknowledging sources of information.

#### Analysis and evaluation of psychological research

- characteristics of repeatable and reproducible psychological research and the consideration of uncertainty
- criteria used to evaluate the validity of psychological research.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

**FIGURE 1** To complete Unit 1 Area of Study 3, you will research and evaluate information from a range of sources including books, scientific journals and online materials.

## GROUNDWORK

This chapter will build on concepts you have learnt in Unit 1 and will allow you to practise skills from Chapter 1. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



Groundwork quiz  
Chapter 6

## 6.1

## Scientific evidence

## KEY IDEAS

- ✦ A research question can be broken down to form a research outline.
- ✦ Any secondary data used to form your response should be assessed in terms of its nature, quality and relevance to your research question.

**contemporary psychological research**

a recent (relevant to the last 12 months) area of psychological research

**Psychological research response**

In Unit 1 Area of Study 3, you will investigate an area of **contemporary psychological research** and analyse information to answer a research question. You will also communicate the findings of your research, which includes explaining any psychological concepts relevant to the research question and identifying any social, economic, legal, political and ethical factors related to the research. To do this, you will need to complete the following tasks:

- 1 Select a topic and write a research question.
- 2 Break down your research question.
- 3 Prepare a research outline.
- 4 Source your information.
- 5 Analyse and evaluate your secondary sources.
- 6 Organise your information.
- 7 Present your information.
- 8 Reference your sources.

The rest of this chapter will guide you through each stage of forming your response. Make sure you also look over any specific assessment information your teacher has given you.

The area of contemporary research you choose to investigate may be in response to any recent discovery, finding, innovation, issue, advancement or case study from the last 12 months. Whatever the stimulus for your research, you must make sure that it relates to knowledge and skills covered in either Area of Study 1 or Area of Study 2 of Unit 1. This means that you should focus on concepts linked to:

- The complexity of psychological development (Chapter 2)
- Defining and supporting psychological development (Chapter 3)
- The role of the brain in mental processes and behaviour (Chapter 4)
- Brain plasticity and brain injury (Chapter 5).

**The complexity of psychological development**

In Chapter 2, you learnt about the complexity of psychological development. You might like to further investigate the complexity of psychological development through exploring contemporary research on:

- the interactive influence of hereditary and environmental factors
- the biopsychosocial model
- emotional, cognitive and social development
- sensitive and critical periods.

**Research tip**

Chapter 1 Psychology toolkit also provides information that can help you to conduct your research.

Some example questions that you might consider exploring for an investigation into the complexity of psychological development include:

- Do genetic or environmental factors play a larger role in the development of mental illness?
- How do early learning centres affect the psychological (emotional, cognitive and social) development of children?
- How does missing a key experience during a critical period affect brain function?



**FIGURE 1** For Unit 1 Area of Study 3 you may choose to investigate social, emotional or cognitive development across the lifespan.

## Defining and supporting psychological development

In Chapter 3, you learnt about how psychological development is defined and how it can be supported. You might like to further investigate the defining and supporting of psychological development through exploring contemporary research on:

- psychological criteria used to categorise behaviour as typical or atypical
- the concepts of normality and neurotypicality
- normal variations of brain development within society, as illustrated by neurodiversity
- supporting psychological development and mental wellbeing
- diagnosis and management of atypical behaviour, including culturally responsive practices.

Some example questions that you might consider exploring for an investigation into defining and supporting psychological development include:

- How does culturally responsive practice affect the treatment and diagnosis of psychological disorders in minority populations?
- How effective is cognitive behavioural therapy as a treatment for managing atypical behaviours?
- How do psychological treatment outcomes vary between populations with differing access to mental health workers, psychologists and psychiatrists?

## The role of the brain in mental processes and behaviour

In Chapter 4, you learnt about the role of the brain in mental processes and behaviour. You might like to further investigate the different roles of the brain and its structures through exploring contemporary research on:

- approaches to understanding the role of the brain in behaviour and mental processes
- the role of the hindbrain, midbrain, forebrain and/or cerebral cortex in behaviour and mental processes.

Some example questions that you might consider exploring for an investigation into the role of the brain in mental processes and behaviour include:

- What is the role of the cerebral cortex and is there a relationship between the size of the cerebral cortex and how intelligent an animal is?
- What is hemispheric specialisation, and can people be categorised as either “right-brained” or “left-brained”?
- Which of the hindbrain, forebrain or midbrain has the most essential role in survival?

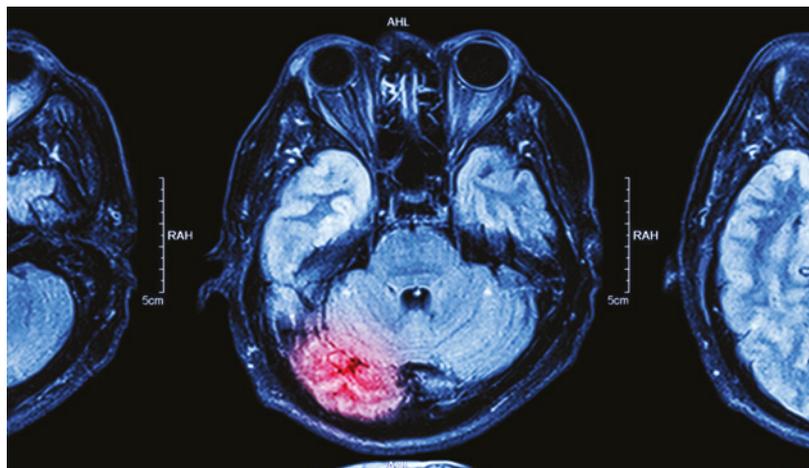
## Brain plasticity and brain injury

In Chapter 5, you learnt about the neuroplastic nature of the brain and how the brain can respond to injury. You might like to further investigate brain plasticity and brain injury through exploring contemporary research on:

- factors influencing neuroplasticity
- structural plasticity and functional plasticity
- the impact of acquired brain injury on biological, social and psychological functioning
- neuroimaging techniques and their contribution to understanding neurological disorders
- chronic traumatic encephalopathy as a progressive and fatal brain disease.

Some example questions that you might consider exploring for an investigation on these areas include:

- How does the brain compensate for loss of function after a brain injury?
- How can acquired brain injury have an impact on biological, social and psychological functioning?
- How do helmets reduce the prevalence of brain injury in contact sports?
- How does learning an instrument change the physical composition of the brain?
- What relationship exists between CTE and contact sports?



**FIGURE 2** For Unit 1 Area of Study 3 you may choose to investigate the impacts of an acquired brain injury.

# Selecting and understanding your research question

## Step 1: Select a topic and write a research question

This task provides you with the opportunity to investigate and understand a topic of your interest. You may choose a question from the suggestions above, use the questions above as a starting point or write your own.

Research questions often start with a **guiding word** (Table 1). The guiding words lead you to explore one or more **key terms**. Your question should be specific, clear and complex (that is, it should not be a yes or no question).

**TABLE 1** Some helpful guiding words and task words

Guiding words	Task words
how, what, when, why, where, who	identify, define, explain, describe, summarise, compare, analyse, evaluate, assess, discuss, justify

### guiding word

a word used to ask a question, such as how, what, when, why, where, who

### key term

a word that relates to the key topic you are investigating

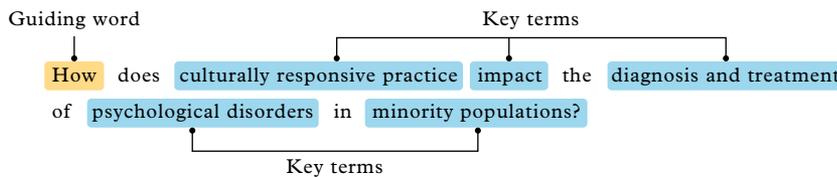
### Research tip

Your question may change as you start researching. No problem, as long as your research is answering your question!

## Step 2: Break down your research question

To answer your research question, you will need to understand all key terms related to the question and identify exactly what it is that the question is asking. It can be helpful to start by identifying the guiding word(s) and key term(s).

In Figure 3, a number of guiding words and key terms have been identified.



**FIGURE 3** Identifying the guiding words and key terms in a question can help break it down.

You can also break down the ideas behind the question by creating a list of **expanding questions**. These are the questions that need to be answered first before you can answer the bigger research question. Writing your expanding questions with specific **task words** will help.

In the example, the question has been broken down into three parts. Expanding questions have been generated for each of them with task words in bold.

- 1 What is culturally responsive practice?
  - **Understand** and **explain** what culturally responsive practice is.
  - **Identify** and **describe** specific examples of culturally responsive practice.
  - **Identify** the differences between culturally responsive practice and other traditional psychological practices.
- 2 How are psychological disorders often diagnosed and treated?
  - **Identify** and **describe** psychological disorders.
  - **Understand** and **explain** the diagnosis and treatment of psychological disorders.
  - **Evaluate** and **assess** how diagnosis and treatment of psychological disorders differs in culturally responsive practice.

### expanding question

a smaller and more specific question that you can derive from the investigation question to help you answer it

### task word

a word that provides direction for what you need to do, such as identify, explain, analyse, evaluate

- 3 How does culturally responsive practice impact diagnosis and treatment of psychological disorders in minority populations?
- **Explain** what minority populations are.
  - **Identify** and **explain** the challenges minority populations can face in receiving proper diagnosis and treatment of psychological disorders through traditional psychological interventions.
  - **Evaluate** and **assess** whether culturally responsive practice can help negate any of the challenges minority populations can face in receiving proper diagnosis and treatment of psychological disorders.

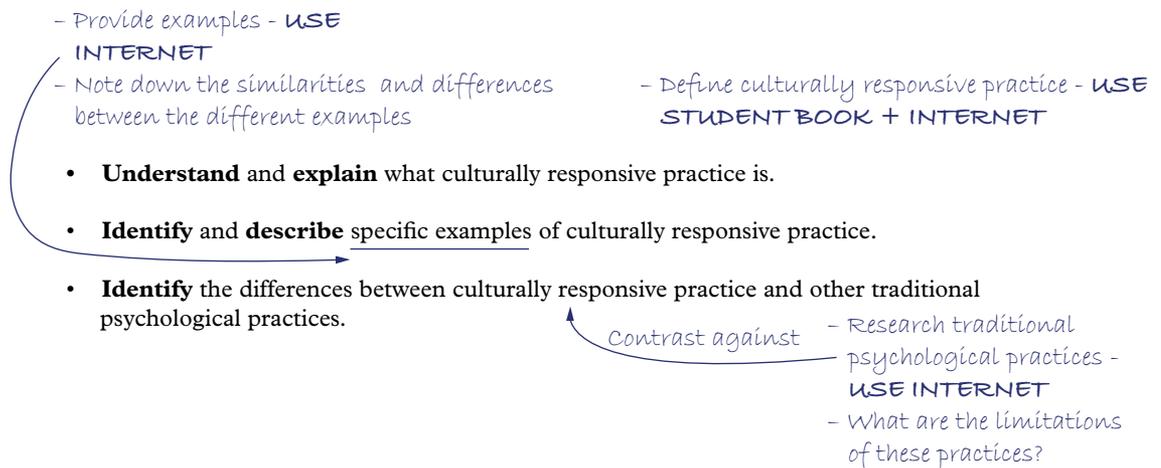
This step is important because it will help you understand what psychological concepts you will need to explain to answer your question.

### Step 3: Prepare a research outline

A **research outline** is a planning tool that can help you stay on top of your work and organise your research. You can also use the outline to draw links between ideas or use it to determine the order that you want to write about the information. This can be handy to help you figure out how you want to present your information later.

A research outline can be developed in many ways. You can start your outline using the expanding questions and give yourself more specific tasks to find the information you need (Figure 4). As you work through your research task you can continuously add ideas and information to your outline.

**research outline**  
a tool to help you organise your ideas; can be a skeleton for presenting information later



**FIGURE 4** You can use your expanding questions to start constructing your research outline.

### Step 4: Source your information

You can now begin your research! You will need to source secondary data that helps answer your question. Recall from your Psychology toolkit that secondary data is data that has been collected by another researcher or research team. There is an abundance of resources from which you can access secondary data. The obvious resources are scientific journals, the internet and books, but you could also try scientific magazines, videos, podcasts, or even getting in touch with people working in the field and asking questions. It is important to examine a variety of resources so that the information is not biased or limited by one perspective.



**FIGURE 5** In addition to books, scientific journals and the internet, you can also obtain information from other sources such as podcasts – just make sure you assess the credibility of the information before using it.

When you access a new piece of information, remember to record the details of it in an organised way. You need to include your secondary data in your logbook for authentication purposes. You may choose to bookmark all the pages you accessed or use a specific website or program that will record these for you. You should include:

- a title or description of the source
- the author or the URL
- the date you accessed it.

Collecting this information will help you to build your reference list later. It is much easier to record this information as you go than to find it again at a later stage.

As you explore each source you will also need to consider the following:

- the nature of evidence and information
- the quality of evidence.

### **The nature of evidence and information**

With endless information accessible through the internet and other formats, it is important to be able to distinguish between opinion, anecdote and evidence, and between scientific and non-scientific ideas. Recall from Topic 1.8 that:

- **evidence** is information or data on a topic that has been systematically collected; this information can help form conclusions
- **anecdotes** are personal observations collected in a casual non-systematic manner, used to support a view or judgment – this information is often biased
- **opinion** is a person's or organisation's judgments or views about a topic; opinions may not always be based on evidence, experience or fact
- **scientific ideas** are knowledges that have been acquired and refined by the scientific method
- **non-scientific ideas** are those that have been established by techniques that do not follow the scientific method.

You should also make sure that you only refer to data and research that is credible. One way to evaluate the credibility of a source is to use the CRAAP method.

- **Currency:** When was the information published? Is it out of date?
- **Relevance:** How does the information fit in with your research question?
- **Authority:** Who published or wrote this information? Are they qualified?
- **Accuracy:** Is the information or data supported by valid, reproducible, repeatable and accurate research?
- **Purpose:** Why does this information exist? Does the author have any intentions or bias?

If a source does not pass the CRAAP test (for example, if it is out of date, or written by a biased source), do not use it to support your research investigation.



**FIGURE 6** Do cats or dogs make better companions? Is your answer based on evidence, anecdote or opinion?

### Quality of evidence

As you review your sources you should make notes on the quality of your evidence. This includes considering how valid the research is and noting whether uncertainty, error or outliers exist within the research. Recall from your Psychology toolkit that research is internally valid if it investigates what it sets out to or claims to investigate. Research is externally valid if the results of the research can be applied to similar individuals in different settings.

#### TO-DO LIST

- Select a topic and write a research question.
- Identify the key terms and guiding words in your question.
- Generate a list of expanding questions to guide your research.
- Prepare a research outline to help organise and draw links between ideas.
- Gather information from different sources.
- Check the nature and the quality of your information and evidence.

## 6.2

# Analysis and evaluation of psychological research

## KEY IDEAS

- ✦ You should analyse and evaluate your secondary sources to ensure that information you refer to is credible and valid.
- ✦ Organising your information and ideas in a consistent way can help you find and refer to key points of information you need to link together to form your response.



### Research tip

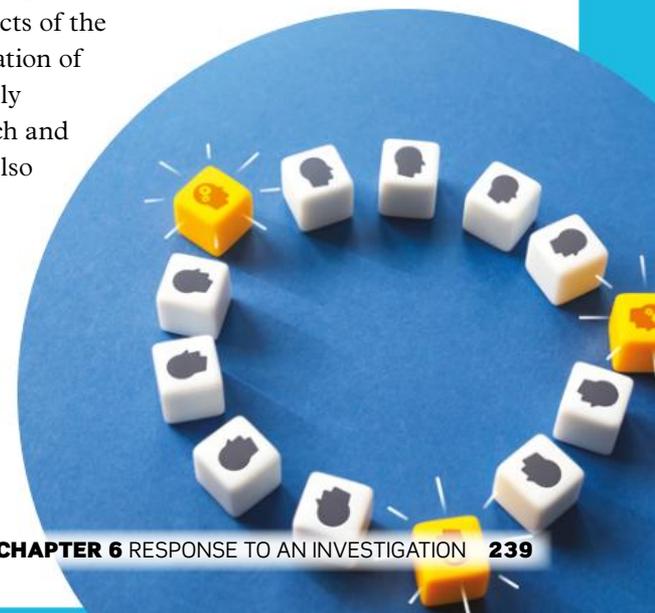
Primary sources are original sources of data and evidence. Secondary sources are analysis or interpretations of primary sources. You need to critically evaluate secondary sources.

## Step 5: Analyse and evaluate your secondary sources

Now that you have collected a range of psychological research and information about your topic, it is time to analyse and evaluate the information from your sources. To help you analyse and evaluate this information, answer the following questions:

- “Where did this idea come from?” – Consider whether you are working with new information or if it has been built upon over many years or through many sources.
- “Can the idea be tested empirically?” or “How has the idea been tested?” – Consider the methodologies used and why they were selected.
- “What are the relevant psychological ideas?” – Consider what psychological concepts are related to this idea and how you can best use them to answer your research question.
- “What is the scientific evidence to support the research question?” and “Does the evidence address the research question?” – Determine what evidence exists within this source that can be used to help answer your research question.
- “Is the claim well justified?” – Check whether other valid sources have made similar findings and/or check that the evidence behind the claim is limited in uncertainty and free from errors.
- “Is the evidence subject to critique?” – Determine whether other valid sources have contradicted or critiqued the evidence, and if so, why. Does this change how you might use this information to answer your research question?
- “What uncertainties still exist?” – Determine whether the measurement of results lacks exact knowledge of the value of the quantity being measured.
- “Have cultural biases affected the research design, data collection and interpretation?” – Consider whether aspects of the research design, data collection and interpretation of ideas limit the research results so that they only apply to Western, educated, industrialised, rich and democratic (WEIRD) societies. You should also consider what sociocultural, economic, legal, political and/or ethical factors influence the information presented in your sources. See Topic 1.9 for guidance on how to do this.

**FIGURE 1** Make sure that you critically analyse and evaluate the information from your sources. Is it relevant? Does it support your research question?



## Step 6: Organise your information

Now that you have analysed and evaluated your sources, you should organise the information you have obtained so you can use it to help answer your question. Organising your information can be done in many ways and you should adopt an approach that works for you. For example, you may choose to summarise the information you have collected in dot points and then order them in a way that you think helps answer your question. Alternatively, you could create a mind map with your research question at the centre and map out the main ideas you have collected around how they link to answering your question. There is no right or wrong way to organise your information. How you choose to bring together your ideas could be completely different to the way in which another person would.



**FIGURE 2** There are many ways to organise your information – make sure you find a way that suits you.

### Research tip

Do not be swayed by bias. Many websites you find may have an agenda, a vested interest (where having a particular opinion benefits them) or may be funded by a particular organisation.

When organising your information, make sure to look for links between multiple sources. This can help you to build a stronger line of reasoning in the way you choose to answer your research question. It also helps you to critically examine the information and data from your sources.

### TO-DO LIST

- Analyse and evaluate the information from your different sources.
- Keep track of the details of the sources you have used.
- Decide on a way to organise your information.
- Look for links between the psychological principles in your sources.

## 6.3

# Scientific communication

## KEY IDEAS

- ✦ Selecting the correct features, language and style to communicate your ideas can improve the clarity and accessibility of the information you are presenting.
- ✦ Sources of information or data used to form your response should be cited using an appropriate referencing style.



## Step 7: Present your information

In Step 6 you organised your information so that it can be used to answer your research question. Now that you have everything you need, you can begin to construct a more coherent answer to your research question and present this in a format that can be easily understood and assessed.

### Choosing a presentation style

Your teacher may have selected a specific type of presentation style for you to present your response. If they have not specified a format, some presentation options you could consider are:

- a written report
- a poster
- a slide show
- a video
- an oral presentation or podcast
- an animation.

If your presentation is a written report, poster or slide show, make sure to include appropriate subheadings (for example, introduction, discussion or conclusion). This makes it easier for your teacher and others to understand the flow of ideas. If your presentation type contains visual elements (such as an animation, poster, slide show or video) make sure you carefully consider colours, font and sizing of visual elements. Some colours and fonts may be hard to read or clash, and this can disrupt the flow of ideas you are presenting. For presentations that contain audio elements, make sure that the sound is clear in recordings or, if you are presenting live, make sure you practise and use a clear voice (Figure 1).

**FIGURE 1** If your teacher has not specified a format for your response, there are many different options to choose from beyond written reports and posters, such as recording a podcast.



## Putting together your presentation

When you put together your presentation, make sure you:

- include **relevant** information only
  - define all key psychology terms relevant to the research question
  - explain any relevant psychological concepts
  - use the correct terminology, conventions and representations
- provide **accurate** information
- are **clear** and **concise**
  - use subheadings and dot points where appropriate
  - use diagrams, data representations, models and theories where appropriate to help explain concepts
- explain the **importance** and **significance** of your ideas
  - link to validity
  - highlight any limitations
  - conclude with a final answer to your research question
- use **correct language**
  - remember who your audience is (for example, age, level of understanding) and set the tone for them
  - use formal language and avoid the first person
- are **prepared**
  - if you are presenting an oral report or video, practise your presentation without reading from a screen or notes
  - submit your work on time
- **answer the research question**
  - if your response does not provide a clear answer to the research question you have set out to investigate you need to go back and refine it!

### Research tip

You can include diagrams to help you explain concepts or express ideas.

### plagiarism

the act of taking and passing off someone else's work or ideas as your own

### in-text reference

an acknowledgment of the source immediately after the research or information is referred to

## Step 8: Reference your sources

As you use your sources to answer your research question, you need to make sure you include references to any source used. Correct acknowledgment of where you have sourced or collected data or information from is very important. When acknowledgment is not given, it can appear as if you are trying to pass off other people's hard work and ideas as your own. This is called **plagiarism** and is very serious. Plagiarising someone's work or research at university can get you kicked out of your course!

There are many different referencing styles. If your teacher has assigned a particular style of referencing for this task, make sure to use that style throughout. If they have not, two common styles you could choose from are:

- Harvard-style referencing
- APA (American Psychological Association) referencing.

Whichever referencing style you select, make sure that you stick to it and only use that one style, do not mix and match different referencing styles.

**In-text references** are used each time you write about, refer to or quote the work of other people in the body text of your response. These references are placed after you have referred to the research or information (for example, using quotes or paraphrasing).

A final reference list or **bibliography** should be included at the end of your report or submitted along with your presentation. This is the full list of all resources you have used to conduct your research and form ideas, presented in alphabetical order. Tables 1 and 2 show examples of how to cite references in-text and in a bibliography.

**bibliography**  
a full list of all the resources used in some research, provided at the end of a report or submitted along with another form of presentation

**TABLE 1** Formats and examples of in-text and bibliography referencing for different types of sources using Harvard-style referencing

Source type	In-text reference	Reference list
Book	(Author(s) last name, year of publication) Example: “Social work interventions with ethnic Arab peoples in Western nations should be informed by culturally specific considerations (Al-Krenawi & Graham 2000).”	Author(s) last name, initial(s) Year of publication, <i>Title</i> , edition other than first, Publisher, Place of publication. Example: Jessulat, P, Hong, L, Allen, J, Blaher-Lucas, E, Rock, M, Morey, K & Edwards, R 2024, <i>Psychology for VCE Units 1 &amp; 2</i> , Oxford University Press, Docklands.
Scientific article		Author(s) last name, initial(s) Year, ‘Article title’, <i>Journal Title</i> , vol. (volume number), no. (issue number if any), p/pp. (page number/range). Example: Al-Krenawi, A & Graham, JR 2000, ‘Culturally sensitive social work practice with Arab clients in mental health settings’, <i>Health &amp; Social Work</i> , vol. 25, no. 1, pp. 9–22.
Website	(Author or organisation, year of publication) Example: “Cultural factors can influence the way a person communicates, makes decisions and manages their health (Agency for Clinical Innovation, 2022).”	Author (if available) Year (the date the site was last updated), <i>Title of article on webpage/ Title of Webpage</i> , Name of Organisation or Website, viewed day month year, doi (URL) Example: Agency for Clinical Innovation 2022, <i>Culturally responsive practice</i> , Agency for Clinical Innovation, viewed 12 October 2023, doi: <a href="https://aci.health.nsw.gov.au/projects/consumer-enablement/how-to-support-enablement/culturally-responsive-practice">https://aci.health.nsw.gov.au/projects/consumer-enablement/how-to-support-enablement/culturally-responsive-practice</a>
Video		Author Surname, Initial Year, <i>Online video title</i> , format (online video), Day Month (video was posted), name of organisation or website, viewed day month year. Example: Dere, J 2015, <i>Challenges and rewards of a culturally-informed approach to mental health   Jessica Dere   TEDxUTSC</i> , online video, viewed 12 October 2023, <a href="https://www.youtube.com/watch?v=VrYmQDiunSc">https://www.youtube.com/watch?v=VrYmQDiunSc</a>

**TABLE 2** Formats and examples of in-text and bibliography referencing for different types of sources using APA-style referencing

Source type	In-text reference	Reference list
Book	(Author(s) last name, year of publication) Example: “Social work interventions with ethnic Arab peoples in Western nations should be informed by culturally specific considerations (Al-Krenawi & Graham, 2000).”	Author(s) last name, initial. (year of publication). <i>Title of book</i> (edition). Publisher. Example: Jessulat, P., Hong, L., Allen, J., Blaher-Lucas, E., Rock, M., Morey, K., & Edwards, R. (2024). <i>Psychology for VCE Units 1 &amp; 2</i> (1st ed.). Oxford University Press.
Scientific article		Author(s) last name, initial. (year of publication). Title of article. <i>Journal Title</i> , <i>volume number</i> (issue number), page–page. doi:xxxx Example: Al-Krenawi, A., & Graham, J. R. (2000). Culturally sensitive social work practice with Arab clients in mental health settings. <i>Health &amp; Social Work</i> , 25(1), 9–22. <a href="https://doi.org/10.1093/hsw/25.1.9">https://doi.org/10.1093/hsw/25.1.9</a>
Website	(Author or organisation, year of publication) Example: ‘A person’s culture can influence how much family and community support they have access to (Agency for Clinical Innovation, 2022).’	Author(s) last name, initial. (year of publication). <i>Title of work</i> . URL Example: Agency for Clinical Innovation. (2022) <i>Culturally responsive practice</i> . <a href="https://aci.health.nsw.gov.au/projects/consumer-enablement/how-to-support-enablement/culturally-responsive-practice">https://aci.health.nsw.gov.au/projects/consumer-enablement/how-to-support-enablement/culturally-responsive-practice</a>
Video	(Author(s) last name or screen name, year of publication, timestamp) Example: ‘Treatments that integrate a person’s own cultural beliefs about the causes of their distress are more effective than treatments that do not (Dere, 2015, 16:36).’	Author(s) last name or screen name. (year, date of posting). <i>Title of video</i> [Format]. Retrieved from ‘website address’ Example: Dere, J. (2015, 21 April). <i>Challenges and Rewards of a culturally-informed approach to mental health</i>   Jessica Dere   TEDxUTSC [Video file]. Retrieved from <a href="https://www.youtube.com/watch?v=VrYmQDiunSc">https://www.youtube.com/watch?v=VrYmQDiunSc</a>

**TO-DO LIST**

- Select a style for presenting your information – confirm this with your teacher.
- Summarise your findings, making sure that you are:
  - starting with an introduction and ending with a conclusion
  - answering your research question
  - drawing links to validity.
- Proofread your work.
- Include in-text references where required.
- Format your reference list.

## Chapter summary

- 6.1**
- As part of Unit 1 Area of Study 3, you will provide a response to a research question related to contemporary psychology.
  - There are many different areas of psychological research you could investigate but it must be contemporary (related to a stimulus found within the last 12 months) and relate back to concepts covered in either Unit 1 Area of Study 1 or Area of Study 2.
  - To answer your research question, you can break down the question into smaller parts and generate expanding questions to guide your research.
  - Using a research outline can help you keep on track with your research and organise your ideas.
  - Not all sources of information are credible. You can use the CRAAP method to evaluate the credibility of sources.
- 6.2**
- There is a range of criteria and questions you can ask to help you analyse and evaluate any relevant psychological research.
- 6.3**
- You can communicate your research findings in different ways. You should include information that is relevant, accurate, significant and important. You should also be clear and concise and use the correct language to answer your research question.
  - Any sources used to form your response should be included in your reference list.

## Research response checklist

Use the following checklist to make sure you have completed the research investigation.

“I have ...”

- selected a contemporary area of psychological research
- written and understood the research question
- selected my main sources of information
- analysed and evaluated all my sources and information
- defined and explained any psychological terms and concepts
- referred to relevant scientific or psychological theories and concepts
- linked and organised ideas together to answer the research question
- clearly communicated information
- used my own words
- included a reference list (and in-text referencing if applicable)
- proofread my work.

## AREA OF STUDY 3

### UNIT

# 1

# Sample response

1 Your research question should include sufficient detail. The question “Are machine learning and AI model diagnoses accurate?” would be too vague as it does not specify the type of diagnoses.

2 In your introduction, provide background context to help set the scene for exploring your question.

3 You can use your textbook as a suitable reference. Your textbook needs to be correctly referenced.

4 In-text referencing is not only a necessary component of psychological research, but also a suitable way to provide evidence to support your arguments or introduction.

5 Clearly identify the contemporary stimulus or issue that has inspired the research question.

6 Each piece of research discussed includes a brief summary of the aim and hypothesis, methodology (research method used), participants, materials, procedure and results.

## 1 Can machine learning and artificial intelligence models accurately predict the diagnosis of mental disorders?

### 2 **Introduction**

Mental disorders describe a range of conditions that affect a person’s emotions, cognitions and behaviours (Jessulat et al., 2024). Diagnosing mental disorders is an important role of both psychologists and psychiatrists, who use the criteria outlined in the DSM-5-TR to inform their diagnoses based on information disclosed to them by patients (Jessulat et al., 2024). Diagnosis of mental disorders can be challenging as patients might not always provide accurate information about themselves or may be affected by more than one type of disorder (Liu et al., 2022). Accurate and early detection of mental disorders gives mental health professionals and patients the best chance of managing and improving symptoms (Essex et al., 2009). Alternatively, misdiagnosis of mental disorders can hinder or delay successful outcomes for patients (Merten et al., 2017).

Recent studies have tested whether machine learning or artificial intelligence (AI) based systems can use data to accurately predict whether a patient will be diagnosed with a mental disorder. These modelling systems conduct analytics on a combination of genetic, medical registry, patient questionnaire and neuroimaging data to make predictions about diagnoses (Liu et al., 2022; Allesøe et al., 2023). Since AI-predicted diagnoses stem from a computer system and are made without in-person patient interaction, they may be limited in their ability to gain access to data about social and environmental factors that could influence or be relevant to the diagnosis of specific disorders. This raises the question of whether machine learning and AI data systems can accurately predict whether an individual will be diagnosed with a mental disorder. It is hypothesised that machine learning and AI data systems will not be able to accurately predict the diagnosis of mental disorders.

### **Scientific evidence/data**

Liu et al. conducted a modelling analysis on the genomic data of 4179 participants, 1384 of whom had been diagnosed with at least one of eight mental disorders.

The aim of the investigation was to determine whether their model could differentiate between participants afflicted with a mental disorder from those unafflicted, and whether their model could predict the diagnosis of participants. Participants were aged between 0 and 21 years. Consent to use data was granted from patients over 18 years of age and parental consent granted for participants under 18. Participants’ genomic data was analysed by the researchers’ deep learning algorithm model to make diagnosis predictions. The first round of modelling accurately predicted 65 per cent of participant diagnoses. The second round of modelling accurately predicted 70 per cent of participant diagnoses in participants who had more than one mental disorder.

Allesøe et al. conducted a longitudinal study using a modelling analysis on data from 63,535 participants belonging to the Danish Health registry. Allesøe et al. aimed

to investigate whether genetic data, combined with the data from the Danish health registry, could be used to predict the diagnosis and severity of mental disorders. The study was conducted from 1981 to 2016 and used a Danish population sample that consisted of individuals born between 1981 and 2005. This sample included individuals diagnosed with mental disorders such as ADHD, ASD, depression, bipolar disorder and schizophrenia. Participants' genetic and registry data was analysed using the researchers' AI deep learning model. Results found that the analysis could predict the diagnosis and severity of mental disorders with up to 81 per cent accuracy.

## Discussion

Liu et al. found that their machine learning modelling system was able to predict diagnoses of mental disorders with up to 65 per cent accuracy. 7 Therefore, results of this study refute the hypothesis that machine learning and AI data systems will not be able to accurately predict the diagnosis of mental disorders. Liu et al.'s study did, however, have 8 limitations in the experimental design. The sample had a limited number of participants that were afflicted with more than one mental disorder. This means the modelling algorithm may not have had enough data available to refine how it diagnoses participants with more than one condition, reducing the accuracy of results. Additionally, since different mental disorders may share genetic risks, genomic information alone may not always be enough to provide an accurate diagnosis.

Allesøe et al. (2023) found that their AI system could predict the diagnosis and severity of mental disorders with up to 81 per cent accuracy. Therefore, results of this study also refute the hypothesis that machine learning and AI data systems will not be able to accurately predict the diagnosis of mental disorders. 9 The research in question did, however, have limitations in its design. Despite having a large sample size, the sample only included Danish citizens. Therefore, results may only be internally valid to the Danish population rather than other cultures where the type of data collected in national health registries can vary. The same investigation would need to be conducted in other countries or using more representative samples before results could be considered externally valid. Both Liu et al. and Allesøe et al. adhered to the ethical principle of non-maleficence by ensuring participants were all deidentified. The 10 implications of accurately predicting mental health disorders using AI or machine learning could improve consistency and accuracy of mental disorder diagnosis globally, which would subsequently improve health outcomes for individuals afflicted with mental disorders.

## Conclusion

The two studies suggest that machine learning and 11 AI data systems can accurately predict the diagnosis of mental disorders to an extent. Both studies also suggest that AI or machine learning programs for diagnosis should be used to support rather than replace traditional clinical diagnosis from mental health professionals.

## References

- 12 Allesøe, R. L., Thompson, W. K., Bybjerg-Grauholm, J., Hougaard, D. M., Nordentoft, M., Werge, T., Rasmussen, S., & Benros, M. E. (2023). Deep learning for cross-diagnostic prediction of mental disorder diagnosis and prognosis using Danish nationwide register and genetic data. *JAMA psychiatry*, 80(2), 146–155. doi: 10.1001/jamapsychiatry.2022.4076
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- Liu, Y., Qu, H-Q., Mentch, F.D., Qu, J., Chang, X., Nguyen, X., Tain, L., Glessner, J., Sleiman, P.M.A., & Hakonarson, H. (2022). Application of deep learning algorithm on whole genome sequencing data uncovers structural variants associated with multiple mental disorders in African American patients. *Molecular psychiatry*, 27(3), 1469–1478. doi: 10.1038/s41380-021-01418-1
- Merten, E. C., Cwik, J. C., Margraf, J., & Schneider, S. (2017). Overdiagnosis of mental disorders in children and adolescents (in developed countries). *Child and adolescent psychiatry and mental health*, 11, 1–11. doi: 10.1186/s13034-016-0140-5

7 Explains whether the results of each piece of research supported the hypothesis stated.

8 Includes discussion of limitations.

9 Evaluates the evidence including discussion of potential limitations and/or biases, samples used, repeatability, reproducibility and validity.

10 Implications of findings are discussed.

11 Addresses original research question.

12 All in-text references must be included in your reference list. Make sure you use your chosen referencing style consistently.

13 Ordering your references alphabetically is a helpful way to avoid leaving out an in-text reference.

UNIT

1

# Review

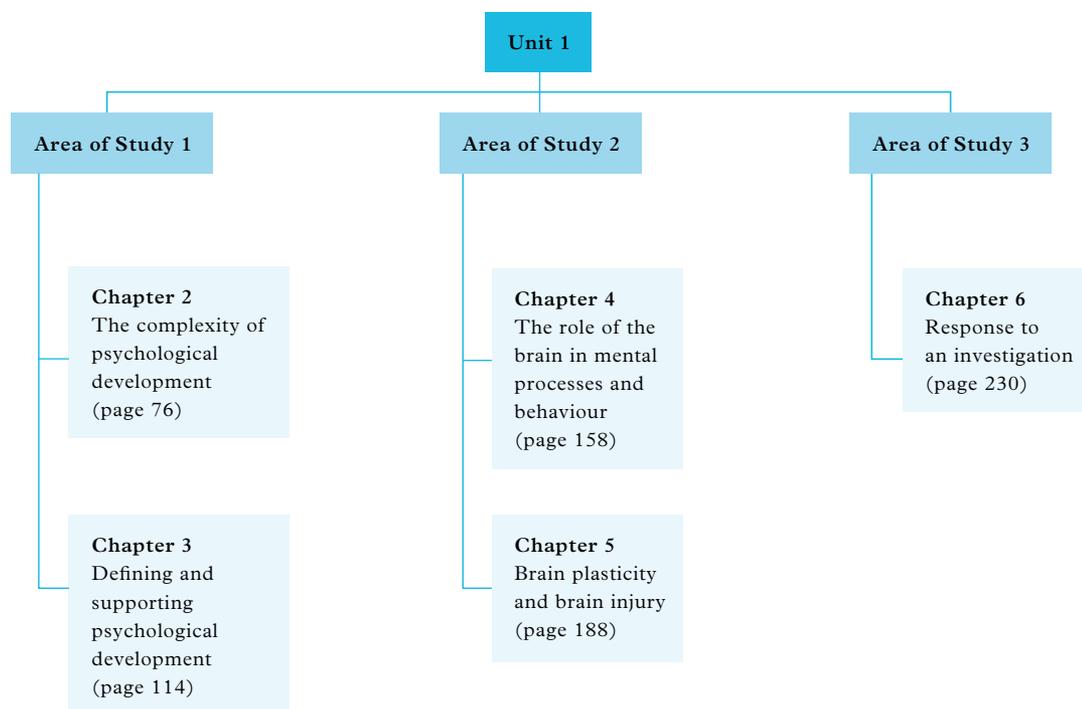
This unit review is designed to help you revise your understanding of key concepts for all the content covered in Unit 1, learn some expert tips for answering exam questions, and practise your skills on a range of exam-style questions.

## Part A - Revisit and revise

Part A of the Unit Review will help you revisit and revise all the key concepts from Unit 1 and test your understanding so that you can identify strengths and weaknesses in your understanding.

### Unit 1 Overview

The chart below shows all the areas of study for Unit 1 and the relevant chapters in your Student Book. Go to the pages shown to review the key concepts for each chapter.



## Test your understanding

Use the following table to guide your revision:

Step 1 – Read the key knowledge for this unit.

Step 2 – Test your understanding of the key knowledge by answering the question(s).

Step 3 – Rate your understanding of each key knowledge point from low to high.

Step 4 – Use the topic and page numbers to revise the concepts you have identified that you need to practise.

**TABLE 1** Test your understanding of Unit 1

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>the interactive influences of hereditary and environmental factors on a person's psychological development</li> </ul>	1 Compare the influence of hereditary factors and environmental factors on a person's psychological development.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 2.1 Pages 78–82
<ul style="list-style-type: none"> <li>the biopsychosocial approach as a model for considering psychological development and mental wellbeing</li> </ul>	2 Use an example to explain how applying the biopsychosocial approach to understanding mental wellbeing can be more beneficial than looking at individual factors influencing mental health.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 2.2 Pages 83–87
<ul style="list-style-type: none"> <li>the process of psychological development (emotional, cognitive and social development) over the course of the lifespan</li> </ul>	3 Compare the four stages of Piaget's theory of cognitive development and list two key cognitive abilities that develop at each.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 2.4 Pages 94–100
<ul style="list-style-type: none"> <li>the role of sensitive and critical periods in a person's psychological development</li> </ul>	4 Distinguish between sensitive and critical periods for psychological development.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 2.6 Pages 107–109
<ul style="list-style-type: none"> <li>the usefulness, and limitations, of psychological criteria to categorise behaviour as typical or atypical, including cultural perspectives, social norms, statistical rarity, personal distress and maladaptive behaviour</li> </ul>	5 Using examples, explain the difference between atypical and typical behaviours.	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.1 Pages 116–121
<ul style="list-style-type: none"> <li>the concepts of normality and neurotypicality, including consideration of emotions, behaviours and cognitions that may be viewed as adaptive or maladaptive for an individual</li> </ul>	6 <ol style="list-style-type: none"> <li>Describe the significance of having defined criteria for normality in developmental psychology.</li> <li>Explain one limitation of this approach.</li> </ol>	<input type="checkbox"/> <b>High</b> – I've got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.2 Pages 122–126

(continued)

TABLE 1 continued

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>normal variations of brain development within society, as illustrated by neurodiversity</li> </ul>	7 Describe the role of individual education plans in supporting the psychological development of neurodivergent people.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.3 Pages 127–132
<ul style="list-style-type: none"> <li>the role of mental health workers, psychologists, psychiatrists and organisations in supporting psychological development and mental wellbeing as well as the diagnosis and management of atypical behaviour, including culturally responsive practices</li> </ul>	8 Compare the roles of a psychologist and psychiatrist in supporting psychological development and mental wellbeing.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 3.4 Pages 133–137
<ul style="list-style-type: none"> <li>different approaches over time in understanding the role of the brain in behaviour and mental processes</li> </ul>	9 Explain how the mind-body problem describes the relationship between the mind and body.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 4.1 Pages 160–163
<ul style="list-style-type: none"> <li>the roles of the hindbrain, midbrain and forebrain, including the cerebral cortex, in behaviour and mental processes</li> </ul>	10 Describe the roles of the three main regions of the brain, using a structure from each region to support your response.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topics 4.3 and 4.4 Pages 170–175 and 176–183
<ul style="list-style-type: none"> <li>the capacity of the brain to change in response to experience and brain trauma, including factors influencing neuroplasticity and ways to maintain and/or maximise brain functioning</li> </ul>	11 Select one factor that can affect neuroplasticity and, using an example, explain how it does this.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 5.1 Pages 190–197
<ul style="list-style-type: none"> <li>the impact of an acquired brain injury (ABI) on a person’s biological, psychological and social functioning</li> </ul>	12 Using an example, describe the biological, psychological and social impacts of brain injury.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topics 5.2, 5.3 and 5.4 Pages 198–201, 202–205 and 206–207
<ul style="list-style-type: none"> <li>the contribution of contemporary research to the understanding of neurological disorders</li> </ul>	13 Describe what the study of neuroscience looks at and explain how it could assist someone with a neurological disorder.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 5.5 Pages 208–212
<ul style="list-style-type: none"> <li>chronic traumatic encephalopathy (CTE) as an example of emerging research into progressive and fatal brain disease</li> </ul>	14 Describe the cause and methods for diagnosis of CTE.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 5.6 Pages 213–217

## Part B – Exam essentials

Now you have completed Part A, it is time to learn and practise some of the skills you will 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 any end-of-unit examinations.

### Exam tip 1 – Refer to structures and regions of the brain

- When you are provided with a scenario in which a person’s function has been affected, such as their vision, you must indicate the area of the brain that is damaged.
- You are expected to specify that “their occipital lobe would be damaged”, rather than just saying “their brain would be damaged”. This demonstrates that you are able to link symptoms with the function of a particular structure in the brain.

## See it in action

Read the exam question below and see how the tip has made a difference in the high-scoring and low-scoring responses.

### QUESTION 1

(3 marks)

Discuss the brain injury that Phineas Gage sustained.

#### Response 1 (high-scoring)



1 mark awarded for one piece of correct information, describing the physical damage sustained by Phineas Gage.

Following the accident at the railway where Phineas Gage was impaled with a metal rod through his head, he sustained a severe brain injury.

This was shown by significant changes in his temper, emotions and empathy, and unsociable behaviour. We now know this was because of the damage sustained to his frontal lobe, because this lobe is responsible for many of the changes experienced by Gage.

1 mark awarded for correctly identifying the psychological effects of the brain injury.

1 mark awarded for specifying the region of the brain impacted.

#### Response 2 (low-scoring)



Marks not awarded due to missing information about how the brain was damaged.

Phineas Gage was in an accident that caused him injury.

This was shown because of changes in his emotions and behaviour towards other people.

1 mark awarded for correctly identifying the psychological effects of the brain injury, but no third mark is given because the relevant brain region or structure has not been indicated.

## Think like an examiner

To maximise your marks on the exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

### Mark the response

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guidance below to mark the response.

#### QUESTION 2

(2 marks)

Explain how the structure of Broca's area was discovered.

*Broca's area is an area of the brain that was discovered when a patient had difficulty speaking.*

### Marking guide

#### Question 1

1 mark – for reference to the frontal lobe

1 mark – for explanation of discovery following physician Paul Broca's autopsy of a patient who had difficulty speaking

### Fix the response

Consider where you did and/or did not award marks in the above response. How could the response be improved? Write your own response to the same question to receive full marks from an examiner.

## Exam tip 2 - Learn the meanings of command terms

- Command terms provide you with instructions about how to answer a question. There is a big difference, for example, in what is expected in your answer to an “identify” and a “discuss” question. **Identify** requires you to recognise, detect and name key elements from a provided scenario. **Discuss** requires you to give a clear and considered extended response that identifies the pros and cons related to the subject matter at hand.

## See it in action

Read the exam question below and see how the tip has made a difference in the high-scoring and low-scoring responses.

### QUESTION 1

(3 marks)

Discuss the use of neuroimaging techniques to diagnose brain-related disorders. Identify a suitable neuroimaging technique in your answer.

### Response 1 (high-scoring)



1 mark awarded for explaining the broader use of neuroimaging techniques.

Neuroimaging techniques have a variety of capabilities and uses and can obtain information about brain structure and function to assist with brain-related disorder diagnosis.

One example is a PET scan, which can be used to provide information about the function of different brain structures.

Various areas of the brain can be monitored during cognitive tasks, and information gained about how different areas of the brain interact when performing a task. This can be used to diagnose brain-related disorders by comparing results obtained with those obtained for a normal brain.

1 mark awarded for correctly identifying a neuroimaging technique that can be used for mental health disorder diagnosis.

1 mark awarded for describing the type of information provided by PET and how this can be used to diagnose brain-related disorders.

### Response 2 (low-scoring)



1 mark awarded for correctly identifying a neuroimaging technique that can be used for brain-related disorder diagnosis.

Neuroimaging techniques like a PET scan are useful for understanding brain-related disorders as they provide information about a brain structure.

A PET scan also provides information about how the brain functions.

Student has correctly identified the type of information provided by PET scans but has lost a mark because the link back to the diagnosis of a brain-related disorder is unclear.

## Think like an examiner

To maximise your marks on the exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

### Mark the response

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guidance below to mark the response.

#### QUESTION 2

(2 marks)

Evaluate the use of an MRI machine as a neuroimaging technique.

*An MRI machine gives lots of information about the brain but does not show function.*

### Marking scheme

#### Question 2

- |  |
|--|
| 1 mark – for clear advantage of using an MRI machine, such as detailed three-dimensional images of the brain                 |
| 1 mark – for clear disadvantage of using an MRI machine, such as not providing information about cognitive or motor function |

### 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 an examiner.

### Exam tip 3 - Discuss how treatments can be used

- Treatments are often linked with questions about neurodevelopmental disorders, other brain-related disorders and brain injury. It is important that you not only identify and describe what the treatment is, but also explain why it will be suitable to assist an individual or group.
- When discussing psychoeducation, you should outline that psychoeducation involves the explanation of information about a diagnosed disorder to affected individuals to increase knowledge and understanding of their disorder and its treatment. You must also include that it will assist the individual and their support network by correcting misconceptions they may hold about the disorder, which can help to reduce stigmatisation.

## See it in action

Read the exam question below and see how the tip has made a difference in the high-scoring and low-scoring responses.

#### QUESTION 1

(2 marks)

Describe a suitable treatment for ADHD.

### Response 1 (high-scoring)



1 mark awarded for correctly identifying the absence of a cure and outlining the approaches for treatment.

While ADHD does not have a cure, it is usually treated with a combination of medication and behavioural therapy. Medication can reduce or relieve some symptoms, and behavioural therapy can be used to teach patients how to manage their symptoms or behaviours.

1 mark awarded for explaining how each approach is suitable to assist patients.

### Response 2 (low-scoring)



1 mark awarded for identifying the absence of a cure and two treatment approaches. No second mark given as suitability of treatments not described adequately or at all.

ADHD has no cure, but you can use medication to help with symptoms or behavioural therapies.

## Think like an examiner

To maximise your marks on the exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

### Mark the response

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guidance below to mark the response.

#### QUESTION 2

(3 marks)

Discuss how a psychologist and psychiatrist could both effectively support a patient with ADHD.

A psychologist would provide a space and allow a patient of ADHD to talk about their problems, and a psychiatrist could instead provide them with medication.

### Marking guide

#### Question 3

- 1 mark – for describing the role of a psychologist in assisting a patient with ADHD with symptoms, thoughts and behaviours
- 1 mark – for describing the role of a psychiatrist in assisting a patient with ADHD with medication and/or psychotherapies
- 1 mark – for explanation of how both therapies would be effective to support a patient with ADHD

### Fix the response

Consider where you did and did not award marks in the above response. How could the response be improved? Write your own response to the same question to receive full marks from an examiner.

## Part C – Exam practice

Now it's time to put the tips and advice you have learnt into practice as you complete these exam-style questions!

### Multiple choice

#### Question 1

Piaget proposed that children can form a schema. Which of the following best describes this term?

- A A mental idea of what something is and how to act on it
- B The ability to focus on only one task at a time
- C Mental structures that enable us to understand past experiences
- D An adjusted pre-existing mental idea to deal with new information

Use the following information to answer questions 2 and 3.

Isabella, a neuroscientist, is conducting research on a small number of individuals who have sustained frontal lobe damage. The participants were interviewed by Isabella, and the findings of the interviews were published in a journal article.

#### Question 2

Which of the following is an advantage of the scientific investigation methodology employed by Isabella?

- A It provides in-depth qualitative data about events and experiences.
- B It provides in-depth quantitative data about events and experiences.
- C Cause-and-effect relationships can be identified between variables.
- D Observation of behaviours is more natural since variables have not been manipulated.

#### Question 3

When publishing the journal article, it is important that Isabella upholds the ethical guideline of confidentiality. This means that:

- A participants must not feel any pressure to have their interview results published.
- B participants have the right to remove their results after the interviews are completed.
- C participants must not be identified in any way.
- D participants and their legal guardian must understand the nature of the interview before they agree to take part.

#### Question 4

Greg has recently been fired from his job as a car mechanic. Since being fired, Greg's friends have noticed that he has struggled to eat well, exercise and sleep properly. His friends have also noticed that he no longer attends the university he was studying at part-time, and he has gone from an outgoing, sociable individual to being quiet and withdrawn. According to which approach to normality would Greg's behaviour be considered abnormal?

- A Situational approach
- B Socio cultural approach
- C Statistical approach
- D Functional approach

#### Question 5

Which of the following would be described as a psychological factor that influences your mental health?

- A Mood changes
- B Poor sleeping habits
- C Education you received
- D Bodily responses to stress

Use the following information to answer questions 6 to 11.

A researcher investigated the relationship between negative thought patterns on sleep duration in Victorian adolescents diagnosed with a mood disorder. Sixty-three adolescents who had been diagnosed with a mood disorder took part in the study. Each participant was required to wear an electronic wristband for a period of two weeks at night, which recorded the duration of their sleep.

#### Question 6

The 63 adolescents who took part in the study were selected via random sampling. This means:

- A adolescents were separated into distinct subgroups based on the type of mood disorder they had been diagnosed with.
- B adolescents were selected in the same proportions that they exist in the population.
- C the 63 adolescents who took part in the study were selected based on availability.
- D every Victorian adolescent who had been diagnosed with a mood disorder had an equal chance of being selected for the study.

**Question 7**

The average sleep duration for each participant was calculated at the end of the two-week period. This measure of central tendency is known as the:

- A mean.
- B median.
- C mode.
- D standard deviation.

**Question 8**

The type of data generated by the study is:

- A primary, quantitative.
- B primary, qualitative.
- C secondary, quantitative.
- D secondary, qualitative.

**Question 9**

At the conclusion of the study, the researcher noticed that one of the wristbands worn by a participant consistently miscalculated the duration of sleep. This type of error is known as:

- A random.
- B systematic.
- C personal.
- D uncertainty.

**Question 10**

Which of the following is a possible extraneous variable in the study?

- A The sample size
- B Only using adolescents in the study
- C Whether the participants experienced any sleep disorders
- D The use of the electronic wristbands

**Question 11**

Prior to commencing the study, the researchers were required to demonstrate to an ethics committee that the benefits of the study would outweigh any potential risk and undue distress to the participants. Which ethical concept were the researchers asked to demonstrate?

- A Justice
- B Integrity
- C Non-maleficence
- D Respect

**Question 12**

The manual published to assist with the diagnosis and classification of various mental disorders is known as:

- A the *Diagnostic and Statistical Manual of Mental Disorders*.
- B the *Disorders and Statistics Manual of Mental Disorders*.
- C the *International Classification of Mental Disorders*.
- D the *International Classification of Disorders*.

**Question 13**

Which of the following best describes a surgical lobotomy?

- A Parts of the brain tissue are temporarily and reversibly disabled.
- B Stimulating parts of the brain using an electrode causes irreversible damage.
- C Stimulating parts of the brain using an electrode causes no permanent damage.
- D Severing brain tissue.

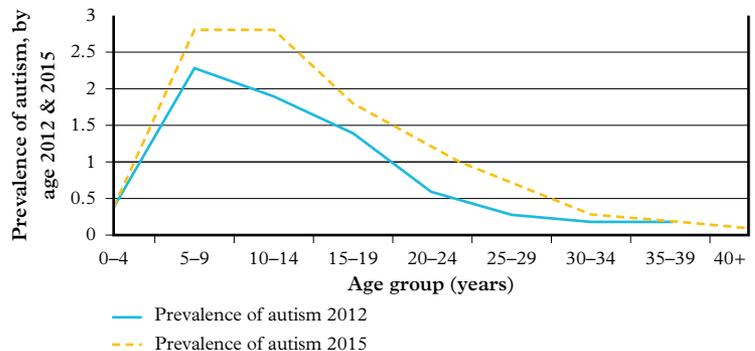
**Question 14**

Ayaan is a very committed student and has been studying a lot for her end-of-year examination. Which brain structure is most likely active when Ayaan is learning this information?

- A Cerebrum
- B Reticular formation
- C Cerebellum
- D Broca's area

Use the following information to answer questions 15 and 16.

Autism spectrum disorder (ASD) is a neurodevelopmental disorder that typically appears within the first few years of a child's life and generally persists into adolescence and adulthood. Consider the graph in Figure 1.



**FIGURE 1** Prevalence of autism by age group in 2012 compared to 2015  
Source: Australian Bureau of Statistics

**Question 15**

In 2012, in which age group was autism most prevalent?

- A 5–9
- B 10–14
- C 15–19
- D 20–24

**Question 16**

Which age group showed the greatest increase in autism prevalence between the years 2012 and 2015?

- A 5–9
- B 10–14
- C 15–19
- D 25–29

**Question 17**

Antonio is ice skating when he slips and hits the back of his head very hard. Antonio remains unconscious, and the paramedics that attend to him supply him with oxygen as they are concerned about damage to his:

- A cerebellum, located in the hindbrain.
- B pons, located in the midbrain.
- C medulla, located in the hindbrain.
- D hypothalamus, located in the hindbrain.

**Question 18**

The primary motor cortex is organised such that:

- A the uppermost parts of the body are controlled by the uppermost parts of the cortex.
- B the lowermost parts of the body are controlled by the regions in the upper and lower parts of the cortex.
- C a larger amount of cortex is devoted to body parts that execute finer motor functions.
- D a large amount of cortex is devoted to body parts in the uppermost part of the body compared to the lowermost part of the body.

**Question 19**

Which brain region in the cerebral cortex is the last to fully develop?

- A Frontal
- B Parietal
- C Occipital
- D Temporal

**Question 20**

Parkinson’s disease can be detected by seeing evidence of:

- A neurodegeneration within the basal ganglia
- B the abnormal build-up of proteins around brain cells.
- C brain abnormalities at birth.
- D neurodegeneration within the parietal lobe.

**Short answer**

**Question 1 (7 marks)**

Monica is a split-brain patient who is involved in a study on hemispheric specialisation. She is placed behind a screen similar to those used in Sperry’s original research. An image of a kaleidoscope is flashed in the centre of the screen. An experimenter then asks Monica to name what she saw and to select it from a variety of objects behind the screen.

- a Predict Monica’s response and provide a justification for your decision. (3 marks)
- b Identify the parts of Monica’s brain labelled A and B in Figure 2 and outline the function of each of these areas. (4 marks)

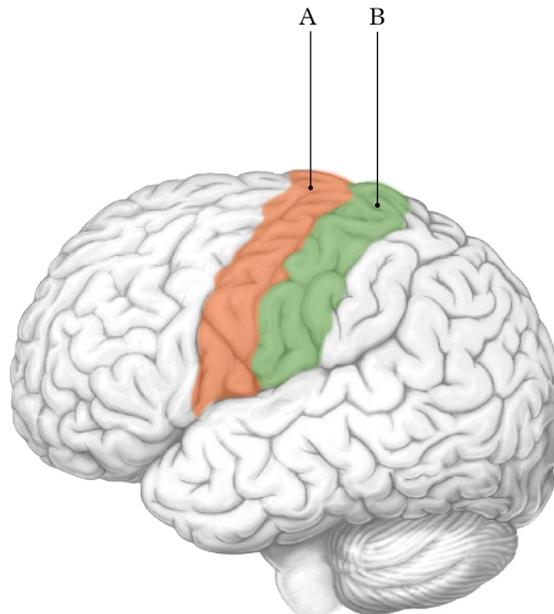
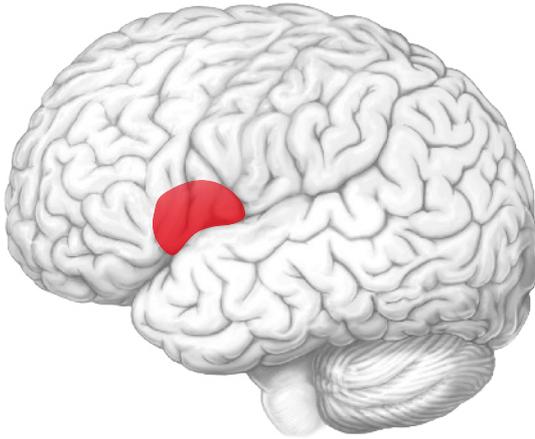


FIGURE 2 Monica’s brain

A: \_\_\_\_\_  
B: \_\_\_\_\_

**Question 2** (10 marks)

Ridha suffered a stroke when he was playing his saxophone during a performance with his school orchestra. The area that was injured is indicated in orange in Figure 3.

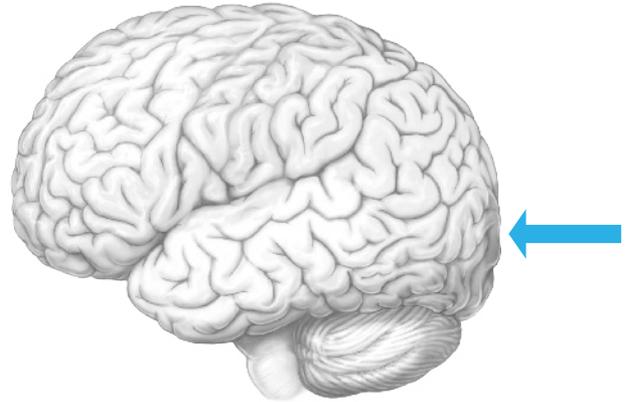


**FIGURE 3** The site of Ridha's injury

- Identify the part of the brain that was injured and state which lobe is involved. (2 marks)
- Identify one difficulty that Ridha is likely to experience as a result of injuring this part of his brain. (1 mark)
- A positron emission tomography (PET) scan was used to image Ridha's brain. Identify one advantage and one disadvantage of using this neuroimaging technique. (2 marks)
- Predict whether Ridha will have trouble playing the saxophone in the future. Justify your prediction. (2 marks)
- Ridha's physician believes that the symptoms of his brain injury will reduce over time due to the structural plasticity of the brain. Define the term "structural plasticity" and outline two changes that occur at the neuronal level that demonstrate structural plasticity. (3 marks)

**Question 3** (12 marks)

Cecelia was playing cricket when the ball struck her violently in the back of the head. Since her injury, Cecelia has had to wear glasses and suffers from headaches. However, given that Cecelia is only 10 years old, the doctors are hopeful that the headaches will go away in time. The area in which the ball struck her head and caused damage is indicated by the arrow in Figure 4.



**FIGURE 4** The site where Cecelia was struck by a cricket ball

- Identify the lobe of the brain that is most likely to have been affected by Cecelia's injury. Justify your response. (2 marks)
- Cecelia's doctor believes the headaches and need to wear glasses will reduce over time. Identify which type of plasticity Cecelia's doctor is hoping will occur and outline two neurological changes that may occur as a part of this process. (3 marks)
- Explain whether Cecelia's doctor would show the same level of confidence about the injury and symptoms reducing over time if this injury happened to Cecelia's parents. (2 marks)
- Identify what form of brain injury has occurred to Cecelia. Justify your response. (2 marks)
- Describe the role a neuroscientist may have in supporting Cecelia's recovery. Include any scientific tools or equipment a neuroscientist may use. (3 marks)

**Question 4** (10 marks)

Harlow’s 1958 study of attachment in monkeys contributed significantly to our current understanding of the value of attachment. It showed that contact comfort was more important for forming attachment than food or nourishment. Harlow, along with other researchers, published an additional study in 1969, to determine whether infant rhesus monkeys had a preference among different types of surrogate surfaces. The surfaces used were selected based on varying textural qualities: cotton athletic socks (soft and textured), rayon (soft and smooth), vinyl cloth (hard and smooth) and rough-grade sandpaper (hard and rough). The mean contact time within a 30-minute period for each of the surrogate surfaces is presented in Table 1.

**TABLE 1** Mean contact time for each surrogate surface

Surface	Mean contact time (minutes)
Sock	14.27
Rayon	5.93
Vinyl	4.84
Sandpaper	1.67

Source: Adapted from Furchner and Harlow (1969)

- a Identify the independent and dependent variables in Harlow’s 1958 study. (2 marks)
- b Give two reasons why, according to psychologists, human infants form an attachment to their caregivers. (2 marks)
- c Present the data from Table 1 in an appropriate graph form. Ensure that relevant graphing conventions are adhered to. (4 marks)
- d Explain what the results of the 1969 research reveals about preference for surrogate surfaces among infant rhesus monkeys. (2 marks)

**Question 5** (7 marks)

Read through questions a to d, then select the disorder about which you wish to answer the questions.

*(Please note that your answers to all of the questions below must relate to the selected disorder.)*

**Autism spectrum disorder**                      **Attention deficit hyperactivity disorder**

- a Provide a definition for your selected disorder. (1 mark)
- b Outline why your selected disorder is an example of neurodivergence. (1 mark)

- c Provide one biological, psychological and social symptom that could be used to justify a diagnosis. (3 marks)
- d Outline a possible treatment option for your selected disorder. (2 marks)

**Question 6** (12 marks)

An experiment was conducted to investigate Piaget’s theory of cognitive development in children. The focus of the research was on conservation of volume. Six children aged between 5 and 12 took part in the experiment. The participants were presented with two cups of equal size, containing an equal amount of liquid.

In the initial phase of the experiment, participants were asked whether the cups contained an equal amount of liquid. Once the participants answered “yes”, the researcher moved on to the next phase of the experiment. Liquid from one of the cups was poured into a tall, narrow glass. Liquid from the other cup was poured into a small, wide glass. Participants were again asked whether the two cups (tall/narrow and small/wide) contained the same amount of liquid. The participants’ responses, “yes” or “no” were recorded by the researchers. The raw data obtained from each participant is presented in Table 2.

**TABLE 2** Raw participant data displaying the ability to conserve

Participant age (Years)	Conservation achieved (Yes/No)
7	Yes
12	Yes
6	No
8	Yes
5	No
7	No

- a Identify the independent variable in the experiment. (1 mark)
- b Construct a hypothesis for the experiment conducted. (3 marks)
- c Explain whether the results obtained from the experiment support Piaget’s theory of cognitive development. (3 marks)
- d Explain how the raw data presented in Table 2 can be organised and presented to make it easier to interpret and evaluate. (2 marks)
- e Using data obtained from the experiment, describe one criticism of Piaget’s theory of cognitive development. (3 marks)

**Question 7** (12 marks)

Dr Ali wanted to investigate the effectiveness of a new drug named PDT (Parkinson’s Disease Treatment) in improving the symptoms of patients diagnosed with Parkinson’s disease.

PDT was clinically tested and found to be highly effective in treating symptoms of Parkinson’s disease in rats. Dr Ali’s team then moved on to testing the effectiveness of PDT on human subjects.

The research team contacted several clinics in Victoria requesting volunteers with Parkinson’s disease to take part in a 12-month trial. Ninety-six patients volunteered for the trial. Participants were pre-tested on the severity of a variety of motor and non-motor symptoms and given a score out of 100 assessed by a panel of independent experts on Parkinson’s disease. The higher the score, the greater the severity of symptoms. Participants were then instructed to take a daily dose of PDT for the course of 12 months.

Participants were not aware that for the first six months of the trial they were administered placebos (sugar-pills with no active ingredients). After the first six months had passed, participants were tested in an identical manner to the pre-test, by the same panel of experts.

For the remaining six months of the trial, participants received the active PDT drug. They were tested again at the end of the trial. The results of the three testing periods are shown in Table 3. At the end of the trial, all participants were financially compensated for being administered a placebo for the first six months of the trial.

**TABLE 3** Participant results from PDT testing

	Pretest	Test at the end of 6 months	Test at the end of the 12 months
Average severity of motor symptoms (score out of 100)	44.4	47.4	38.9
Average severity of non-motor symptoms (score out of 100)	21.2	22.6	18.3

- a Identify two ethical concepts that have been breached in this experiment. (2 marks)
- b Describe the type of brain damage that Parkinson’s disease causes. (2 marks)
- c Identify the experiment design used in this experiment. Justify your response and explain why this design was selected over others. (3 marks)
- d The original study was conducted on rats. Explain how an experimenter would go about enacting the do not harm principle in rat versus human studies. (2 marks)
- e Describe the advantage of using a placebo in this study. (1 mark)
- f Write a suitable conclusion for this experiment. (2 marks)

**Question 8** (10 marks)

There are many influential psychologists who have contributed to our understanding of childhood development. Jean Piaget was influential in developing a theory of cognitive development, while Mary Ainsworth explored the concept of attachment.

- a Describe the two closely related processes of assimilation and accommodation using examples. (2 marks)
- b Evaluate Ainsworth’s Strange Situation test. (4 marks)
- c Outline two similarities and two differences between the work of Piaget and Ainsworth. (4 marks)

UNIT

# 2

## How do internal and external factors influence behaviour and mental processes?

**FIGURE 1** In Unit 2 you will look at how colour influences our gustatory (taste) perception.

## Unit 2 Overview

In Unit 2 of VCE Psychology, you will evaluate how social cognition plays a role in shaping a person's attitudes, perception of themselves and their relationships with others. You will explore different factors and contexts that can influence the behaviour of individuals and groups and explore the diversity of different cultures and how culture can influence individuals. You will consider Aboriginal and Torres Strait Islander people's experiences within Australian society and how different experiences can affect psychological functioning. You will also either adapt or design a scientific investigation that will explore how internal and external factors influence behaviour and mental processes.

Source: Adapted from *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

## Unit 2 Areas of Study

The learning for this unit has been divided into three Areas of Study. The table below shows how each area of study aligns with the chapters in this book and lists the page numbers for each chapter.

Area of Study	Chapter	Pages
<b>Area of Study 1</b> How are people influenced to behave in particular ways?	<b>Chapter 7</b> Social cognition	264–295
	<b>Chapter 8</b> Factors that influence individual and group behaviour	296–335
	<b>Unit 2 Area of Study 1</b> Checkpoint	336–341
<b>Area of Study 2</b> What influences a person's perception of the world?	<b>Chapter 9</b> Perception	342–381
	<b>Chapter 10</b> Distortions of perception	382–407
	<b>Unit 2 Area of Study 2</b> Checkpoint	408–415
<b>Area of Study 3</b> How do scientific investigations develop understanding of influences on perception and behaviour?	<b>Chapter 11</b> Student-designed investigation	416–441
	<b>Unit 2 Area of Study 3</b> Sample poster	442–443

## Unit 2 Outcomes

In this unit, you will:

- analyse how social cognition influences individuals to behave in specific ways and evaluate factors that influence individual and group behaviour
- explain the roles of attention and perception, compare gustatory and visual perception and analyse factors that may lead to perceptual disorders
- adapt or design and then conduct a scientific investigation related to internal and external influences on perception and/or behaviour and draw an evidence-based conclusion from generated primary data.

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CHAPTER

# 7

# Social cognition

## KEY KNOWLEDGE

- the role of person perception, attributions, attitudes, and stereotypes in interpreting, analysing, remembering and using information about the social world, including decision-making and interpersonal interactions
- the avoidance of cognitive dissonance using cognitive biases
- the positive and negative influences of heuristics as mechanisms for decision-making and problem-solving
- the influence of prejudice, discrimination and stigma within society on a person's and/or group's mental wellbeing and ways to reduce it.

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## GROUNDWORK

This topic will build on concepts you have come across in Chapters 2 and 3. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



Groundwork quiz  
Chapter 7

## INVESTIGATIONS

7.1

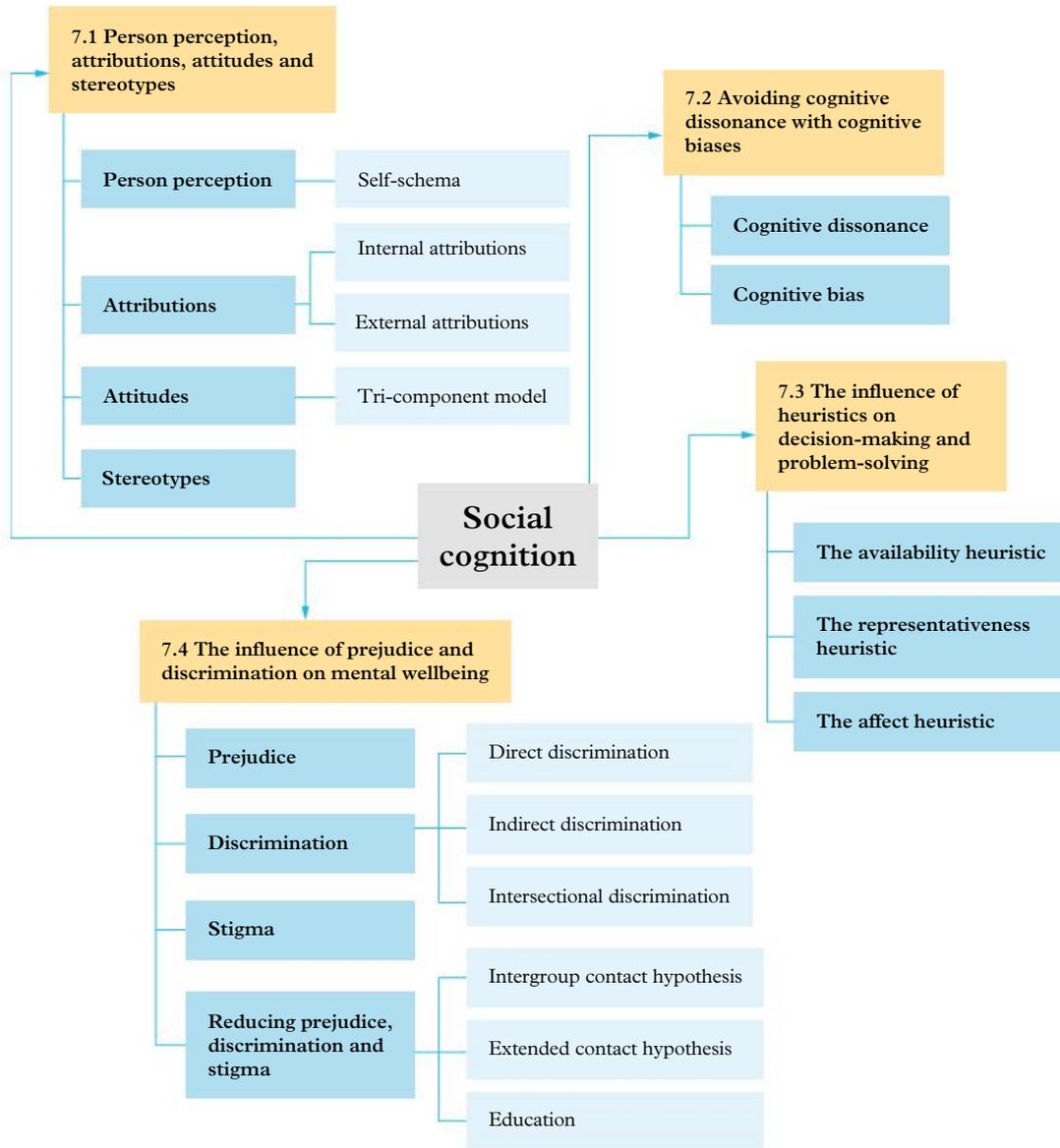
**INVESTIGATION:  
CONTROLLED EXPERIMENT**

How does age affect person perception?

Page 484

**FIGURE 1** Social cognition is the study of how people process and use information about others in social interactions. We use social cognition to decide how to behave around and interact with the people we encounter in life.

## CONCEPT MAP



**\* CONTENT WARNING:** Readers are advised that this chapter includes sensitive material including examples of stereotypes, prejudice and discrimination.

# 7.1

## Person perception, attributions, attitudes and stereotypes

### KEY IDEAS

- ✦ Social interactions involve processes of social cognition.
- ✦ Person perception, attributions, attitudes and stereotypes contribute to social cognition and affect interpersonal interactions.
- ✦ Decision-making in interpersonal interactions is affected by social cognition.



### social cognition

how people attend to, perceive, interpret and respond to social interactions

**Social cognition** is how people attend to, perceive, interpret and respond to social interactions. We use social cognition to decide how to behave around, and interact with, other people. For example, while you would speak formally in a job interview, you would speak casually with your friends at school. These decisions are often made automatically, based on our schemata.

## Schemata

### schema

(pl: schemata) an organised mental framework of knowledge about a person, place or thing

**Schemata** are our mental frameworks of knowledge about a person, place or thing. This knowledge may consist of learnt facts, personal experiences and emotions associated with a person, event, object or other stimulus. Schemata guide our decisions about how to behave during social interactions and allow us to make these decisions with little effort.

Imagine that you spot two people on the train in the morning. The first person is wearing activewear and the second is wearing a suit. You might assume the first person is going to the gym while the second person is going to work. These assumptions have come from your schemata on what particular people look like (for example, active people, office workers) and help guide your interactions with them.

As we learn new things and gain new experiences, we may realise that some of our existing schemata is not always correct. Errors in our schemata can lead to us to make mistakes when we interact with others. To avoid making mistakes and better adapt to our social environments, our schemata can change. Schemata can be affected by:

- person perception
- attributions
- attitudes
- stereotypes.

## Person perception

### person perception

the impression formed of another person based on our first-hand interactions with them and second-hand information learnt about them

**Person perception** refers to the mental processes used to form impressions of other people. The information that we use to form our person perception can come from two sources:

- information from our first-hand interactions with other people; for example, what you observe when you meet someone for the first time or what you learn about someone after having a conversation with them
- second-hand information that we learn about a person from other people's interactions or records of that person; for example, gossip about a person heard from friends or information about someone in a school report.

When we encounter a person, we tend to make various judgments about them based on information about their appearance, personality, occupation, behaviours and intelligence. These judgments can influence our perception of the person and how we interact with them. Consider the two men shown in Figure 1 – at first glance how do your perceptions of these two people differ? It is important to recognise that person perception can be imperfect, as what we individually perceive about a person can differ from what is true. Person perception often changes as you become more familiar with a person, their motivations, behaviours and characteristics. This more informed perception from closer interactions provides a more accurate guide to your social interactions with the person.



**FIGURE 1** Consider the two men pictured. What are your impressions of these people? What kind of people do you think they are? What information have you used to inform your perceptions?

## Self-schema

Our **self-schema** is a mental framework that consists of the knowledge and beliefs we hold about ourselves. It includes our values, attitudes and self-identity. Researcher Clayton Critcher (2010) suggests that when we form an impression of someone, we tend to use our own self-schema as a reference point to better understand the person. We compare our characteristics to those of the other person, looking for similarities and differences. For example, if you met a person that had shared interests with you, you may be more likely to perceive them in a positive way. Alternatively, if you met a person who had opposing views to you, you may perceive them more negatively. This is known as **egocentric pattern projection**, the process of projecting our own beliefs and assumptions onto others. This highlights how our self-schema can influence our person perception, and how our perceptions of others are often a reflection of our own self-concept. When comparing aspects of others against our self-schema we tend to rely on physical cues, saliency detection and social categorisation.

### **self-schema**

a mental framework of knowledge about oneself, self-identity

### **egocentric pattern projection**

the tendency for people to project their own traits and behaviours onto others

## Physical cues

### physical cue

physical feature of a person that contributes to our impression of them

**Physical cues** are the physical features of a person that contribute to our impression of them. Research shows that we commonly first use another person's attractiveness, gender identity, age and race to form a person perception. Other visual physical cues include a person's height, body type, weight, facial features and clothing. Non-visual physical cues include body odour and vocal tone. When forming a person perception, we compare the other person's physical cues to those of our self-schema.

## Saliency detection

### saliency detection

the focused attention towards specific pieces of information about a person over other pieces of information

When we encounter another person, our visual system automatically detects and prioritises certain elements that are distinctive or eye-catching. This process is called **saliency detection** and describes how we focus our attention to the most distinctive aspects or features of another person. Saliency detection is influenced by several things, including our self-schema. For example, if part of your self-schema is that you like jewellery, you might notice if someone is wearing an expensive ring that you find beautiful. You might form the impression that the person is wealthy and has good taste. If you were a person uninterested in jewellery, you might not pick up on this feature and it therefore would not contribute to your impression of the person.



**FIGURE 2** If you were interested in jewellery, you might be quick to notice if someone is wearing a diamond ring due to saliency detection. Picking up on this feature may then contribute to your person perception of the person.

## Social categorisation

### social categorisation

placing someone into a group or groups based on impressions we have formed about people with certain characteristics

Our person perception of someone is also influenced by **social categorisation**. Social categorisation happens when we place someone into a group or groups, based on impressions we have formed about people with certain characteristics. Groups might be based on characteristics, such as physical cues, age, gender identity, hobbies and address. Social categorisation is often an unconscious process. It allows us to quickly form an impression about what a person might be like and how we should interact with them.

## 7.1 SKILL DRILL

### Exploring the use of observational studies

#### Key science skill: Plan and conduct investigations

A study was conducted to examine how social categorisations and person perception can change over time. In the study, 100 first-year university students were randomly selected by the researchers from local universities and asked to complete a survey about schemata social categorisations and their person perceptions about migrants and other people of different racial ethnicities. The survey consisted of a range of open and closed questions to collect both qualitative and quantitative data. The same students were requested to repeat the survey

at the end of their first year of university, and the results were analysed by the researchers.

- 1 Identify the type of investigation methodology this study would fall under. Justify your answer.
- 2 Identify the type of sampling that was used by the researchers, and outline one advantage and one disadvantage of this type of sampling.
- 3 Distinguish between qualitative and quantitative data.
- 4 Outline why a survey is an ideal way to gather data in this study.

Need help planning and conducting investigations? Go to Topic 1.3 in your Psychology toolkit.

# Attributions

Have you ever noticed yourself wondering why people act the way they do? Or do you often try to explain other people’s and your own behaviour? Being able to explain the reasons for events and behaviours helps us navigate our social experiences. **Attributions** are the inferences or explanations we make about the causes of events and behaviours. For example, if you see wet grass outside in the morning you might “attribute” the wet grass to it raining the night before. There are two categories of attributions: internal attributions and external attributions.

**attribution**  
an inference made about the causes of events and behaviours (our own and others’)

## Internal attributions

**Internal attributions** refer to explanations that we make based on a person’s internal factors such as personality traits, abilities, mood, age, motivation or intelligence. For example, if you see a waitperson drop a glass you might attribute this to the person being clumsy (internal factor). Or if someone is awarded school captain, you might attribute this to the person having good leadership skills (internal factor).



**internal attribution**  
an inference that attributes an event or person’s behaviour to personal factors

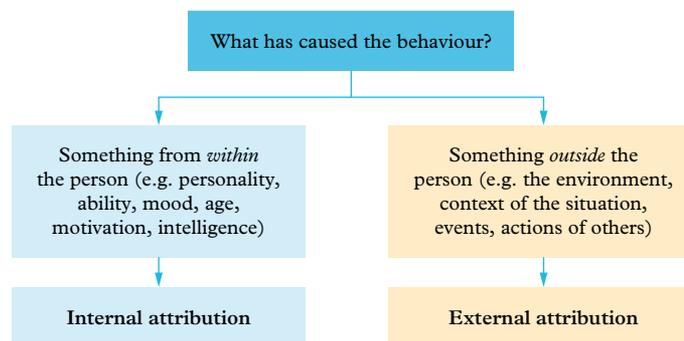
## External attributions

**External attributions** refer to explanations based on external factors, such as the environment, the context of a situation or the actions of another person. For example, if you see a waitperson drop a glass while walking near a “wet floor” sign, you might attribute the accident to the floor being slippery (external factor). Or if someone is awarded school captain, you might attribute this to them being well-regarded among their cohort (external factor).

**FIGURE 3** If you see wet grass in the morning, you may attribute this to overnight rain.

**external attribution**  
an inference that attributes an event or person’s behaviour to environmental factors

Both internal and external attributions can have important implications for how we perceive and interact with others, as well as for our own self-perception and motivation. They can also be influenced by a range of factors such as cultural norms, social cues and personal biases.



**FIGURE 4** How to assess whether an attribution is internal or external

## Fundamental attribution error

Attributions can help us arrive at relatively accurate or helpful explanations of a person's behaviour; however, they are also subject to our own biases leading us to an incorrect or inaccurate explanation of why a behaviour has occurred. People often rely heavily on using internal or **dispositional factors** to explain behaviour. **Fundamental attribution error** is the tendency to explain behaviours through internal factors, while neglecting the role of external factors. For example, if someone behaves aggressively, we might assume that they have an aggressive personality, without considering **situational factors** that may have contributed to their behaviour, such as being provoked. Fundamental attribution error can lead to inaccurate perceptions of others and unfair judgments. It is important to be aware of this bias to make more accurate attributions of behaviour and consider both internal and external factors.

### **dispositional factor**

(internal factor)  
factor that stems from an individual's personality characteristics that affect a person's behaviour; used to assign internal attributions to a person's behaviour

### **fundamental attribution error**

the tendency to attribute actions and behaviours to a person's personal traits and overlook the influence of external factors

### **situational factor**

(external factor)  
environmental factor that affects or causes an individual's behaviour; used to assign external attributions to a person's behaviour

### **attitude**

a relatively enduring positive or negative evaluation of an attitude object

### **attitude object**

what you make a judgment about or have positive or negative feelings towards

### **explicit attitude**

an attitude that we are conscious of and able to self-report

### **implicit attitude**

unconscious attitudes that are involuntarily formed and that we are typically unaware of

## Attitudes

Consider the following statement: "Taking at least one mathematics subject should be compulsory in VCE." Now think about how you feel or would respond to this statement. If you think deeply about your response, you will probably remember experiences and recall knowledge about the issue that help explain your evaluation, or attitude. An **attitude** is a positive, negative or neutral evaluation of an **attitude object** (yourself, another person, object, event or issue). Attitudes have certain characteristics (Allport, 1935):

- They are learnt and accumulated over time, based on our experiences and accumulation of knowledge about the attitude object.
- They are relatively enduring and stable. This means that they are consistent both over time and in different situations. They can be difficult to change.
- They can influence behaviour. Regardless of whether they are positive or negative, attitudes give us information on how to respond to an attitude object.

## Attitudes can operate in different forms

**Explicit attitudes** are where you openly express your attitude and behave in a way that reflects the attitude. For example, you might think that exercise is good for your health (attitude), so you visit the gym daily (action).

**Implicit attitudes** are involuntary, uncontrollable and sometimes unconscious. It is possible to be unaware that you hold an attitude until your actions reveal it. For example, moths are harmless (attitude), but you involuntarily scream in fear when you see a moth (action).

Attitudes play an important role in shaping our perceptions and behaviours towards people, objects, events and issues. Understanding how attitudes are formed and maintained is critical to understanding social cognition.

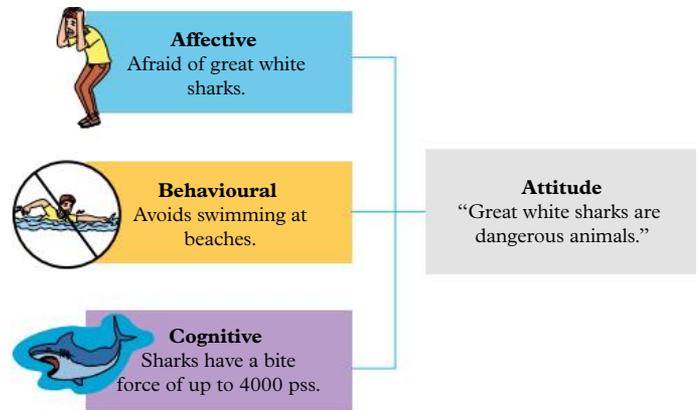
## Structure of attitudes: the tri-component model

The most common model used to describe the structure of attitudes comes from Rosenberg et al. (1960). According to their **tri-component model of attitudes**, all attitudes consist of three components (affective, behavioural and cognitive) and these components interact with each other and contribute to the attitudes we hold. The model is often referred to as the "ABC model of attitudes" (even though the affective and cognitive components affect the behavioural component).

- The **affective component** refers to the feelings and emotions we have about the attitude object.
- The **behavioural component** refers to the actions we take in response to the attitude object.
- The **cognitive component** refers to the understanding, knowledge and beliefs we have about the attitude object.

For example, consider someone who has the attitude that “great white sharks are dangerous animals” (Figure 5). In this case the attitude object is great white sharks. The affective component is that the person fears sharks, the behavioural component is that they avoid swimming, and the cognitive component is that they know how forceful a shark’s bite can be.

In this example, the affective, cognitive and behavioural components equally interact to contribute to the attitude that great white sharks are dangerous animals. In some attitudes, the affective, cognitive or behavioural component might have dominance, rather than them having equal weighting. In our example, if the person did not know about the bite force of great whites they might not have formed a strong affective component. In some cases, a behaviour may not match up with the affective and cognitive components. In other cases, affective and cognitive components do not match. This is called cognitive dissonance. You will learn more about this in Topic 7.2.



**FIGURE 5** The affective and cognitive components of your attitude lead to the behavioural component or action, that is, avoiding swimming at beaches.

**tri-component model of attitudes**

the most common model used to describe the structure of attitudes, where all attitudes consist of an affective, behavioural and cognitive component

**affective component**

in relation to the tri-component model of attitudes, the feelings and emotions we have towards an attitude object

**behavioural component**

in relation to the tri-component model of attitudes, our observable actions in response to an attitude object

**cognitive component**

in relation to the tri-component model of attitudes, the knowledge and understanding we have about an attitude object

**7.1 CHALLENGE**

**Identifying attitude components**

Identify the affective, cognitive and behavioural attitude components for the following scenarios.

- 1 Eleanor is making dinner plans with her friends when one of them suggests that they go to the local restaurant that specialises in fish tacos. Eleanor immediately agrees because Mexican food is one of her favourite types of food, and the restaurant is just around the corner. Unfortunately, the other friends disagree with the idea as nobody else likes to eat fish.
- 2 Drago is an avid fitness fanatic. He goes to the gym and runs at least six times a week and he enjoys the feeling of being fit and healthy. He also enjoys being around and training with others, who motivate him to train harder.
- 3 Remy has just received her assessment mark, a C+. She had anticipated getting at least an A. Disappointed, Remy decides that she needs to re-evaluate how she prepares for her next assessment so that she can avoid the mistakes she made on her recent assessment.
- 4 Mohinder is walking home from work when a car passes by and the passengers yell racial slurs at him before speeding off. Mohinder shakes his head and continues to walk home, thinking about how typical it is of others to racially abuse him, and how he used to be angry when it occurred but that he has now come to accept it as part of the society that he lives in.

# Stereotypes

## stereotype

a commonly held, oversimplified belief about members of a particular group

**Stereotypes** are commonly held, oversimplified beliefs about members of a particular group. They can be held by members of a whole society or be entrenched within a smaller social group. They are assumed to apply to all members of a group and are often based on:

- gender identity
- race
- age
- ability
- religion
- sexuality
- occupation
- social class
- address.

## Study tip

To help remember the many concepts covered in this topic, you could list some personal examples of each of the concepts.

Stereotypes can be positive or negative. A positive stereotype focuses on one of a group's perceived positive characteristics; for example, the belief that people who wear glasses are well-educated. A negative stereotype focuses on one of a group's perceived negative characteristics; for example, a belief that all people who live in a particular suburb are poorly educated.

Like person perception, attributions and attitudes, stereotypes guide us in our interactions with others and the understanding of our environment. Relying on stereotypes (both positive and negative) to guide our behaviour can, however, lead to negative outcomes.

Imagine that a Year 9 student who wears glasses asks you to tutor them so that they can improve their mark in science. During the session, the student shows understanding of the topic at a Year 7 level only, but you assign them Year 9 extension work. The student leaves the session feeling more confused and worried about their science mark. Although your behaviour is based on the positive stereotype that people who wear glasses are well-educated, the outcome for the student is negative. The stereotype has caused you to ignore the actual level of the student's understanding.



**FIGURE 6** Intelligence is an example of a stereotype often applied to people who wear glasses.

Stereotypes often contribute to prejudice and discrimination against others. For example, in the late nineteenth and early twentieth centuries, women in Australia were restricted from voting and standing in elections due to gender stereotypes of the time. During this time, women were stereotyped as being incapable of making rational political decisions and being most suited to homemaker roles. It was only in 1908 that women in Victoria were granted the right to vote and stand for parliament. You will learn more about prejudice and discrimination in Topic 7.4.



FIGURE 7 Prior to 1908 women in Victoria were not allowed to vote or stand in elections.

## 7.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain the term “social cognition”, using a relevant example.
- 2 Describe the three components of an attitude.
- 3 Outline how saliency detection may contribute to social categorisation.
- 4 Explain why person perceptions and stereotypes are used by individuals as guides for how they should interact socially with others.

### Apply, analyse and compare

- 5 Compare external and internal factors as contributors to attributions.
- 6 After a serious skiing accident, Amy is left paraplegic and uses a wheelchair to move around. Attractive and young, Amy finds that many people that she meets look at her with sympathy and sometimes go out of their way to be too kind to her.

Analyse the reasons why others treat Amy in this way, with reference to attitudes and attributions.

- 7 Comment on your use of self-schema when creating a person perception of:
  - a a celebrity you like
  - b a celebrity you do not like.

### Design and discuss

- 8 Discuss the advantages and disadvantages of using attributions, attitudes and stereotypes in our social cognitions when interacting with others.
- 9 Design a survey to measure attitudes towards a topic of your choice (such as pizza toppings, school, hot weather or psychology). In your survey, include:
  - a a series of statements about the topic
  - b a ranking of opinions (known as a Likert-type scale) about each of the statements where others can indicate what they think about the statements
  - c a way in which you can use this information to determine the attitudes (affective, cognitive and behavioural components) towards the topic of your choice.

# 7.2

## Avoiding cognitive dissonance with cognitive biases

### KEY IDEAS

- ✦ Cognitive dissonance is an unpleasant state and occurs because of inconsistent cognitions.
- ✦ Cognitive biases can be used to reduce or resolve cognitive dissonance.
- ✦ Cognitive biases often occur automatically without our awareness.



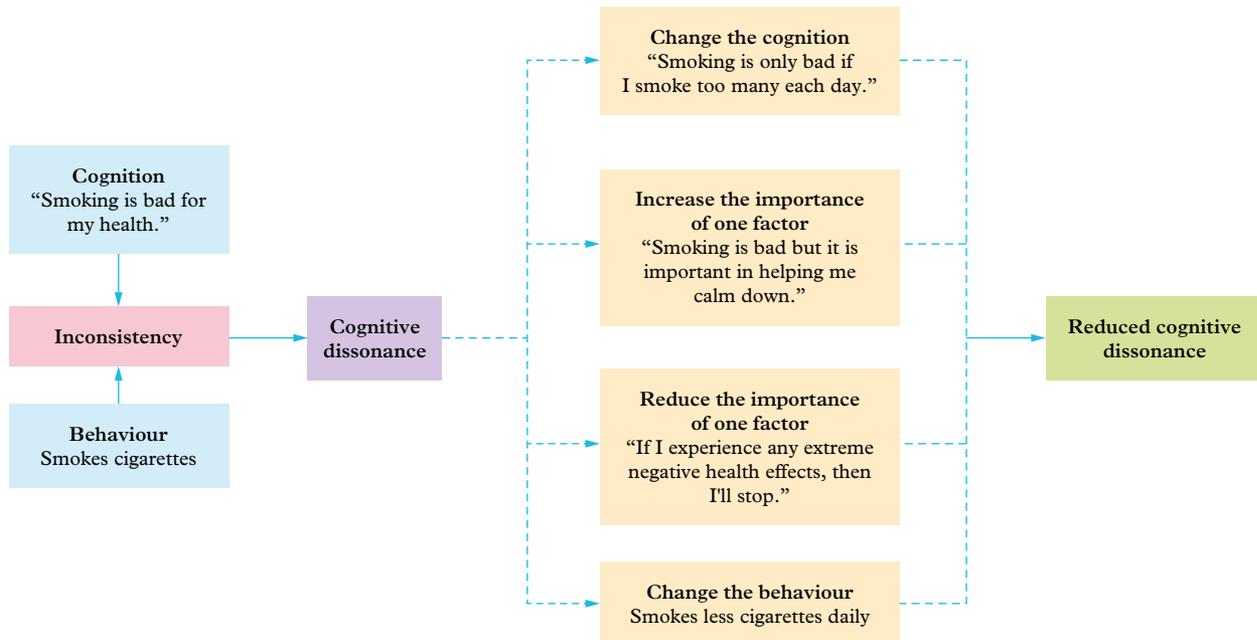
### Cognitive dissonance

Have you ever felt guilty about cheating on a test because deep down you knew it was the wrong thing to do? Maybe you made a nasty comment in anger to someone and felt guilty about it later because you did not really mean what you said. These are both examples of cognitive dissonance. Proposed by Leon Festinger in 1957, **cognitive dissonance** is an unpleasant psychological state of tension or anxiety created when two or more cognitions (thoughts, attitudes or beliefs) or a cognition and behaviour are inconsistent with one another. Dissonance might exist between:

- attitudes
- attitudes and thoughts
- attitudes and behaviour
- self-image and behaviour.

For example, if you believe that an exam is a fair way to test your knowledge (belief), but you cheat anyway (conflicting behaviour), you are likely to experience dissonance in the form of guilt or regret. Or if a smoker understands that smoking is bad for their health (belief) and then smokes (conflicting behaviour), they would also be likely to experience dissonance.

**cognitive dissonance**  
an unpleasant psychological state of tension or anxiety created when two or more cognitions (thoughts, attitudes or beliefs) or a cognition and behaviour are inconsistent with one another



**FIGURE 1** How a person may attempt to reduce cognitive dissonance caused by understanding the health risks of smoking while being a smoker

## Cognitive bias

Cognitive dissonance is uncomfortable. Humans often try to reduce anything that causes discomfort and find ways to maximise pleasure and comfort. You might try to reduce the discomfort of cognitive dissonance by:

- changing the cognition
- changing the behaviour
- reducing the importance of one of the inconsistent cognitions or behaviours
- strengthening the importance of one of the cognitions or behaviours.

Each of these outcomes can be achieved by using a form of **cognitive bias**. Cognitive biases are systematic errors in thinking that stem from the brain’s tendency to simplify information through relating it to personal experiences and preferences. This affects our decision-making and problem-solving. Cognitive biases are often simplistic and inaccurate and are applied automatically without our awareness. They are formed from our personal experiences, observations, memory and attention. Cognitive dissonance is often reduced or avoided using various forms of cognitive bias, such as:

- actor–observer bias
- anchoring bias
- attentional bias
- confirmation bias
- false-consensus bias
- functional fixedness
- halo effect
- hindsight
- misinformation effect
- optimism bias
- self-serving bias
- Dunning–Kruger effect.

Not all biases work to reduce cognitive dissonance, such as functional fixedness and, in some cases, the misinformation effect. The biases, and how they can influence cognitive dissonance, are outlined in Table 1.



**cognitive bias**  
systematic errors in thought processes and thinking that affect decision-making and problem-solving

**TABLE 1** Cognitive biases and how they affect cognitive dissonance

Bias and description	How it influences cognitive dissonance	Example
<p><b>Actor–observer bias</b></p> <p>The tendency to perceive the reasons for the behaviour of another (the actor) on dispositional (internal) factors, while recognising the reasons for our own (the observer) behaviour on situational (external) factors</p>	<p>We justify that a mismatched cognition is beyond our control because it is based on situational factors. This allows us to reduce the importance of that cognition, which reduces dissonance.</p>	<p>You (the observer) cheat on an exam. You believe that cheating is wrong. You feel guilty for cheating. To reduce the guilt caused by the dissonance between your behaviour and your belief, you reduce the importance of your behaviour by justifying it with a situational factor. That is, that your teacher did not teach you well enough for you to pass the exam.</p> <p>If someone else (an actor) cheated, you would most likely explain their behaviour using a dispositional factor; for example, that they were just not smart enough to pass without cheating.</p>
<p><b>Anchoring bias</b></p> <p>The tendency to base decisions on the first piece of information we receive (the anchor) about a thing or event, and failure to change decisions when more information is available; can lead to poor decision-making</p>	<p>Dissonance occurs when a decision based on an anchor leads to a poor outcome. If we change our cognition about the action we have taken based on the anchor, we reduce the dissonance associated with the poor outcome.</p>	<p>You want to sell your bike. You research the value of your bike and learn that it is worth around \$200, used (the anchor). You advertise it for sale at school, and another student offers to pay you \$190 for the bike. You accept (the decision). Later, a friend tells you that they would have paid at least \$220 for your bike because it is close to new and in good condition. The disappointment you feel at not getting a higher price is a form of cognitive dissonance.</p> <p>To reduce the dissonance, you tell yourself that you are happy to have sold your bike for the lower price because you know that it was really only worth \$200.</p>

(continued)

TABLE 1 continued

Bias and description	How it influences cognitive dissonance	Example
<p><b>Attentional bias</b> The tendency to notice and pay attention to some stimuli or information while ignoring other stimuli or information; can lead to decisions based on only one of several possible outcomes</p>	<p>We reduce dissonance by only paying attention to the stimuli or information that aligns with our beliefs. This strengthens the importance of a cognition and allows us to ignore the cognition or behaviour that conflicts with our beliefs.</p>	<p>John holds discriminatory views about people of races other than his own. One day, John sees a person of another race staring at his house. John believes the person is “casing” his house so that they can break in later. John is angry and verbally abuses the person. Afterwards, John feels guilty about his behaviour. He tries to relax by reading the newspaper online. He scans all the articles and notices one article about a crime committed by someone of a different race. John concludes that his earlier behaviour was justified – his house would have been broken into if he had not acted as he did. This reduces the dissonance he feels.</p>
<p><b>Confirmation bias</b> The tendency to seek out and favour information that supports existing beliefs, cognitions, attitudes and behaviours while ignoring conflicting information</p>	<p>Dissonance is reduced when we seek and find information that supports one of our conflicting cognitions or behaviours. Finding the supportive information strengthens the importance of that cognition or behaviour and reduces the importance of the other cognition or behaviour.</p>	<p>During an election, we seek out information, facts and media that best support our impressions of the candidates and the political parties. We are likely to disregard or disapprove of any other information contrary to our views.</p>
<p><b>False-consensus bias</b> The tendency to view our own attitudes, cognitions and behaviours as relatively common and shared with most others</p>	<p>Dissonance is reduced when we view one of our conflicting cognitions or behaviours as common. The importance of that cognition or behaviour is strengthened, and the importance of the conflicting cognition or behaviour is reduced.</p>	<p>You visit a popular restaurant and order the well-reviewed fish tacos. You do not enjoy the fish tacos. It is so disappointing! When a friend tells you that they are going to the restaurant and asks you if they should try the fish tacos, you say no, they will not like them, assuming that your friend will have the same opinion as you. This makes you feel better about your own experience – the fish tacos are well-reviewed, but “nobody” really likes them.</p>
<p><b>Functional fixedness</b> The tendency to view something in terms of its primary purpose or function, preventing the ability to see its potential use or flexibility in other contexts</p>	<p>Functional fixedness does not directly reduce cognitive dissonance. Rather, functional fixedness may contribute to cognitive dissonance in certain situations. This can happen when an individual’s preconceived ideas about an object’s function conflict with seeing the object used differently or unconventionally, challenging their existing beliefs. This can prevent or restrict our ability to problem-solve.</p>	<p>You need to draw a straight line for a diagram but do not have a ruler. You have your student card on you, but functional fixedness prevents you from considering using the edge of the card to rule a line. When you witness your friend using their student card to draw a straight line, it creates cognitive dissonance. The conflict arises between your fixed belief that the student card can only serve its conventional purpose and the new information that challenges that belief.</p>

(continued)

TABLE 1 continued

Bias and description	How it influences cognitive dissonance	Example
<p><b>Halo effect</b></p> <p>The tendency for a positive impression of one of a person's traits to influence impressions of all of the person's traits (even though we do not know anything about these traits)</p>	<p>When we have an overall positive impression of someone and they behave in a way that contradicts that impression, it can create cognitive dissonance. To reduce dissonance, the halo effect prevents us from challenging our positive impression of the person, and we tend to give the person the benefit of the doubt, reconcile their actions or downplay the conflicting behaviour. This allows us to reduce dissonance by rationalising the person's behaviour as an exception or attributing it to external factors.</p>	<p>Your lab partner Alice is a good friend who you admire for her intelligence and strong work ethic. One day, Alice makes a significant mistake in an experiment, which reduces your mark for an assessment. Alice's mistake creates cognitive dissonance because it contradicts your positive impression of her. To reduce the discomfort, instead of reevaluating your perception of Alice's competence, you rationalise Alice's mistake by thinking "she must have been really tired or stressed".</p>
<p><b>Hindsight effect</b></p> <p>The tendency to view past events as having been more predictable than they really were</p>	<p>When an event does not occur as we expect it to, we reduce the dissonance of disappointment after the event by believing that we knew it would end this way, anyway.</p>	<p>Your team is leading at half-time in the grand final and you are quietly confident that your team will win.</p> <p>Disappointingly, the opposition gains the lead after the break and wins.</p> <p>You experience the dissonance of disappointment; however, you tell your friends that you knew your team was going to lose the game, anyway.</p>
<p><b>Misinformation effect</b></p> <p>The tendency for new misleading or inaccurate information to alter the memory or perception of an event</p>	<p>It can create cognitive dissonance when a person holds a strong belief or memory and is then introduced to misleading information that contradicts their belief or memory.</p> <p>It can reduce cognitive dissonance when a person uses new information presented to reconcile or alter a memory or belief that originally caused dissonance.</p>	<p>You remember that a specific event at a party occurred in a certain way. A friend presents you with new or different information about the party that challenges your recollection of the event, creating cognitive dissonance.</p> <p>Alternatively, if your original recollection of the event had caused you to feel dissonance and the new information helps reconcile that discomfort, the misinformation effect can reduce dissonance.</p>
<p><b>Optimism bias</b></p> <p>The tendency to overestimate the likelihood of positive outcomes and underestimate the likelihood of negative outcomes happening</p>	<p>This can act as a coping method to reduce cognitive dissonance when individuals hold onto optimistic beliefs to minimise the discomfort caused by dissonance.</p>	<p>You accidentally break your friend's wrist when playing contact sports. This causes you to experience cognitive dissonance since you care about your friend's safety, but your actions caused them to get hurt. You tell yourself that "it will heal in no time", overestimating a positive outcome to reduce the cognitive dissonance you experienced.</p>

(continued)

TABLE 1 continued

Bias and description	How it influences cognitive dissonance	Example
<p><b>Self-serving bias</b> The tendency to attribute successes to internal factors (such as personal qualities or abilities) and failures to external factors (such as environment, context, acts of others)</p>	Dissonance is reduced as self-serving bias allows a person to selectively focus on information that supports their beliefs or actions, while ignoring or minimising information that contradicts them.	You get a good mark on an exam and attribute your success to your intelligence and hard work (internal factors). But when you receive a poor grade, you attribute your grade to the difficulty of the test or an unfair teacher (external factors), rather than your lack of preparation or understanding.
<p><b>Dunning–Kruger effect</b> The tendency for people with lower understanding or skill to overestimate their ability</p>	Reduces dissonance by allowing individuals to maintain their positive self-image and avoid the discomfort associated with recognising their limitations or mistakes.	<p>You read an article about dog grooming. You love dogs and it seems like an easy job. As soon as you see a dog grooming job advertised, you apply. You are interviewed for the job, but you do not get it.</p> <p>You believe that you were the perfect candidate for the job, so you blame your failure on the interviewer’s questions. You tell yourself that you were not able to fully explain how perfect you were for the job due to bad interview questions.</p>



## 7.2 CHECK YOUR LEARNING

**Describe and explain**

- 1 Explain why cognitive dissonance occurs.
- 2 Outline how cognitive biases can affect cognitive dissonance.
- 3 Describe anchoring bias with reference to a relevant example.
- 4 How can cognitive dissonance motivate us?

**Apply, analyse and compare**

- 5 Contrast the halo effect and false-consensus bias.
- 6 Compare confirmation bias and attentional bias.
- 7 Ange’s parents have gone away for the weekend and left Ange to look after the house with explicit instructions not to have a house party. Ange’s friends know he is home alone and pressure him into having a house party that will involve alcohol. He is eager to have the party but worries

about the things that could go wrong: mess, broken furniture, too much noise, people getting hurt, his parents’ reactions if they found out. After thinking about it and with increasing pressure from his friends, Ange decides to have the house party, but still feels conflicted about his choice.

- a Analyse the source(s) of cognitive dissonance that Ange is experiencing.
- b Comment on the cognitive biases that Ange has used in making the choice to have the house party.

**Design and discuss**

- 8 “Cognitive biases and their use in reducing cognitive dissonance can contribute to our attributions.” Discuss this statement.
- 9 Create your own examples for each of the cognitive biases.



## 7.3

# The influence of heuristics on decision-making and problem-solving

## KEY IDEAS

- ✦ Heuristics are part of our social cognition, and are integral for us to quickly make decisions and solve problems that involve social interactions.
- ✦ The use of heuristics is prone to errors and biases, which can negatively affect social interactions.

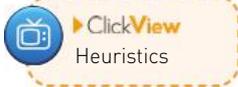


## Heuristics in decision-making and problem-solving

Each day we participate in many social situations where we need to make decisions about how we interact with, behave towards and respond to others. Many of the decisions we make are brief and generally predictable, so we minimise the amount of effort and time we need to put in to make these decisions.

### heuristic

cognitive shortcut (general rule) that guides our decision-making and problem-solving



**Heuristics** are cognitive shortcuts that help us to simplify complex information, make decisions and problem-solve quickly and efficiently. Heuristics allow us to generalise information to a variety of situations and make decisions during social interactions with little thought or consideration. This means that we can use our attention and cognition for other tasks that require greater mental focus and thought. For example, consider a student trying to select their partner for a group project. After spending a few minutes tossing up between three of their good friends, they decide on one, complete the project with them, and receive a good mark. The next time the student needs to pick a partner, they simply ask their former partner as they know they can work well together and by deciding quickly, the student saves time and effort.

Often, heuristics help us make good decisions about social interactions with others and solve problems. However, heuristics can also lead us to make errors or ignore relevant information that could have otherwise helped us make a different, more appropriate, decision. For example, had the student picked another group-work partner, they might have received an even better mark or had more fun working with them. Because heuristics are applied without much thought or consideration, we can also avoid assessing whether a thought or decision is illogical or wrong in a situation. This can lead to decisions that negatively affect the nature and quality of a social interaction.

There are a range of different types of heuristics. Three of the most commonly occurring heuristics include the availability heuristic, the representativeness heuristic (Tversky & Kahneman, 1973), and the affect heuristic (Zajonc, 1980).

### The availability heuristic

The **availability heuristic** refers to our tendency to make decisions based on how easily we can retrieve memories and thoughts related to a person, event or object. This can affect how we estimate the likelihood of an action or behaviour occurring. For instance, imagine you are walking home alone late at night and you see a person walking briskly towards you.

### availability heuristic

the tendency to make decisions based on how easily memories and thoughts about a person, event or object come to mind

One of your initial thoughts might be that the person poses a threat to your safety. This thought, which comes to mind quickly, prompts you to cross the road or find a different route home to avoid any interaction with the oncoming individual. This decision to cross the road is based on the availability heuristic.

The speed at which thoughts and memories come to us is influenced by various factors, including the importance we place on them, the frequency with which we use them, and our personal experiences. As we use a heuristic more often to make decisions in social interactions, we become more familiar with it. This familiarity allows us to retrieve the heuristic more quickly in similar situations.

## Priming

### priming

a phenomenon in which exposure to previous stimuli can influence how a person reacts or responds to a following stimulus

**Priming** refers to providing a person with an idea or preconception before exposing them to a stimulus. In a study conducted by Higgins, Rholes and Jones in 1977, participants were primed with a series of adjectives and then presented with a description of an imaginary person who had performed a physical feat, such as rock climbing or rafting. Participants were asked to describe their impressions of the person. Those who had been exposed to adjectives such as “adventurous” reported favourable impressions, while those who had been exposed to adjectives such as “reckless” reported unfavourable impressions.

This study highlights a potential problem with the availability heuristic. Participants who were exposed to both positive and negative adjectives recalled them easily and applied them in a different situation. In the real world, reinforcement or recent exposure to negative or inaccurate ideas through friends, family, school or the media can trigger these ideas easily and lead us to make decisions based on inaccurate information.

### representativeness heuristic

the tendency to make decisions based on the classification of people, objects and events into categories of similar people, objects and events

## The representativeness heuristic

The **representativeness heuristic** is a mental shortcut we use to classify people, objects and events into categories based on traits consistently shared across those in a category. For example, if you see someone wearing Vans (a brand of skate shoe) and holding a skateboard on the train, you might categorise them as a “skater”, and assume they will behave or act in accordance with traits you think are shared by “skaters”. The representative heuristic can be useful in everyday life because it allows us to quickly make judgments based on limited information. However, it can also lead to errors in judgment when the information we use to categorise is not representative of who we are categorising or when we rely too heavily on our assumptions about a category. This can lead us to make faulty assumptions and draw incorrect conclusions.

For example, a person holding a skateboard wearing Vans might not be able to skate at all. Instead, the board could be a present for a friend, or they could be holding it for a friend.

If we assume that all people who look a certain way or come from a certain background behave in a certain way, we may overlook individual differences and perpetuate stereotypes. It is important to recognise the limitations of the representative heuristic and to be open to new information that can challenge our existing ideas about how we group others. By doing so, we can avoid making hasty judgments and cultivate a more accurate understanding of the world around us.



**FIGURE 1** If you saw a person wearing Vans shoes and holding a skateboard, you might assume that they are a skater based on both items being associated with people who skateboard.

## Base-rate fallacy

As the representativeness heuristic leads us to ignore other possible classifications for objects, people and events in favour of classifications that are most familiar to us, this can sometimes cause us to also ignore statistical information that contradicts our personal experiences.

This is known as the **base-rate fallacy**. The base-rate fallacy is a cognitive error where someone ignores or underestimates the general probability or “base rate” of a particular event and instead relies on specific or individual information when making judgments or decisions. This can lead to overestimating the likelihood of rare events and underestimating the likelihood of common events. For example, consider a student who chooses a university degree because a family friend landed a high-paying job in that field after graduation. If the overall employment rate in that field is 10 per cent, and the friend’s success is an outlier, the student’s decision has neglected the base rate.

The base-rate fallacy can result in incorrect or biased decisions in contexts such as medical diagnoses, financial investments and legal judgments. Historically, the base-rate fallacy has led to harmful stereotypes, prejudice and discriminatory behaviour. You will learn more about these ideas and events in Topic 7.4.

### **base-rate fallacy**

an error in decision-making that stems from information about the rate of occurrence of a trait in a population (the base rate) being ignored

## The affect heuristic

The **affect heuristic** is a mental shortcut where people rely on their emotions and feelings to make judgments or decisions quickly, instead of relying on more objective information or analysis. When we use this heuristic, we rely on our emotions, rather than facts, knowledge or cognitions, to make decisions in social interactions. For example, a person may be more likely to buy a product that makes them feel happy or excited, such as a dream sports car, even if another car is more practical for their needs.

### **affect heuristic**

the tendency to rely on our emotions, rather than facts, knowledge or cognitions to make decisions in social interactions



**FIGURE 2** The affect heuristic might cause a person who has always dreamed of owning a sports car to quickly decide to buy one, regardless of whether another car may be more practical.

An experiment conducted by Finucane and colleagues (2000) showed that participants were more likely to rely more on their emotions than on analytical thought when weighing up risks and benefits in time-pressure situations. Positive emotions were more often used when the levels of risk involved were low, and negative emotions were more often used when the levels of risk were high.

These findings support the research of Zajonc (1980), who proposed that emotional responses to stimuli occur quickly and can be illogical or irrational. For example, after a fight with a close friend, your negative emotions may dominate your conscious awareness and influence your decisions, causing you to respond angrily to anyone who tries to talk to you. On the other hand, if you and your friend had just booked an exciting overseas holiday, your positive emotions may flow on to the other decisions you make and interactions you have.

### 7.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Define the term “heuristic”.
- 2 Explain how heuristics may affect decision-making in social interactions.
- 3 Outline how the affect heuristic may have an impact on decision-making.
- 4 Describe the positive and negative influences of heuristics in social interactions.

#### Apply, analyse and compare

- 5 Distinguish between the availability heuristic and the representative heuristic.
- 6 Cole is at his first university tutorial where he meets Qun. Qun is friendly and happy to talk with Cole, but she struggles to communicate in English as it is her second language. After the tutorial, Qun asks if Cole would like to

have lunch with her. During lunch, Cole finds Qun to be lively and funny, and learns that she plays the cello in a local orchestra. The following week, Cole attends the same tutorial where he sees Qun again.

Comment on how Cole might use availability and affect heuristics to guide his interactions with Qun this week.

#### Design and discuss

- 7 Discuss how stereotypes, attitudes and attributions may contribute to the formation and use of heuristics.
- 8 Discuss with your class and propose which heuristic is most commonly used. Make a list of situations where heuristics have led to both positive and negative outcomes in social interactions.

**FIGURE 3** Positive emotions that come from booking a holiday with a friend may flow on to the other decisions or interactions you have that day.



# 7.4

## The influence of prejudice and discrimination on mental wellbeing

### KEY IDEAS

- ✦ Prejudice and discrimination are based on stereotypes and inaccurate information.
- ✦ Prejudice and discrimination can have both negative and positive effects on the mental wellbeing of individuals and society as a whole.
- ✦ Factors that contribute to prejudice and discrimination can be systematically addressed to remove misconceptions about other people and groups.



## Prejudice

### prejudice

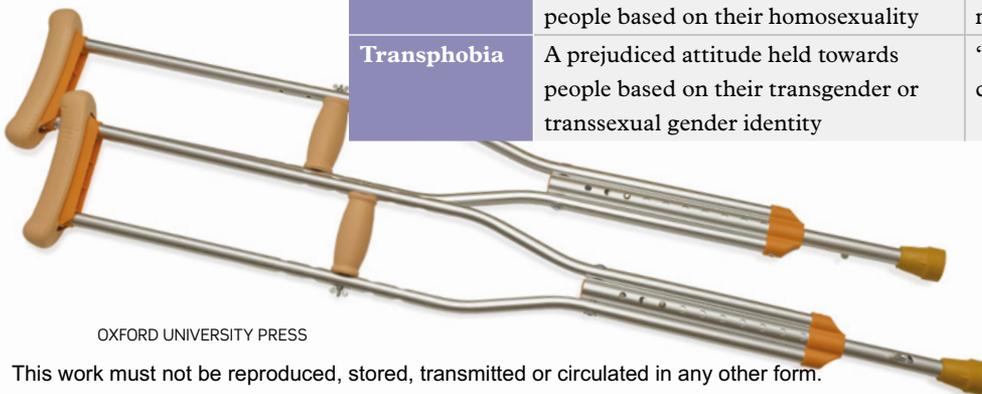
an attitude where people are evaluated and defined by their race, ethnicity, religion, gender identity, sexual orientation or other social group and its respective members

**Prejudice** is a negative or unfavourable attitude held towards a group of people that is founded on insufficient or incorrect information about the group concerned. Prejudice often stems from stereotypes (see Topic 7.1) or misinformation about religion, gender, sexual orientation, ethnicity, race, age and other social factors.

As prejudice is an attitude, it fits the tri-component model of attitudes, meaning that it consists of affective, cognitive and behavioural components. The affective component describes the feelings held about a group and the cognitive component describes any misinformed ideas, stereotypes or beliefs held about the group. Examples of prejudiced views are summarised in Table 1. The behavioural component of prejudice is called discrimination and occurs when a person acts on their feelings and beliefs about a group.

**TABLE 1** Summary of forms of prejudice

Common type of prejudice	Description	Example of prejudiced view
Sexism	A prejudiced attitude held towards a group, often women, based on their sex	“Women should not vote because their opinions are less valuable than men’s.”
Ageism	A prejudiced attitude held towards people, often elderly, based on their age	“People should not be allowed to drive after they turn 75.”
Ableism	A prejudiced attitude held towards people based on their disability	“People with disabilities should be taught in separate schools.”
Racism	A prejudiced attitude held towards people based on their race or ethnicity	“Asian international students should not be allowed to attend university in Australia.”
Homophobia	A prejudiced attitude held towards people based on their homosexuality	“Two men should not be allowed to get married.”
Transphobia	A prejudiced attitude held towards people based on their transgender or transsexual gender identity	“A trans person should not be allowed to change their pronouns.”

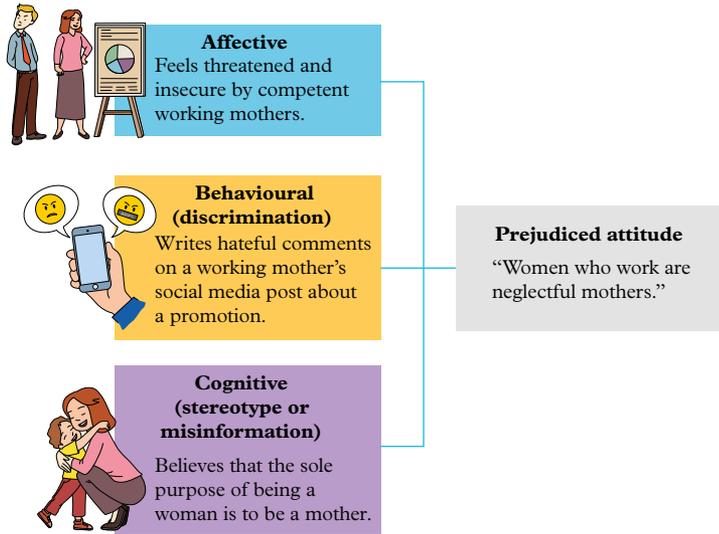


**FIGURE 1** Ableism is a prejudiced attitude held towards people based on their disability.

# Discrimination

**discrimination**  
unfair behaviour or unequal treatment towards others based upon their group membership or other characteristics

**Discrimination** is the act of expressing a prejudiced attitude towards an individual or group. For example, in Figure 2, a person holds the prejudiced view that “women who work are neglectful mothers” and expresses this attitude by writing hateful comments on a working mother’s social media post. In this scenario, the act of writing hateful comments is discrimination.



**FIGURE 2** The tri-component model applied to a prejudiced attitude

In Australia, antidiscrimination laws prohibit any form of discrimination based on age, disability, race, ethnicity, sex, pregnancy, marital status, family responsibilities, sexual orientation, gender identity and intersex status. Discrimination on these grounds is against the law if it occurs in contexts including work, education, getting or using services and buying or renting property. Different forms of discrimination include direct discrimination, indirect discrimination and intersectional discrimination.

## Direct discrimination

**Direct discrimination** arises from treating a person or group differently because of their characteristics. It is a clear behavioural expression of prejudice directed towards a person or group.

**direct discrimination**  
when a person or group is treated less favourably than others because of group membership or other characteristics

Examples of direct discrimination include:

- an employer not hiring someone because of their pregnancy
- a shop assistant refusing to serve Aboriginal customers
- extreme violence against people of specific religions, nationalities or sexual orientation.

In each of these examples, behaviours are intended to alienate or subordinate (treat as less important) people of a particular group. Direct discrimination is still prevalent in Australia, but it has reduced since the introduction of antidiscrimination laws by Commonwealth, state and territory governments, and the significant penalties that apply if the laws are breached. Reduced public tolerance for discriminatory acts, social and traditional media reporting of discrimination and improved education have also contributed to the reduced levels of direct discrimination.

## Indirect discrimination

**indirect discrimination**  
when an unreasonable rule or law that applies to everyone has an adverse effect that disadvantages a group or person because of group membership or other characteristics

**Indirect discrimination** (also known as modern discrimination) arises from treating a group or person in the same way as everyone else, which results in a group or person being disadvantaged or neglected. For example, consider a rooftop restaurant that can only be accessed via a staircase because there is no lift. People who rely on mobility aids such as walkers and wheelchairs are unable to attend the restaurant because they have been treated like able-bodied people. This has the effect of neglecting their individual needs and discriminating against them. Another example is a business rule requiring managers to work full-time. This indirectly discriminates against parents and guardians who work part-time to also care for their children, preventing these people from being considered for managerial positions.



**FIGURE 3** Indirect discrimination occurs when a group or person is treated the same way as everyone else, and this treatment neglects that group or person's specific needs.

Indirect discrimination is also prohibited by antidiscrimination laws. Discrimination is not illegal, however, when a rule or regulation imposes a reasonable requirement related to health and safety. For example, a law that requires drivers to have a certain level of vision would be considered a reasonable requirement and not discriminatory against people with low vision since it is enforced to promote road safety.

## Intersectional discrimination

**Intersectional discrimination** is when a group or individual faces more than one form of discrimination, placing them at greater disadvantage. This often occurs when a person belongs to more than one group that is commonly affected by prejudice. For example, a female person of colour (POC) facing discrimination in the form of sexism and racism when they are not considered for leadership positions because they are neither male nor white. Another example is an elderly person with a disability facing discrimination in the form of ageism and ableism when their opinions are ignored because of their age and disability.

**intersectional discrimination** when people experience overlapping forms of discrimination



**FIGURE 4** A female person of colour experiencing intersectional discrimination due to sexism and racism

# Stigma

## stigma

a negative social attitude or stereotype attached to a characteristic of an individual or group

## self-stigma

internalisation of the stigma or prejudice associated with stereotypes that leads to self-discrimination

## social stigma

society's or the general public's negative thoughts or actions in response to the stigma around a person or group

**Stigma** is a negative belief or stereotype associated with a specific characteristic, such as race, health condition, age, gender or sexuality. Stigma can lead to inaccurate beliefs and negative stereotypes becoming tied to individuals and groups. This can contribute to self-stigma and social stigma.

**Self-stigma** is when someone internalises negative stereotypes or feels ashamed due the stereotypes they are associated with. Examples of self-stigma include:

- a person feeling ashamed of their sexual orientation due to societal pressures to conform to heterosexual norms
- a person avoiding seeking mental health treatment due to their belief that seeking help is a sign of weakness
- a person believing that their chronic illness is a personal failure or a punishment for past behaviours.

**Social stigma** is the negative reaction of the public towards stigmatised individuals or groups, resulting in discrimination and differential treatment. Examples of social stigma include:

- refusing to hire someone with a mental health condition because of stereotypes about their ability to work
- avoiding someone with HIV/AIDS due to fear and misunderstanding about how the virus is transmitted
- refusing to sit next to a person on a bus who is wearing traditional religious clothing due to fear or discomfort of the unknown.

## Effects of prejudice, discrimination and stigma on mental wellbeing

Mental wellbeing refers to an individual's psychological state, including how they think, handle emotions and behave. Positive mental wellbeing allows a person to thrive in response to different conditions and challenges, leading to increased self-esteem, motivation, happiness and confidence, as well as improved decision-making and lower feelings of stress and anxiety. On the other hand, poor mental wellbeing can make it difficult for a person to cope with different challenges and experiences.

Prejudice, discrimination and stigma can have significant negative impacts on a person's mental wellbeing. These experiences can cause anxiety, depression, shame, guilt, low self-esteem and low confidence, as well as social isolation and exclusion. Prejudice, discrimination and stigma can also create barriers to accessing mental health services and other forms of support, which can make negative impacts on mental wellbeing worse. For example, individuals who have experienced racism may be less likely to seek mental health services due to fear of further discrimination or mistrust of the health-care system. Additionally, stigma may prevent individuals from seeking treatment for mental health conditions, leading to more severe mental wellbeing issues in the long term.

While prejudice and discrimination can harm mental wellbeing, they can also increase solidarity among the targets of discrimination, as they gain a greater sense of identity and affiliation with their group in response to shared experiences.

## Reducing the effects of prejudice, discrimination and stigma

The effects of prejudice, discrimination and stigma can cause significant harm to individuals and groups. Fortunately, social psychologists have identified effective means of breaking down harmful misconceptions and interactions that lead to prejudice, stereotypes and stigma. This includes the intergroup contact hypothesis, the extended contact hypothesis and education.

### The intergroup contact hypothesis

Studies of prejudice have identified that affiliation with an **in-group** is a key factor in the establishment and maintenance of prejudice. People who are prejudiced towards others often view themselves as members of a group, culture or subculture that is distinct from others in some way. This creates a sense of being part of an in-group. Membership of an in-group is determined by sharing a common identity or feature, such as race, ethnicity, religion, nationality, or even a common interest or hobby. People in the in-group tend to see themselves as belonging together and often have positive feelings towards each other.

#### **in-group**

a social group that an individual feels loyalty and respect towards due to membership



**FIGURE 5** An in-group is a social group an individual respects and is loyal to through membership, for example, a sports team.

On the other hand, an **out-group** refers to a group of people who are seen as different, or not part of the in-group. People in an out-group may be viewed negatively, stereotyped or discriminated against because of their perceived differences. Out-group members are often seen as lacking the qualities and values of the in-group, which reinforces the in-group's sense of identity and cohesion.

#### **out-group**

a group that an individual does not belong to or identify with

**intergroup contact hypothesis**

a theory used to reduce prejudice where members of an out-group and in-group meet and make sustained contact according to the preconditions of equal status, common goals, institutional support and cooperation

In 1954, Gordon Allport presented the **intergroup contact hypothesis**, which proposed that contact between members of different groups, under certain conditions, can reduce prejudice and promote positive intergroup attitudes. According to the intergroup contact hypothesis, several conditions can influence the effectiveness of intergroup contact and harmony. These are outlined in Table 2.

**TABLE 2** Conditions for the intergroup contact hypothesis to succeed

Preconditions	Explanation	Example
Equal status	When groups are regarded as being of the same worth or value in society. When groups perceive themselves to be of equal status, they are more likely to engage in positive interactions with one another.	Employees of different ethnic backgrounds are all given equal opportunities for advancement and recognition at a workplace.
Common goals	When groups need to work together to achieve a mutual goal or interest, they are more likely to work together and see each other as allies rather than enemies.	Liberal, Labor and Greens political party members working together to advocate for a policy that they all support.
Institutional support	When authorities support intergroup contact to help to facilitate positive interactions between groups.	A company adopts an antidiscrimination policy to reduce and prevent discrimination at work.
Cooperation	When group members work together in a non-competitive environment, they are more likely to break down barriers and develop positive attitudes towards each other.	Individuals from different religious backgrounds support each other in a local mothers group.

The conditions in Table 2 help in-groups and out-groups to interact in ideal conditions. Intergroup contact allows members of each group to learn about each other and form a more accurate understanding of each other, compared to what is provided by false beliefs and stereotypes that form the basis of prejudice.

**The extended contact hypothesis**

**extended contact hypothesis**

a theory suggesting that prejudice can be reduced by an in-group member sharing positive information about an out-group member that challenges the exclusionary ideas held by the in-group

The **extended contact hypothesis** (Wright et al., 1997) builds on the intergroup contact hypothesis by suggesting that even indirect contact with members of an out-group can reduce prejudice and improve intergroup relations. The theory suggests that if a person simply hears positive things about an out-group member from a fellow in-group member, it can help reduce prejudice towards the out-group. This is because the positive view challenges the stereotype that all members of the out-group are bad or inferior, and instead shows that out-group members can have positive relationships with members of one’s in-group.

Imagine you are on a local football team that has a heated rivalry with the neighbouring suburb’s team. Due to the existing rivalry, you feel that rival team members are all rude, play dirty and disrespect the game. When a teammate of yours tells you that their cousin is on the rival team and that he is a nice guy who plays fair and loves the game, the negative feelings you have towards the rival team lessen. This example shows how even indirect positive contact between groups can help reduce negative attitudes and improve intergroup relations.

## Education

Prejudice, discrimination and stigma can all arise from people believing false information and stereotypes about groups. Education can play an important role in reducing stigma, prejudice and discrimination by providing individuals with accurate information, challenging stereotypes and misconceptions and by promoting positive attitudes towards marginalised groups. For example, in the early years of the human immunodeficiency virus (HIV) and acquired immunodeficiency syndrome (AIDS) epidemic, HIV and AIDS were heavily stigmatised due to a lack of understanding about how the virus spread and which populations were most affected. Not only was there stigma around the conditions, but affected individuals and groups were also subject to high levels of prejudice and discrimination. Large-scale public education campaigns and community outreach were able to increase awareness and understanding about HIV and AIDS. Today, there is significantly less stigma surrounding HIV and AIDS, and individuals affected have better access to treatments and support. Education and awareness campaigns have also helped to reduce the spread of HIV and AIDS by promoting safe practices and harm-reduction strategies.



**FIGURE 6** The city of Melbourne preparing for World AIDS Day, a day that raises awareness about the issues surrounding HIV and AIDS

## 7.4 REAL-WORLD PSYCHOLOGY

### Eddie Betts and Wayne Milera Junior recall instances of prejudice

*The following contains extracts from an Adelaide Crows Football media interview from 3 July 2019.*

In 2019, several AFL players reported experiences of discrimination.

The issue prompted Crows players Wayne Milera Junior and Eddie Betts to open up about their own experiences of prejudice ...

Speaking to AFC Media, both players recalled moments in which they felt racially stereotyped when visiting a bank. Betts described a time when he visited a Victorian bank to withdraw a five-figure sum of money.

Despite the bank teller confirming his ID, Betts said the manager was not satisfied.

“I showed my ID and the manager walked past and looked at me,” Betts said. “He looked at me again and asked the lady, ‘Is the ID okay? Are you sure it all matches up?’

“She goes, ‘yeah, yeah, it’s fine’. Then he came back again – ‘You sure that’s lining up with the same ID?’. All because I was getting 10 grand out of the bank.”

Milera recounted a similar time where he felt racially stereotyped by a bank teller, who made the incorrect assumption the 21-year-old was presenting as a welfare recipient. The truth was, Milera was there to obtain a housing loan.

“I needed to get a one-month bank statement, just a transaction record of the last month,” he said.

“I get to the counter. I’m getting served by this lady and a couple comes in. The lady stops serving me and goes and serves the other people. I didn’t really think too much, I just thought that was pretty rude.”

Milera waited patiently for 10 minutes before the teller resumed serving him.

“She said ‘What do you need it for?’ I said, ‘I just need the one month,’” he said.

“She said, ‘Do you just need it for Centrelink?’

“She assumed I’d need it for Centrelink, to go take it to Centrelink. I thought that was pigeonholing Aboriginal people that all of us are on Centrelink, or all of us are dole bludgers.

“I said ‘no, it’s not actually. It’s for a house loan.’”



FIGURE 7 Eddie Betts

The bias may be unconscious, but for Wayne, the impact of being racially stereotyped was profound.

“Personally, for myself, once it happens to you it puts you in a real down sort of place,” Milera said.

“You can go from being really happy to just be feeling like a lesser person when you’re vilified, or something’s happened to you.”

### Apply your understanding

- 1 Describe the discriminatory behaviour that was displayed towards Betts.
- 2 Describe the discriminatory behaviour that was displayed towards Milera and the stereotype that underpinned this discrimination.
- 3 Explain whether the discrimination experiences described by Betts and Milera are examples of direct or indirect discrimination.
- 4 Milera states, “You can go from being really happy to just be feeling like a lesser person when you’re vilified, or something’s happened to you.” Explain how stereotypes can lead to stigma.

## 7.4 CHECK YOUR LEARNING



### Describe and explain

- 1 Define the terms “prejudice”, “discrimination” and “stigma”.
- 2 Explain the relationship between prejudice and discrimination.
- 3 Outline how prejudice can be influenced by stereotypes and attitudes.
- 4 Describe the effects of prejudice and discrimination upon mental wellbeing with the use of a relevant example.

### Apply, analyse and compare

- 5 Analyse how prejudice can be reduced using the intergroup contact hypothesis.
- 6 Comment on how extended contact may be used to address prejudice between an in-group and out-group of your choice.

- 7 Compare direct and indirect discrimination and the adverse effects upon the individual and groups in society.

### Design and discuss

- 8 “Prejudice and discrimination are naturally occurring thoughts and behaviours that will always occur.” Discuss this statement.
- 9 Conduct research on how and where discrimination and prejudice is evident in modern society. What are the out-groups that are experiencing this discrimination and what is being done to address it? Discuss your findings.

## Chapter summary

- 7.1** • Social interactions involve processes of social cognition.
- Person perception, attributions, attitudes and stereotypes contribute to social cognition and affect interpersonal interactions.
- Decision-making in interpersonal interactions is affected by social cognition.
- 7.2** • Cognitive dissonance is an unpleasant state and occurs because of inconsistent cognitions.
- Cognitive biases can be used to reduce or resolve cognitive dissonance.
- Cognitive biases often occur automatically without our awareness.
- 7.3** • Heuristics are part of our social cognition, and are integral for us to quickly make decisions and solve problems that involve social interactions.
- The use of heuristics is prone to errors and biases, which can negatively affect social interactions.
- 7.4** • Prejudice, discrimination and stigma are based on stereotypes and inaccurate information.
- Prejudice, discrimination and stigma can negatively affect the mental wellbeing of individuals and society as a whole.
- Factors that contribute to prejudice, discrimination and stigma can be systematically addressed to remove misconceptions about other people and groups.

## Revision questions

### Multiple choice

- 1 Peta is dropping her children off at school. On the way, she watches as another mother hugs and kisses their child before waving goodbye. Shortly after, Peta is in the café when the same mother that was at the school enters and greets Peta. Peta is likely to infer that the mother:
  - A is a nice person due to her internal attributions of the mother.
  - B is a nice person due to her prejudice towards the mother.
  - C is a nice person due to her discrimination towards the mother.
  - D is not a nice person due to her external attributions of the mother.
- 2 The tri-component model of attitudes proposes that:
  - A all attitudes are dependent on the behavioural component.
  - B an attitude consists of an emotional, cognitive and psychological component.
  - C all attitudes must have components that are congruent with each other.
  - D an attitude consists of an affective, cognitive and behavioural component.
- 3 Rema has just joined a new gym to develop her strength and endurance. On her first visit, she sees other women at the gym and immediately thinks that they are also there to develop strength and endurance. Rema's assumption of the other women in the gym is based on which cognitive bias?
  - A Halo effect
  - B Self-serving bias
  - C False-consensus bias
  - D Anchoring bias
- 4 Which of the following best describes cognitive dissonance?
  - A An unpleasant psychological state due to inconsistent cognitions
  - B An unpleasant physiological state due to inconsistent attitudes
  - C A state of discomfort due to anxiety and attitudes
  - D A state of discomfort due to inconsistent affects
- 5 Neil has arrived in Hong Kong and, upon checking in to his hotel, is surprised by how well the receptionist is able to speak English. This is because of:
  - A Neil's stereotypes.
  - B Neil's cognitive dissonance.
  - C Neil's discrimination.
  - D Neil's self-schema.
- 6 According to the intergroup contact hypothesis, which of the following preconditions must be present in order to reduce prejudice?
  - A Cooperation, institutional support, common goals and equal status
  - B Legislation, commonality, equal status and shared goals
  - C Competition, adversity, commonality and cooperation
  - D Generalisation, recognition, attributions and likeability
- 7 Discrimination is \_\_\_\_\_, whereas prejudice is \_\_\_\_\_.
  - A a negative attitude towards an out-group; unfair and unequal treatment towards others
  - B a negative behaviour; a negative attitude towards an out-group
  - C unfair and unequal attitudes towards others; a negative cognition towards an out-group
  - D unfair and unequal treatments towards an out-group; a negative attitude towards an out-group



- 8 Decision-making in social interactions that is based on emotions rather than facts or cognitions involves the use of:
- A the representativeness heuristic.
  - B the affect heuristic.
  - C the availability heuristic.
  - D the anchoring heuristic.
- 9 Claire works as a fashion reporter for a reputable fashion magazine. Whenever she interviews someone, one of the first things that she notices about a person is the clothes that they wear. This is due to:
- A priming.
  - B saliency detection.
  - C physical cues.
  - D stereotyping.
- 10 Social categorisation involves:
- A attitudes held towards a person.
  - B the schemata of others.
  - C grouping people according to impressions formed over time.
  - D external attributions.

### **Short answer**

#### **Describe and explain**

- 11 Priya always enjoys cycling, especially with her friends as it makes her feel relaxed. She goes on bike rides daily and knows that it is beneficial for her health and social wellbeing.
- Identify the three components of Priya's attitude towards cycling.
- 12 Describe how physical cues and saliency detection can contribute to person perception.
- 13 Outline how attentional bias and self-serving bias can affect cognitive dissonance.
- 14 Define the term "heuristic".
- 15 Outline the effect of discrimination upon mental wellbeing.

### **Apply, analyse and compare**

- 16 Matt is a professional mediator who has been asked to work with a company that has concerns with its workers. The workers have, over the years, formed groups among themselves that have resulted in discriminatory behaviours occurring in the workplace.
- Outline and justify the strategies that Matt can use to reduce discriminatory behaviour in the workplace.
- 17 Compare internal and external factors that contribute to attributions.
- 18 Analyse how person perceptions are formed and how they contribute to decision-making in social interactions with others.
- 19 Stavros has recently immigrated from Greece to Australia. While he has some family in Australia, he is largely unfamiliar with the country and its culture and is only aware of what others have told him about Australia and Australian society.
- Comment on how Stavros may use stereotypes as he settles into Australia and forms new relationships with others, and the issues that may arise due to this use of stereotypes.
- 20 Distinguish between actor–observer bias and confirmation bias as ways of addressing cognitive dissonance.
- 21 Jameela works as a security guard for a popular night club. Part of her job requires her to manage who enters the night club in order to keep a balance of genders in the club, as well as to prevent individuals and groups of people who may cause trouble from entering.
- Analyse how the availability and representativeness heuristic will be used by Jameela in fulfilling her job as a security guard.

**22** In-groups and out-groups are commonly involved in situations where prejudice occurs. Define what an in-group and out-group is, and comment on why prejudice occurs between these groups.

**23** Compare self-stigma and social stigma using examples.

**Design and discuss**

**24** Using an example, discuss how education could be used to reduce the occurrence of prejudice, discrimination and stigma.

**25** Discuss the extent to which the tri-component model of attitudes can explain social cognition.

**26** “The use of stereotypes in determining how one should behave results in more positive than negative outcomes.” Discuss this statement.

**27** With the use of relevant examples, critically evaluate the use of cognitive bias as a way of reducing cognitive dissonance.

**28** Discuss the importance of person perception in analysing others and decision-making in social interactions.

**29** Discuss how the intergroup contact hypothesis and extended group hypothesis could be used to reduce the occurrence of prejudice and discrimination that has occurred due to a rivalry between two schools.

You can find the following resources for this section in your obook pro:

pro

**Quizlet**

Compete in teams or against yourself to test your knowledge.



**Chapter quiz**

Test your understanding of key knowledge in this chapter.



**Chapter checklist**

Rate your understanding of key knowledge in this chapter.

CHAPTER

# 8

## Factors that influence individual and group behaviour

### KEY KNOWLEDGE

- the influence of social groups and culture on individual behaviour
- the concepts of obedience and conformity and their relative influence on individual behaviour
- positive and negative influences of different media sources on individual and group behaviour such as changing nature of social connections, social comparison, addictive behaviours and information access
- the development of independence and anti-conformity to empower individual decision-making when in groups.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

### GROUNDWORK

This topic will build on concepts you have come across in Chapter 7. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.

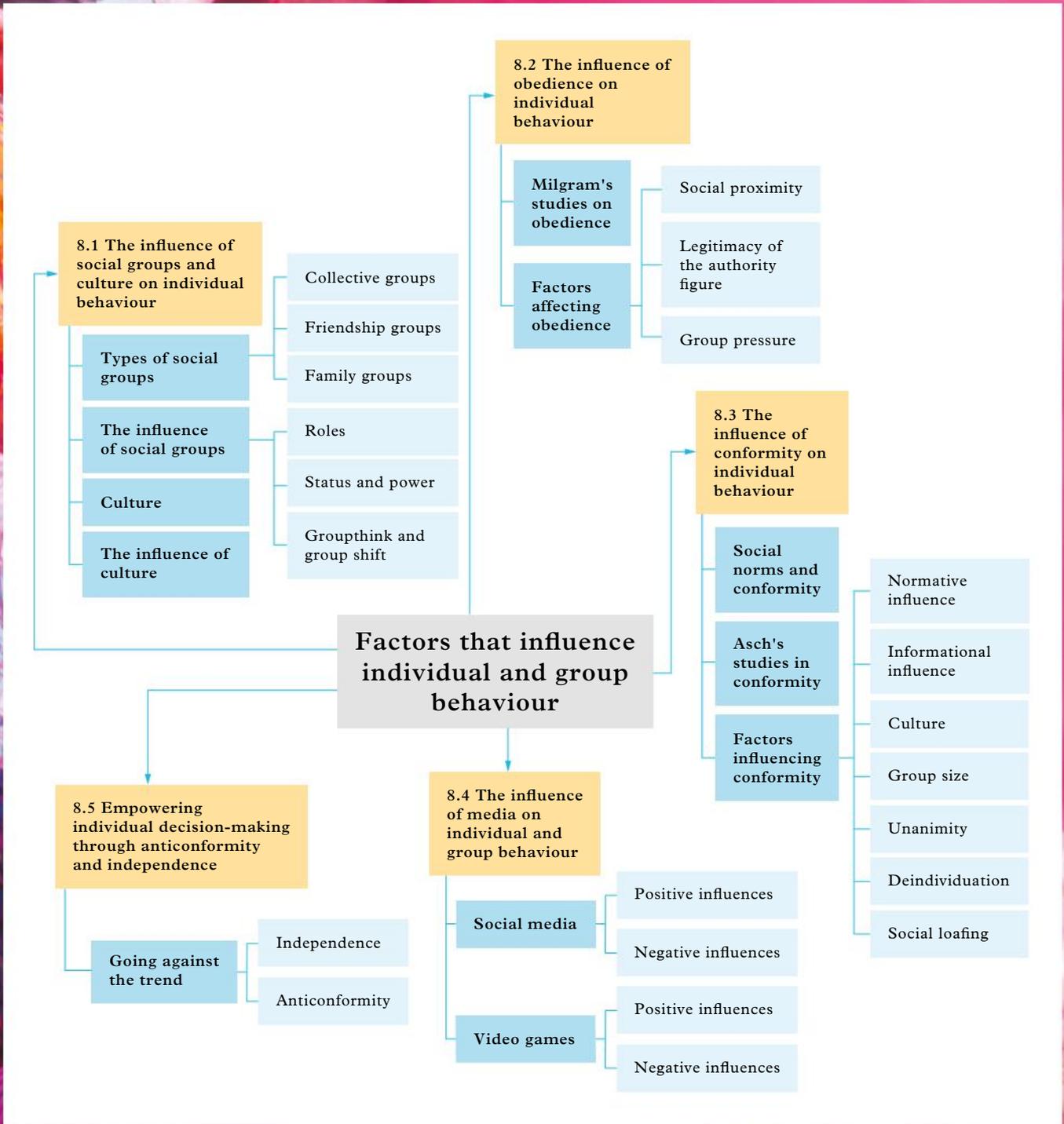


### INVESTIGATIONS

<b>8.4A</b>	<b>INVESTIGATION: CORRELATIONAL STUDY</b>	Is there a relationship between time spent on social media and perceived social connectedness?	Page 486
<b>8.4B</b>	<b>INVESTIGATION: CASE STUDY</b>	How can advertising affect our individual behaviour?	Page 487

FIGURE 1 The cultures we belong to and engage with can influence our individual behaviour and thinking.

# CONCEPT MAP



# 8.1

## The influence of social groups and culture on individual behaviour

### KEY IDEAS



- ✦ Members of social groups can have varying levels of status and power, both of which can influence individual behaviour and group behaviour.
- ✦ Groupthink and group shift are two phenomena that can influence decision-making in groups.
- ✦ Cultural norms can both encourage and discourage us to behave and think in certain ways.

Do you think of yourself as a leader or someone who follows the crowd? Do you feel you influence others, or are you someone who is easily influenced by others? From the moment we are born, we become part of a network of social groups that interact and rely on each other for different needs. Our dependence on social groups influences the emotions, cognitions, behaviours and attitudes we experience. This influence shapes a significant portion of our identity and sense of self. Social groups we rely on include:

- family
- friends
- classmates
- co-workers
- teammates
- colleagues.

You might have noticed that when interacting with these different groups you act differently. For example, when you are hanging out with your friends you might behave differently to how you behave around your parents. Social influence is how we change our behaviour due to the influence of others. In this topic we will explore how our decision-making, thought processes and behaviours are influenced by social groups and culture.

### Types of social groups

A **group** is a collection of two or more individuals that:

- interact with each other over a period of time
- influence each other
- strive to achieve mutual goals.

Advances in technology and changes to social norms have provided new opportunities to communicate and interact with others in groups. As individuals we often belong to or are affiliated with more than one group. We are also likely to drift into and out of different types of social groups throughout our lifespan.

#### Collective group

Groups can be categorised by the way that members interact with each other and the purpose of their interaction. A **collective group** consists of two or more individuals who have minimal interaction with each other, but still influence each other and share similar goals. For example, by attending a football match and cheering on a team, you become a member of a collective group that all barrack for the same team (Figure 1). Though the interaction with the people around you may be brief, in that moment they can influence you to cheer louder or affect your mood. Your common goal is supporting your team.

#### group

a collection of two or more individuals who interact with each other, are aware of their membership in the group and strive to achieve mutual goals

#### collective group

a group type of two or more individuals who have minimal interaction with each other, yet still influence each other and share similar goals



**FIGURE 1** Australian fans at a Wallabies game

## Friendship group

A **friendship group** consists of two or more individuals who share positive interactions, have norms or standards of behaviours, share similar attitudes and possess unique traits (idiosyncrasies), such as specific language, slang, body movements or image symbols (for example, a dress code). Most adolescents belong to a friendship group and often shift between friendship groups over time (Figure 2). Friendship groups may also consist of **cliques**, smaller collections of friends who can better communicate with each other, experience greater levels of attachment and engage in more interactions.



**FIGURE 2** Throughout your adolescence you may shift between your friendship groups.

**friendship group**  
a group type of two or more individuals who share positive interactions, have norms or standards of behaviours, share similar attitudes, and possess idiosyncrasies

**clique**  
a group type consisting of a smaller number of friends, often of similar age and gender, who are able to communicate more easily with each other and have more significant levels of attachment and complex interactions

## Family group

Membership of a **family group** is based on blood, marital, adoptive or other personal ties (Figure 3). Family groups are often considered to be the most fundamental social group, as most human societies and cultures have been built around family. Family group members also tend to experience higher levels of attachment to each other and more complex interactions.



**FIGURE 3** Membership of a family group is based on blood, marital, adoptive or other personal ties.

**family group**  
a group type where membership is based on blood or by marital, adoptive or other intimate ties

## The influence of social groups

Social groups can affect the way we think, feel and make decisions and ultimately affect the behaviours we display. How group members influence us and vice versa depends on the roles of each group member and the status and power that exists within a group.

### Roles

**Roles** are behaviours adopted or allocated to people in a group that carry an expectation of how certain individuals should behave in different situations for the benefit of the group. For example, a friendship group might have one person who is the main instigator for planning group meet-ups – this person could be seen to have a role as an organiser for the group. When the friendship group is planning a trip, that person might be expected to do the majority of the planning due to their role in the group. Another member of the friendship group might be particularly talented at getting other members to reconcile after arguments; this member of the group could be seen to have a role as a mediator.

Roles can be informal and implicit, such as the unspoken agreements that exist within a clique or group of friends, or formal and explicit, such as the official codes adopted by colleagues in a workplace. Roles are not always equal in a group. Some group members may be perceived to have roles that are of greater importance than others.

### Status and power

**Status** is an individual's position in a group, relative to others. Positions that are perceived by the group to be of greater importance or warrant more respect are considered to have greater status.

People in positions of higher status also have an increased ability to influence others in the group by initiating ideas and activities that the group will adopt. This capacity to influence others' thoughts, feelings and behaviours, as well as being able to resist the influence of

others on themselves, is known as **power**. Group members who have higher status often have a greater influence, or power, within a group. For example, a famous artist such as Taylor Swift (Figure 4) would be perceived by her fanbase to hold great importance and high status, which gives her greater power to influence her fans.

High-status roles within a group are not always fixed, but can vary over time and across different situations. For example, in an English class a student who consistently achieves the best marks may be perceived by the class to have the highest status based on their academic ability. However, in a physical education lesson with the same class, a different student who is more athletically gifted and a great team leader may be perceived by the same peers to have the highest status.



**FIGURE 4** Taylor Swift has a lot of power to influence her die-hard fans, or “Swifties”.

#### role

pattern of behaviour that distinguishes between different activities within the group that are done for the greater good of the group as a whole

#### status

the position a person holds in a group or society relative to others

#### power

the capacity to influence others and resist attempts of influence by others

Shifting of status and power within groups across situations is best explained through the expectation states theory (Correll & Ridgeway, 2003). This theory proposes that status is derived from two distinct sources:

- Specific status characteristics are directly related to ability on a group task. For example, the captain of a football team obtains a higher-status role due to displaying characteristics that benefit the team such as athleticism, leadership and the ability to motivate players.
- Diffuse status characteristics are not directly related to ability on a group task but are thought to have either positive or negative value, which can affect status. For example, an older candidate is selected to lead a workforce because they are seen to have more wisdom due to their age and experiences.

Group members with higher status are also able to use different types of power as they influence others in groups. Psychologists John R P French and Bertram Raven (1959) suggested that there are six power dynamics that can be used to influence others.

**TABLE 1** French and Raven’s (1959) six power dynamics

Type of power	Explanation	Example
Reward power	The ability to give or promise rewards in return for compliance	A parent giving their child money for cleaning their room
Coercive power	The ability to give or threaten punishment for non-compliance	A teacher giving a detention to a student who misbehaves in class
Informational power	The belief that the individual has more information or resources than others	A professor in the field of aerospace engineering providing advice to others about aircraft design
Expert power	The belief that the individual has greater expertise and knowledge than others	A neurosurgeon conducting brain surgery on a patient and managing a group of other surgeons during the operation
Legitimate power	The belief that the individual is authorised by a recognised power structure to command and make decisions	A police officer who is granted the power to arrest through relevant legislation (laws)
Referent power	Attraction to, identification with, or respect for the individual	A social media influencer who you admire for their fashion sense



**FIGURE 5** Reward power is the ability to provide rewards such as money, promotions and gifts in return for compliance.

Power dynamics can be used individually, or in combination with others. For example, teachers can use reward power by praising good behaviour, as well as coercive power by imposing a detention for misbehaviour. Law enforcement officers have legitimate power given to them by government: coercive power to arrest those breaking the law, and informational power to assist victims of crime and resolve issues.

The relationship between status and power was made clear in research conducted by psychologist Philip Zimbardo. His experiment, famously known as the “Stanford prison experiment”, is outlined in Real-world psychology 8.1. It highlighted how easily changes in status, power, roles and social expectations can alter the way people behave and treat others. The inferences and conclusions from Zimbardo’s research have also been used to explain the way changes in status led to horrific abuses of power in the war prison, Abu Ghraib, as well as other settings where individuals have been placed in positions of high status over others.

## 8.1 REAL-WORLD PSYCHOLOGY

### The Zimbardo Stanford prison experiment

A prison environment is one that has clearly established roles: prisoners are of low status and have little to no power, while prison guards are of high status and have significant power. In 1971, US psychologist Philip Zimbardo conducted the Stanford prison experiment to observe how status and power influenced people in a simulated prison environment. While it was intended to last for two weeks, the experiment was terminated after six days due to the experimenter losing control of participant behaviour and the distress experienced by some participants. Today the experiment is used as an example to explain how status and power can influence behaviour in groups.

#### Aim

The aim of the experiment was to examine whether participants would conform to the social roles of a prison guard or prisoner, when placed in a simulated prison environment.

#### Method

##### Participants

Participants were all healthy, young male students from Stanford University. They were selected from a pool of 75 people who responded to a newspaper advertisement requesting participants to take part in a paid study investigating the prison experience. Of the 75 respondents, 24 were selected after a series of interviews and physical tests. Participants were paid US\$15 for their participation in the experiment.

Eighteen participants were randomly allocated into one of two roles: prison guard or prisoner. Prison guards possessed higher status and power, while prisoners were afforded limited to no status and power. The remaining six participants were placed as reserves in case participants withdrew from the study. Zimbardo played the role of the Prison Superintendent.

##### Materials

To enhance the reality of the experiment, prison guards were dressed in khaki uniforms and given batons, whistles and reflective sunglasses to hide their identity (Figure 6). Prison guards were given significant freedom by Zimbardo to develop rules and methods to maintain control and order over prisoners.

The simulated prison itself was constructed in the basement of Stanford University. Doors were replaced with cell doors that could be locked from the outside, “cells” had limited furnishings, such as beds and chairs, and had no windows or access to natural light. A small janitor’s closet was converted into a small cell that could be used for “solitary confinement”.

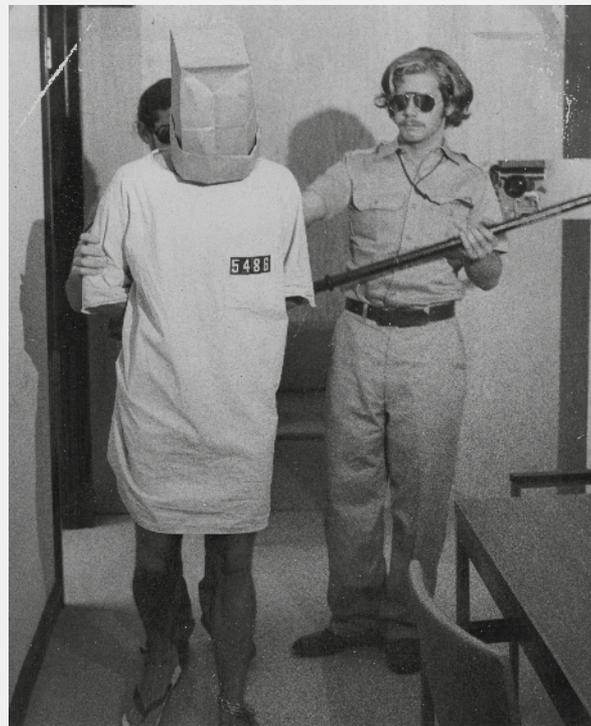


FIGURE 6 A participant dressed as a guard

## Procedure

Participants who were assigned the role of prisoners were mock-arrested from their homes by local police. They were then taken to the police station and fingerprinted, charged and driven to the simulated prison (Figure 7). At the prison they were strip-searched, sprayed with head-lice powder, and issued a uniform (a short, dress-like robe with no underwear) before being placed in a cell with two other inmates. Each prisoner was assigned a number which, in combination with the uniform, served to deindividualise the prisoners, stripping them of their identity.

Zimbardo instructed prisoners that they had to obey all instructions from the guards, ask permission to use the toilet, and to refer to themselves only by their prison numbers. Prisoners also had to refer to prison guards as “Mr Correctional Officer”.

Zimbardo played the role of Prison Superintendent in the experiment, the person who oversaw the running of the prison and the prison guards. This role that Zimbardo adopted at the time affected his ability to make impartial decisions, as well as uphold certain ethical considerations of the study.



**FIGURE 7** Zimbardo played the role of Prison Superintendent in the experiment.

## Results

After day one, the prison guards began to exert their power over prisoners. More power over prisoners was exerted the second day when prisoners staged a small rebellion and were subsequently reprimanded by the guards. The prison rebellion itself displayed participants’ unwillingness to adopt the low-status role of “prisoner”.

Over the course of the first week, the guards’ power over prisoners continued to increase. Guards controlled the behaviour of prisoners by ordering them to clean bathrooms with bare hands, refrain from smiling or laughing, stay awake when sleep deprived, spend time in solitary confinement and do push-ups. Prisoners were also subjected to humiliating acts, such as being forced to defecate in a bucket in their “cells” rather than being allowed to go to the bathroom.

During this time prisoners became increasingly distressed, traumatised and humiliated by the prison guards. By day four, four prisoners were “released” for reasons including confusion, anxiety, stress and depression. These four participants, however, were not automatically withdrawn from the study as Zimbardo initially refused to allow the participants to leave. Prisoner behaviour progressively became more passive and submissive to the prison guards’ commands.

By the sixth day the prison guards were completely immersed in their roles, to the point where they began to abuse their power through systematic psychological torture of the prisoners. This was particularly evident during evenings when prison guards believed they were not being observed (the whole experiment was recorded through closed-circuit television). Prisoners had also become fully immersed in their roles and were completely submissive to the prison guards. Due to several factors, including the guards’ abuse of prisoners, Zimbardo’s loss of control over the experiment and criticisms of the experiment by another Stanford University psychologist, the experiment was terminated on day six.



## The significance and criticisms of the experiment

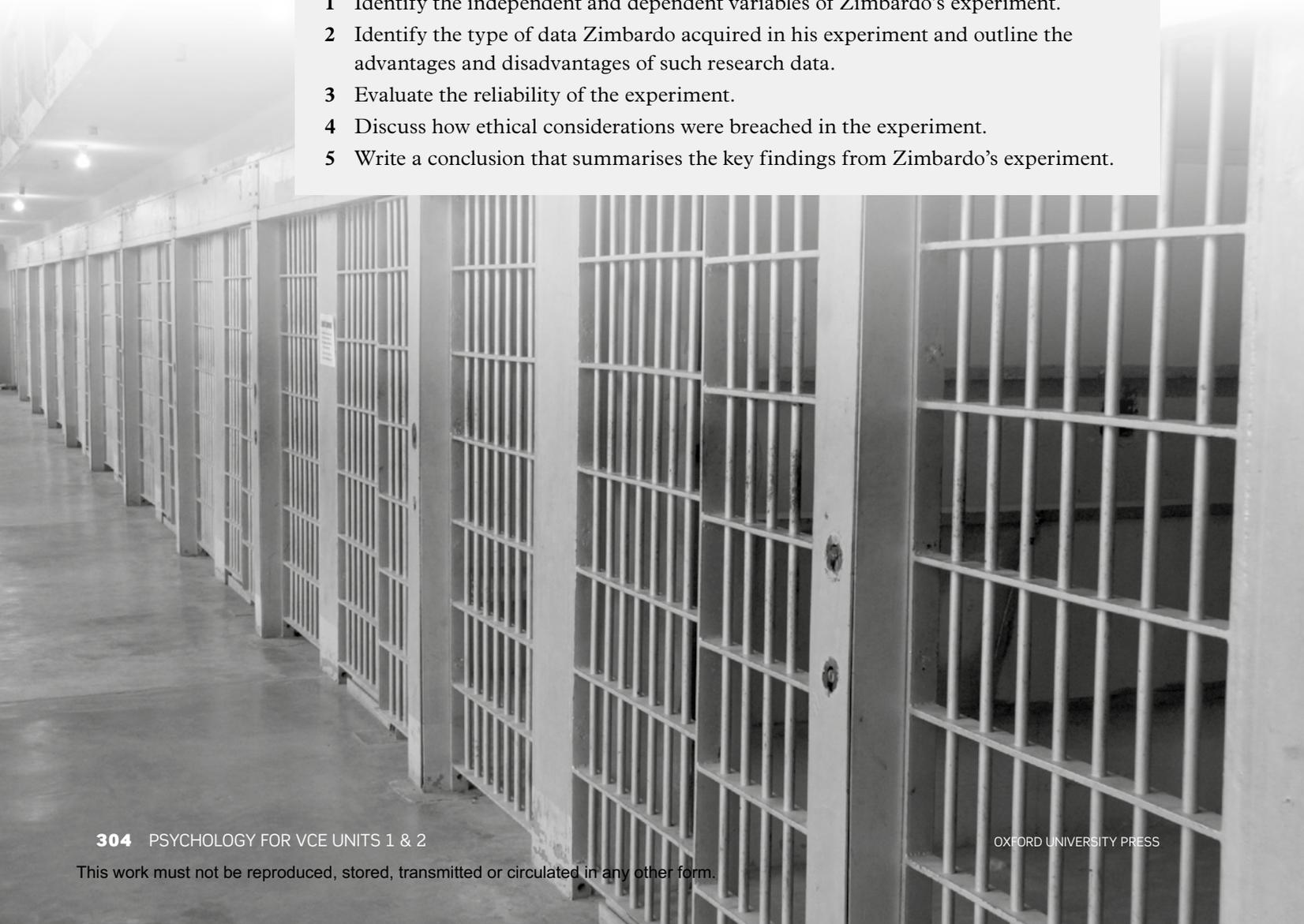
Zimbardo's experiment made a number of important findings:

- that individuals readily conform to the social roles that are expected of them
- that individuals will easily adopt roles despite the significant changes that such roles may have upon the behaviour, cognition and emotion of an individual
- that individuals who have high-status roles will use power to influence behaviours, irrespective of the adverse consequences and distress of others
- that group expectations of the individual will make it easier for an individual to give up their sense of individuality and identity.

The Stanford prison experiment is an example of the adverse effects that can occur when ethical considerations are breached in an experiment. Ethical considerations of the no-harm principle, withdrawal rights, debriefing and beneficence were all breached. After the experiment concluded participants faced adverse effects of distress, anxiety, trauma and depression. Moreover, Zimbardo's active participation in the experiment and subsequent inability to appropriately uphold ethical considerations highlighted the need for experimenters to remain impartial and separate from experimental conditions.

### Apply your understanding

- 1 Identify the independent and dependent variables of Zimbardo's experiment.
- 2 Identify the type of data Zimbardo acquired in his experiment and outline the advantages and disadvantages of such research data.
- 3 Evaluate the reliability of the experiment.
- 4 Discuss how ethical considerations were breached in the experiment.
- 5 Write a conclusion that summarises the key findings from Zimbardo's experiment.



## Groupthink and group shift

Roles, status and power are not the only factors that can influence an individual's behaviour and decision-making in groups. Social psychologists have also found that phenomena such as groupthink and group shift can also influence individuals in group settings.

### Groupthink

Have you ever been in a situation where your friends decide to do something you think is a bad idea, but you just go along with it? **Groupthink** occurs when individuals in groups make decisions that are aligned with what the group decides, even though they do not agree with the decision or believe that it is not the best decision to maintain group harmony. Groupthink can occur when:

- a group has an exaggerated sense of confidence or morality
- a group is tight-knit, cohesive and has a belief that all group members think alike
- group members actively suppress differing opinions
- leaders in the group take a clear position early in decision-making processes.

These conditions can put pressure on an individual to agree with group decisions and influence the behaviour and decision-making of the individual. Pressure to agree can stem from the fear that disagreements will result in negative reactions from other members of the group and/or upset the positive dynamics of the group. For example, Carlos is a student completing group work with his classmates. One of the group members, Jimi, has taken the lead and assigned work to different group members. Carlos disagrees with the process and distribution of work, but the rest of the group all agree with Jimi's plan. Carlos decides not to voice his concern or suggest a different way of approaching the work to avoid confrontation and maintain harmony within the group.

The consequences of groupthink include:

- lack of creativity or individual thinking within groups
- bad group decisions due to lack of criticism and critique
- overconfidence within the group.

Groupthink has led to catastrophic incidents in the past. In 1986, a NASA space shuttle called the *Challenger* was scheduled to depart on a space orbit mission (Figure 8). Unfortunately, 73 seconds after launch initiated, the shuttle exploded due to a part failure. An investigation following the explosion found that groupthink played a role in the mission failure. Executives of the mission had prioritised launching on time to satisfy media expectations over waiting and gathering more data to confirm the safety of the part that malfunctioned. This ultimately led to the mission's demise and resulted in the deaths of all astronauts on board.

**groupthink**  
a phenomenon that occurs in groups where group decision-making suppresses individual opinions in the interest of positive group dynamics



**FIGURE 8** Launch of the *Challenger* space shuttle on 28 January 1986, before its failure

## Study tip

Next time you are in a group, such as a sporting team, classroom or your friendship circle, look to see if you can pick up examples of groupthink, power, status and other concepts from this topic. This can give you a range of relevant examples to draw back on and help you remember concepts from this topic!

## 8.1 CHALLENGE

### Groupthink and bad decisions

The phenomenon of groupthink has led to people making poor decisions in groups that result in catastrophic outcomes. One example of this is the 1986 explosion of the NASA space shuttle, *Challenger*. The shuttle exploded due to a series of poor choices and group dynamics that were associated with the phenomenon of groupthink.

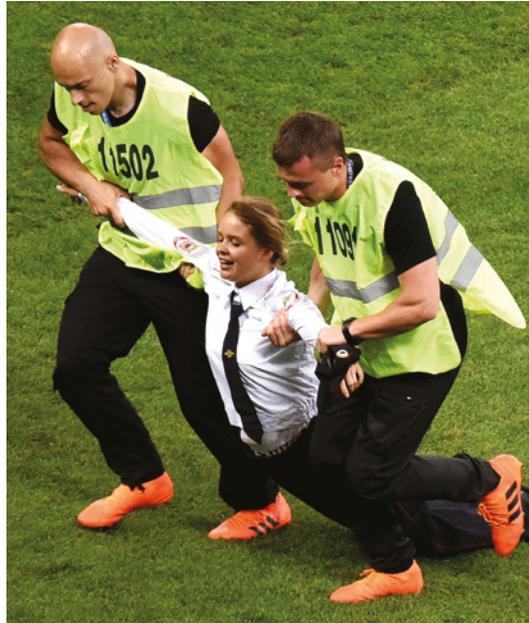
- 1 Conduct your own research to find other historical events that were a result of groupthink and subsequent poor decisions made by those involved. Outline the series of events that led to the adverse outcome in the event.
- 2 Discuss how the phenomenon of groupthink could have been avoided in the historical event you have chosen.

### group shift

a phenomenon that occurs in groups where an individual's behaviours and decision-making are more exaggerated

### Group shift

Another phenomenon that describes how groups can influence individual decision-making is group shift. **Group shift** is a subset of groupthink that occurs when an individual's interactions in a group cause them to display more extreme or exaggerated behaviour and decision-making. Group shift can cause an already timid individual to act even more timidly,



**FIGURE 9** Group shift can cause a person to act in more extreme ways than they would act in outside the group.

or an aggressive individual to become more aggressive. Group shift causes the person to make decisions and show behaviours that differ to those they would make or show outside of the group situation. Factors that can influence group shift to occur include when members of the group exaggerate a situation and when extreme decisions are met with excitement by the group.

For example, consider a group of sports fans after their team loses a final. The loss might trigger the group to engage in public demonstrations with small amounts of aggression, such as swearing in frustration or booing the team. A fan with already-aggressive tendencies may experience group shift if their behaviours shift towards more aggressive acts than they would usually engage with outside of the group, such as rioting or getting into fist fights.

## Culture

**Culture** often refers to the customs, values, attitudes, beliefs, knowledges, behaviours and other characteristics that are shared among members of a particular group or society. Many different elements can be central to a culture including:

- ideals
- religion and spirituality
- age
- ethnicity
- food
- understandings
- nationalism
- interests
- politics
- behaviour
- gender roles
- traditions
- social identity
- respect for authority.

Many different types of cultures exist. For example, youth culture relates to ways of living that are common to adolescents and young people, while Buddhist culture relates to practices and understandings shared among people who engage with Buddhism. Since cultures are so varied and can stem from many elements, it can be difficult to define exactly what culture is. However, there are five characteristics that are consistent across most cultures.

- 1 Cultures are learnt. We do not inherit culture, but pick it up from our exposure to and interactions with people, media, environments and situations.
- 2 Cultures are shared. We share culture with different group members and often impart aspects of our culture to other people in our lives.
- 3 Cultures are symbolic. Cultures contain verbal and non-verbal symbols such as gestures, language, values, norms and sanctions.
- 4 Cultures are integrated. Cultures include multiple aspects that are interconnected with each other.
- 5 Cultures are dynamic. Cultures can adapt to changing environments and can also intersect with other cultures.

**culture**  
the various characteristics, such as values, beliefs and knowledges, that are shared among members of a particular group or society

## The influence of culture

In Chapter 2 you learnt about how environmental factors can influence our psychological development. Through this same sense the cultures we belong to and engage with can greatly influence and shape how we think and behave.

**Cultural norms** are the established expectations or rules set out in a culture that stem from shared beliefs. Cultural norms can include values, attitudes and behaviours. For example, in some Asian cultures it is customary to refer to family friends or people older than you as Auntie or Uncle as a sign of respect, even if you are not related. Another example can be seen in some Scandinavian cultures where it is normal for parents to let babies sleep outdoors in prams while the parents remain inside (Figure 10).

**cultural norm**  
an informal rule or standard understood by members of a group or society



**FIGURE 10** In Scandinavian countries, it is normal for parents to let their babies sleep outside.

Cultural norms may encourage or discourage us to behave or think in certain ways so that we fit in or act in accordance with our culture. We may also adhere to certain cultural norms in some settings but not adhere to the same norms in other settings. For example, a person could come from a culture where they show a high level of respect to those older than them in family settings, but when they are at school they show equal respect to their friends, regardless of whether they are older or younger.

## 8.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe the characteristics of a group.
- 2 Identify and explain the five characteristics shared by different cultures.
- 3 Identify the type of power dynamic used in each of the following examples:
  - a A boss promises a sales worker a promotion if they meet their sales target for the year.
  - b A mother threatens to confiscate her child's toys if the child does not eat their vegetables.
- 4 Using your own example, explain how cultural norms can influence behaviour.

### Apply, analyse and compare

- 5 Contrast groupthink and group shift, using examples.

- 6 Distinguish between power and status and describe how both can shift within groups.
- 7 Compare specific status characteristics and diffuse status characteristics.
- 8 Comment on the relationship between roles, status and power in groups.

### Design and discuss

- 9 The events at Abu Ghraib Prison in Iraq during the 2003 US-led war highlighted how power and status can lead to inhumane treatment of others. Conduct research into the events at Abu Ghraib and discuss:
  - the events that occurred
  - the types of power used by the guards against the prisoners
  - how the roles and status of those involved contributed to the inhumane treatment of the detainees.

**FIGURE 11** What sort of power dynamic best describes a mother threatening to confiscate the toys of a child that refuses to eat vegetables?



## 8.2

# The influence of obedience on individual behaviour

### KEY IDEAS

- ✦ Obedience occurs in social hierarchies when a person in a lower position follows the commands of someone in a higher position.
- ✦ The degree and likelihood of obedience is affected by factors such as proximity, legitimacy of the authority figure and group pressure.



## Obedience

Interactions in social groups often involve members that have unequal levels of power and status. A member of the group who has higher status and power generally has more influence over the behaviours and decisions of other group members compared to a member with less status and power (Figure 1).

**obedience**  
behaviour that complies with the demands of a direct order

**authority**  
the capacity to influence others

The act of **obedience** occurs in social hierarchies when a person in a lower position follows the commands of someone in a higher position. Obedience in society is common as groups often consist of hierarchal structures where some people hold positions of higher status or greater **authority**. Extreme examples of obedience have been seen historically in war, where soldiers have followed the orders of commanders despite the orders conflicting with soldiers' own morals. Social psychologists have studied obedience to help make sense of why actions such as war crimes can happen.



**FIGURE 1** The coach of a sports team has more authority over the team than individual players do.

Obedience can also benefit many different situations. For example, obedience to the law can help ensure that our society is protected and peaceful. Obedience to our work managers can ensure that work is produced to a high quality and delivered on time. Obedience to your teachers can ensure that everyone in the classroom is provided with a safe environment that promotes learning.

### Milgram's studies on obedience

US social scientist Stanley Milgram studied obedience through a series of experiments which have since been replicated in different countries, populations and variations. Milgram's obedience studies have helped identify the factors within groups that can increase the likelihood of obedience.

## The experiment

**ClickView**  
Milgram's  
obedience  
experiment

Milgram's interest in investigating obedience stemmed from two sources. The first was the work of Solomon Asch about the concept of conformity (which will be explored later in the chapter). The second was the behaviours and decisions of Nazi soldiers who contributed to the murder of millions of Jewish people during the Second World War. Milgram sought to understand why soldiers prosecuted as war criminals would often state that the heinous crimes they conducted were not because they hated Jewish people, but because they were following orders from above (Figure 2).



**FIGURE 2** Stanley Milgram wanted to understand why so many Nazi soldiers followed orders that led to the genocide of Jewish people.

### Aim

Milgram's first study (1963) aimed to investigate whether individuals would obey an authority figure who instructed them to inflict pain on another person.

### Method

Participants were selected from a pool of respondents who replied to an advertisement Milgram put in the local paper. The advertisement asked for males aged 20 to 50 to be part of a paid experiment about learning and memory. Forty males of various occupations were selected for the study.

Participants were individually met by Milgram (the experimenter) and taken into a room where the experimenter could establish rapport with participants. A **confederate** (someone, often another experimenter, who knows exactly what is about to occur in the experiment) posing as another participant was then introduced to the real participant. The participant and confederate were then randomly allocated to the role of "teacher" or "learner". The random allocation process was rigged by Milgram to ensure that the real participant was always allocated as the "teacher" and the confederate was always allocated as the "learner".

**confederate**  
a person in a  
psychological  
experiment who  
pretends to be a  
subject but is  
actually working for  
the experimenter

The role of the learner in the experiment was to learn and memorise a list of paired words that had to be accurately recalled when requested by the teacher. The role of the teacher in the experiment was to administer an electric shock to the learner every time the learner gave an incorrect answer, using the “teaching machine” (Figure 3). The teachers did not know that the shock device Milgram had provided them with was a fake.

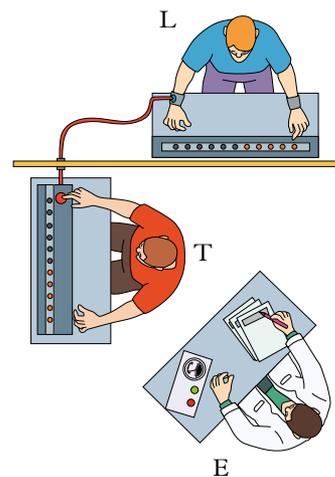


**FIGURE 3** Stanley Milgram and his experimental “teaching machine”

The teacher watched as the learner was taken into an adjoining room. The learner was then wired to an electric shock generator by electrodes placed on their wrists. The teacher watched the learner being wired to the electric shock generator and was positioned to overhear Milgram explain to the learner that a paste was applied under the electrodes to prevent blistering and burning and hear the learner respond by explaining he had a slight heart condition. The teacher was then placed in an adjoining room so they could no longer see the learner but could hear what was happening to them via intercom.

Teachers were told their task was to teach learners how to remember word pairs by administering an electric shock each time the learner made a mistake (Figure 4). Teachers were also told that, although the shocks could be painful, they would not cause permanent tissue damage. The shock generator consisted of 30 levers spanning from 15 to 450 volts, increasing in 15-volt increments. Each lever was also marked with descriptions of the severity of the shock ranging from “slight shock” to “danger/severe shock”. Teachers were instructed to raise the shock administered to the learner by 15 volts each time the learner made a mistake.

During the course of the first experiment, the learner would deliberately make mistakes to follow the script shown in Table 1. The learner was not actually exposed to any electric shocks at all because the shock generator was a fake device.



**FIGURE 4** Milgram’s experimental set-up, where the experimenter (E) orders the teacher (T), the participant, to administer electric shocks to the learner (L), who is actually a confederate planted by the experimenter.

**TABLE 1** Script used in Milgram's experiment

Volts	Response from confederate ("learner")
75	Ugh!
90	Ugh!
105	Ugh! (louder)
120	Ugh! This really hurts!
135	Ugh!
150	Ugh! Experimenter! That's all. Get me out of here. I told you I had heart trouble. My heart's starting to bother me now. Get me out of here, please. My heart's starting to bother me. I refuse to go on. Let me out!
165	Ugh! Let me out! (shouting)
180	Ugh! I can't stand the pain. Let me out of here! (shouting)
195	Ugh! Let me out of here! Let me out of here! My heart's bothering me. Let me out of here! You have no right to keep me here! Let me out! Let me out of here! Let me out of here! My heart's really bothering me. Let me out! Let me out!
210	Ugh! Experimenter! Get me out of here. I've had enough. I won't be in the experiment anymore!
225	Ugh!
240	Ugh!
255	Ugh! Get me out of here!
270	(Scream) Let me out of here! Do you hear? Let me out of here!
285	(Scream in agony)
300	(Scream in agony) I absolutely refuse to answer anymore! Get me out of here. You can't hold me here. Get me out! Get me out of here!
315	(Intense scream in agony) Let me out of here! Let me out of here! My heart's bothering me! Let me out of here! (hysterical) Let me out of here!
Above 315, up to 450	Silence

At 75 volts, the teacher heard a grunt from the next room. At 120 volts the teacher heard the learner cry out. Whenever the participant questioned the experimenter on whether they should continue, the experimenter would reply with one of the following:

- "The experiment requires that you continue."
- "It is absolutely essential that you continue."
- "You have no other choice, you must go on."

At 150 volts, the participant heard the learner cry out and complain of heart trouble, refusing to go on. At 195 volts, the learner further complained of a heart condition and demanded to be let out. At 270 volts, the participant heard the learner screaming and begging to be let out because they could not stand the pain anymore. At 300 volts the learner refused to go on and cried to be let out. At 315 volts the learner was hysterical and screaming to be let out. After 315 volts, the learner remained silent, but the teacher was instructed to treat this as a "wrong answer".

The experiment concluded when either the teacher absolutely refused to continue or after the 450-volt shock was administered. After the experiment, participants were debriefed and informed that the learners were, in fact, confederates and that they did not actually receive any electric shocks.

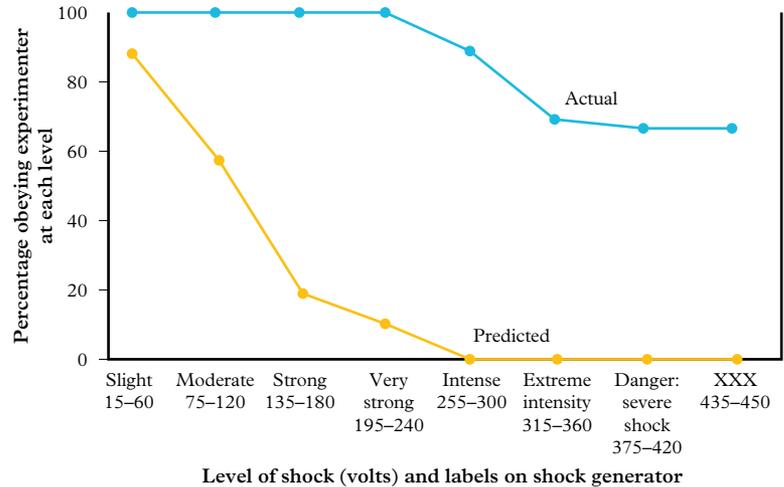
## Results

Prior to the experiment being conducted, Milgram asked a panel of 110 experts on human behaviour, including 39 psychiatrists, to predict how a normal, average, everyday individual would go in this experiment. The panel predicted that 10 per cent of participants would go to 180 volts and that nobody would follow the commands to the end and apply 450 volts.

The actual results of the experiment compared with the predicted results are shown in Figure 5.

As Figure 5 demonstrates, the panel vastly underestimated the number of participants who would progressively shock learners in the experiment. Of the 40 participants involved in the study, nearly all continued to administer shocks up to 255 volts, and 65 per cent of participants continued to administer shocks up to the lethal 450-volt limit. Only five participants refused to go on with the experiment after reaching 300 volts.

The results from Milgram's study showed the extent to which obedience can influence behaviour and decision-making. They showed that, even when provided with knowledge about how a behaviour or choice could cause harm to another, average, everyday individuals are still likely to follow the commands of an authority figure. Other researchers (Blass 1999, Kilham & Mann 1974, Meeus & Raaijmakers 1986, Burger 2009) have conducted Milgram's experiment in different countries and populations. The results continued to highlight the high rates of obedience as participants consistently administer shocks up to and beyond the 300-volt range. Findings of these studies suggest that moral judgment will often be disregarded for the sake of compliance.



Source: Vaughan & Hogg (2008)

FIGURE 5 The predicted results of Milgram's experiment versus actual results

## Ethical criticisms of Milgram's experiment

Milgram's study has been criticised for many ethical breaches in its design. Withdrawal rights were claimed to have been breached, as several participants protested about their involvement and asked to stop. The response from the experimenter to continue with the experiment is considered to have prevented participants from leaving the experiment, and thus denying them the right to withdraw.

Milgram's experiment also had a profound effect on participants themselves. Many participants experienced distress during the experiment when they believed they were inflicting pain upon another person. The experience of psychological harm during the experiment highlights a breach of the no-harm principle, where experiments should not expose participants to any form of physical or psychological harm, direct and/or indirect. This, however, was defended by Milgram, who claimed that the short-term psychological distress experienced by participants was not significant, considering the results shine a light onto the adverse consequences of obedience.

## Limitations of Milgram's experiment

Milgram's experiment has also faced criticism for limitations in its experimental design. Milgram's sample was not representative of the population he wished to draw conclusions about (adults in the US). Rather, Milgram's sample only consisted of white US males. Additionally, Milgram's experiments were only conducted in a laboratory setting. Therefore, it cannot be assumed that the same results would occur in naturalistic settings.

## Factors affecting obedience

Milgram conducted a further 18 experiments that varied certain factors of his original experiment on obedience. Some of these experiments included:

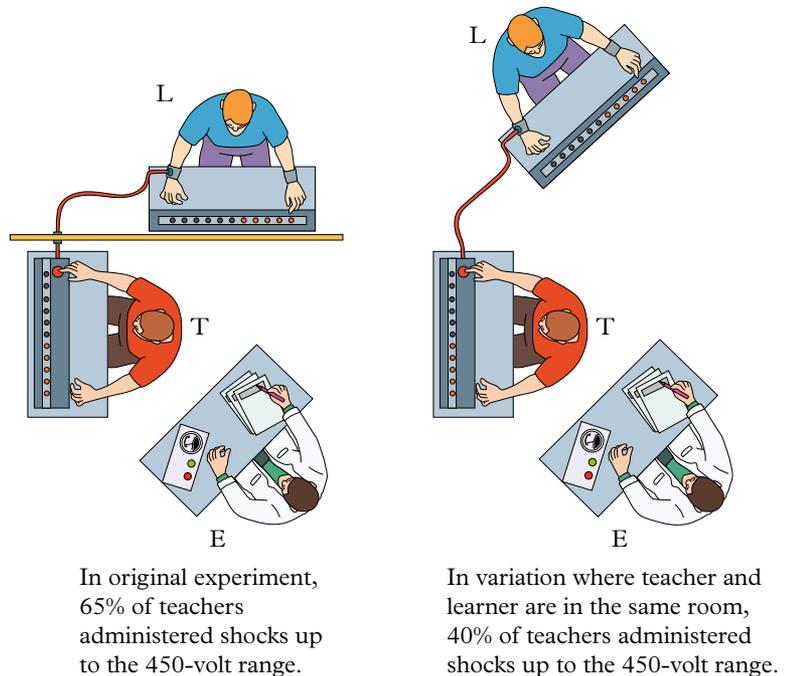
- using only female participants
- changing the visibility of the "learner" such that they can be seen by the "teacher"
- removing the experimenter from the situation
- changing how the experimenter gives instructions from in person to via phone.

In each variation, Milgram found that the likelihood and degree of obedience differed to that of the original experiment. Based on the results of his experiment variations, Milgram identified three factors that affected the likelihood of obedience occurring: proximity, legitimacy of the authority figure, and group pressure.

### Social proximity

**Proximity** describes the physical closeness (physical proximity) or emotional closeness (emotional proximity) between two individuals. The greater the proximity (emotional or physical) between the person giving an order and the person the order is directed to, the greater the likelihood of conformity. Milgram experimented by altering the physical proximity between the learner, the teacher, and the experimenter (Figure 6). Milgram found that when the learner was out of sight from the teacher during the experiment, 65 per cent of participants administered shocks up to the lethal 450-volt range. This increased to 100 per cent of participants when the learner could not be seen or heard by the teacher, and decreased to 40 per cent when the learner was placed in the same room as the teacher.

**proximity**  
how physically or emotionally close one person is to another



**FIGURE 6** The percentage of teachers who administered shocks to the 450-volt range decreased when physical proximity to the learner increased.

Milgram suggested that when participants are close enough to see the adverse effects that result from the commands of the authority figure, they become less likely to obey. In one variation where participants were not placed in the same room as the experimenter, and the experimenter relayed commands via phone, obedience was reduced to 20.5 per cent. This decreased further to 2.5 per cent when the experimenter was completely absent, gave no orders at all and when the participant was free to choose when to stop.

### Legitimacy of the authority figure

**Legitimacy of the authority figure** is an explanation of obedience that suggests we are more likely to obey people who we think have higher status or positions than us. For example, you might be more likely to conform to a change in your diet that is suggested by a nutritionist because they are seen to have higher status than you in the field of nutrition.

In Milgram's original experiment participants thought the experimenter was an expert in psychology and medicine because he was wearing a white lab coat. This perception influenced participants to take less responsibility for their actions. The participants believed that they had permission from a figure of authority to administer shocks. When the authority figure and symbols of authority were removed, such as removing the experimenter's lab coat, the rate of obedience decreased.

### Group pressure

**Group pressure** is when the majority of group members place pressure on others in the group to influence their behaviour. Milgram's experiments found group pressure to have the most significant impact on obedience. One experiment variation that involved two confederates posing as "teachers" and refusing to continue after administering a 150-volt shock resulted in only 10 per cent of the real participants administering shocks up to 450 volts (in other words, participants allowed themselves to be influenced by the teachers who displayed clear dissent and stopped administering shocks earlier). Another variation, where two confederates posing as "teachers" agreed to administer the shocks, resulted in 93 per cent of real participants administering shocks up to 450 volts.

#### legitimacy of the authority figure

the perception of a figure to be legitimate or hold higher authority that can cause us to more readily obey them



**FIGURE 7** Wearing a lab coat made the experimenter look like an expert in medicine.

#### group pressure

when the majority of a group place social pressure on others in the group to influence their behaviour

## 8.2 CHECK YOUR LEARNING

### Describe and explain

- 1 Define the term "obedience".
- 2 Outline the independent and dependent variables used in Milgram's research on obedience.
- 3 Identify and explain one ethical guideline that was breached in Milgram's experiment.
- 4 Summarise the results from Milgram's research and explain why the findings are considered valid.

### Apply, analyse and compare

- 5 Distinguish between legitimacy of the authority figure, proximity and group pressure as factors that affect obedience.

- 6 With the use of relevant examples, analyse how roles, status and power may also influence the likelihood of obedience.

### Design and discuss

- 7 Design a method for an experiment you can conduct to assess the effects of legitimacy of an authority figure on obedience. The method may involve your teacher, yourself and your classmates, and even other teachers.



# 8.3

## The influence of conformity on individual behaviour

### KEY IDEAS

- ✦ Conformity refers to the act of changing one's behaviour to match the responses or expectations of others.
- ✦ Factors that influence conformity include normative influence, informational influence, culture, group size, unanimity, deindividuation and social loafing.



### Social norms and conformity

Many of our everyday behaviours are influenced by formal and informal rules and expectations. Formal rules can prevent unwanted behaviours, such as criminal activity, and help keep members of a society safe. Informal rules tend to have more of an impact on our social interactions. **Social norms** are informal rules, thoughts, feelings and behaviours expected to be upheld by members of a group or society. Social norms can both promote and discourage specific behaviours and interactions. For example, a common social norm is to wait patiently in line when queuing up for something and to not cut in front (Figure 1). If you did happen to cut the line, you could expect to see some annoyed faces surrounding you.

While social norms can provide us with guidance on how to behave and interact, we also have the choice to not abide by these norms. In fact, many Western societies promote individualism and freedom of expression. So why do we often adhere to social norms? Why do we commonly give up our individualism to be accepted by groups and societies?

**Conformity** is the act of changing one's behaviours, thoughts or feelings to match the responses of others in a group. The concept of conformity has been explored by social psychologists to understand group behaviours and determine why people tend to “follow the crowd” in many situations.

#### social norm

an informal rule or standard understood by members of a group or society

#### conformity

the act of changing one's behaviour to match the responses of others in a group



**FIGURE 1** Waiting patiently in line is a social norm that most people adhere to.

## Asch's studies in conformity

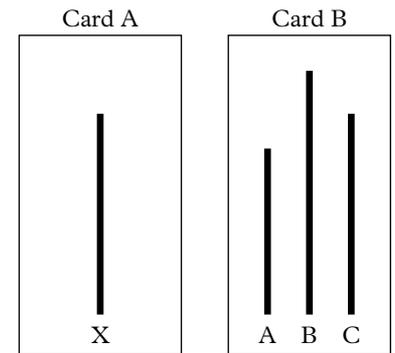
Between 1951 and 1956, psychologist Solomon Asch conducted a series of experiments to assess the strength of a person's independence under different conditions. These experiments helped shed light on why people conform and how common the occurrence of conformity is.

### Aim

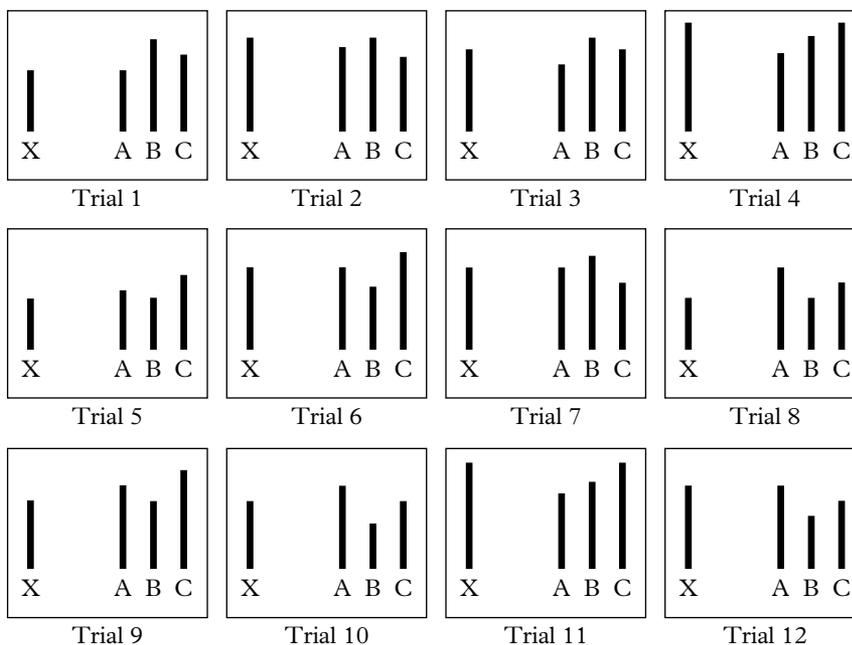
The aim of Asch's first experiment (1952) was to investigate the extent to which an individual within a group will conform to the majority opinion.

### Method

The participants consisted of 50 US male, first-year university students. Each participant was told they were participating in a visual discrimination task. Each participant was then allocated into a group that contained between seven and nine confederates (actors planted by the experimenter). The group was then shown two cards (Figure 2) and asked, "Which line on Card B is closest in length to Line X on Card A?". Members of the group had to respond in order of how they were seated, which was manipulated to ensure the participant would always be the second-last to answer. A total of 18 trials were run with varying card sets (Figure 3). In 12 of the 18 trials, all confederates in the group responded with the same wrong answer.



**FIGURE 2** Card A and Card B presented to participants in Solomon Asch's first experiment on conformity



**FIGURE 3** Variations of card sets presented in 12 of the experiment's trials

### Results

- Thirty-seven of the 50 participants (74 per cent) conformed (gave the same wrong answer as confederates) on at least one occasion.
- Fourteen of the 50 participants (28 per cent) conformed more than six times.
- Thirteen of the 50 participants (26 per cent) maintained their independence (did not conform) throughout the trials.
- On average, approximately 32 per cent of participants displayed conformity in the experiment.

## Conclusion

After the experiment, Asch asked the participants why they conformed. Participants reported that they experienced uncertainty and self-doubt because of the disagreement between themselves and the rest of the group. This evolved into fear of disapproval, feelings of anxiety and fear of isolation from the group. Some participants reported that they had doubted their own perception of the lines. Others reported that they had conformed to avoid standing out. From these responses and Asch's results, Asch concluded that the two main reasons participants conformed were that:

- participants wanted to feel they belonged to the group
- participants believed other group members to be more informed than themselves.

In a variation of his experiment, Asch asked participants to write their responses down privately instead of publicly voicing them. This variation resulted in a lower conformity rate of 12.5 per cent. This result further supported the notion that fear of social disapproval is a contributing factor to conformity.

## Ethical criticisms of Asch's experiment

Asch's conformity experiment has been criticised for ethical breaches in its design. The experiment involved the use of deception, because participants were led to believe they would be participating in a study on visual discrimination, when the true purpose of the study was to investigate conformity and factors affecting conformity.

While deception was considered necessary for the study (if participants knew the true intention of the study it would probably have influenced their responses), the effects of deception on participants are still worth considering. Deception may have caused participants to feel uncomfortable or misled, and may have damaged their trust in scientific research. Asch's experiments also failed to provide adequate debriefing to inform participants about the true nature of the study and address any psychological stress or confusion that they may have experienced during the experiment.

## Limitations of Asch's experiment

Asch's conformity experiment was restricted to a sample of only 50 US male university students. Therefore, application of the results to other populations (for example, female students or other age groups) is limited and results have low external validity. Additionally, the line judgment task used in the experiment is an artificial task that does not represent conformity in everyday life. This limits the practical application of the results to other real-life situations, such as smoking or drinking around friends. Due to these limitations, the experiment's findings have been judged to have limited relevance to everyday life.

### 8.3 SKILL DRILL

#### Evaluating investigation methods

##### Key science skill: Analysing and evaluating data and investigation methods

Asch's first experiment was manipulated to ensure that the participant was always the second-last to respond.

##### Practise your skills

- 1 Discuss how the validity of the experiment would change if the participant was allowed to respond first or second in the group.

Need help analysing and evaluating investigation methods? See Topic 1.7 in your Psychology toolkit.

## Factors that influence conformity

To better understand the factors that influence conformity, Solomon Asch conducted many variations of his original experiment. Several other researchers also repeated Asch's original experiment in different countries to observe if other factors would affect conformity. Rod Bond and Peter Smith (1996) conducted a meta-analysis of 133 studies from 17 countries that had used a similar procedure to Asch's original experiment. The findings of the meta-analysis suggested that the following factors could influence the level of conformity:

- normative influence
- informational influence
- culture
- group size
- unanimity
- deindividuation
- social loafing.

### Normative influence

**Normative influence** is when the desire to be accepted or gain approval from others in a group increases our tendency to conform. For example, Isaiah joins a friendship group that bullies another student. Isaiah knows and feels that bullying is wrong, but still participates in bullying the student to gain approval from his friendship group and fit in. Normative influence and the tendency to conform often increases when group members share similar characteristics, such as age or gender. It also further increases when group members consist of people the individual seeks to gain acceptance from.

### Informational influence

**Informational influence** is when an individual conforms to the opinions or behaviours of a group or person that they believe has greater expertise and knowledge so the individual can act "correctly". For example, a person attending a fine dining restaurant who does not know which fork to use might copy the actions of a nearby wealthy-looking couple because they assume the couple understand fine dining etiquette.

### Culture

In Topic 8.1 you learnt about how culture can influence individual behaviour. The cultures we belong to and are exposed to can also influence our likelihood of conforming. For example, in US culture, tipping the waitstaff after a meal is a cultural norm. If you visited a restaurant in the United States, you would be more likely to conform to tipping because you would be seen as inconsiderate if you did not tip. On the other hand, tipping is not expected in Japanese culture. Many Japanese restaurants will even refuse or decline your tip, so in this environment you would be more likely to conform to not tipping.

Social studies have also shown that Eastern societies have significantly higher levels of conformity than Western societies. It is proposed that this difference stems from whether culture is centred around individuals or groups. Western cultures are often **individualist cultures** that regard a person's individual goals and independence as more important than the needs of society as a whole. Eastern cultures are often **collectivist cultures** that regard the collective goals or needs of society as more important than individual goals. This means that in collectivist cultures there is a greater expectation to conform to cultural norms that are believed to benefit the culture as a whole.

#### **normative influence**

when individuals are more likely to conform to others because they seek approval or social harmony

#### **informational influence**

when individuals are more likely to conform to others' positions or opinions when the concern is to make accurate and valid judgments

#### **individualist culture**

culture that emphasises the needs and desires of individuals more than the needs and desires of the group

#### **collectivist culture**

culture that emphasises the needs and desires of the group more than the needs and desires of individuals

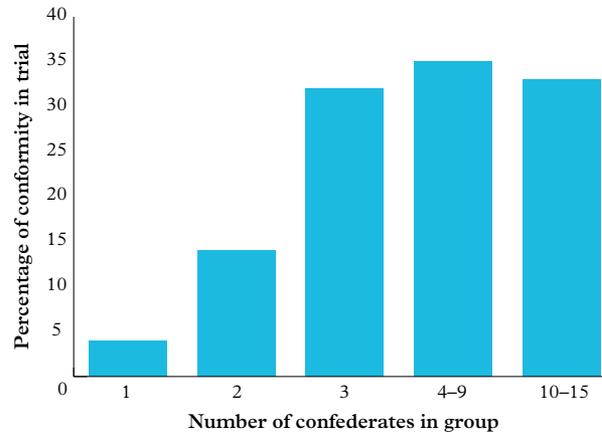


**FIGURE 4** You would be more likely to conform to tipping after a meal in the United States because tipping is a cultural norm there.

## Group size

**group size**  
the number of  
individuals that  
make up a group

**Group size** is the number of individuals within a group. Asch varied his experiments to investigate whether the number of confederates influenced the results. Results from these variations showed that the larger the size of the majority group (the greater the number of confederates), the greater the percentage of conformity, but only up to groups of four to nine confederates (Figure 5). When the number of confederates increased beyond four, the percentage of conformity began to plateau (that is, the level of conformity did not continue to rise).



**FIGURE 5** Percentage of conformity in Asch's trials with a varying number of confederates in each group

## Unanimity

**unanimity**  
complete agreement  
of a shared opinion  
among the group

Another factor that influences conformity is **unanimity**, or complete consensus among the group. In Asch's original study all confederates provided the same wrong answer. This unanimity is believed to have affected the rate of conformity. For example, imagine you and four of your close friends are about to order dinner. You feel like pizza but all four of your friends say they want sushi. Because your friends are unanimous in their preference, you may be more likely to go along with getting sushi rather than saying you would like pizza. However, if one of your friends said they felt like Mexican food and another said fish and chips, you may be more inclined to say you would prefer pizza.

Asch's later studies showed that when one confederate provided a correct answer in each trial, the level of conformity decreased from 32 per cent to 5 per cent. Asch also found that when one confederate provided an incorrect answer that differed from the others in each trial, the level of conformity decreased from 32 per cent to 9 per cent. These results show that a single differing opinion in the group setting was able to significantly reduce the percentage of participants that conformed.

## Deindividuation

**deindividuation**  
the loss of identity  
or individual  
characteristics

**Deindividuation** is the loss of individual identifying characteristics in a certain setting. Deindividuation can trigger people to act differently to how they usually would when they are easily identifiable. For example, if you are walking in a library and bump into someone, you might instantly turn around and apologise – you are easily identifiable in that setting. However, if you bump into several people while walking to the front of the stage at a crowded festival, you might not apologise because the large crowd makes you less identifiable.

Variations of the Asch experiment have tested the effect that deindividuation can have on conformity. One variation involved participants being placed in isolated booths to give their answer after being provided with feedback from other group members. Participant conformity was shown to be higher in face-to-face settings compared to settings where participants were deindividuated.

**social loafing** when an individual is less likely to put in effort in a group task compared to the effort they would put into an individual task

## Social loafing

**Social loafing** is the tendency of an individual to put less effort into their work when placed in a group setting compared to when they are working alone. For example, an employee completing a group task with four other employees may not put as much effort into the work compared to the effort they would put in if they had to complete the project by themselves (Figure 6). Social loafing in group settings can affect conformity. For example, when considering Asch's studies, a participant in the original experiment might have conformed to the majority to avoid putting effort into the task (giving the same answer as the majority to avoid working out which line was closest to line X).



**FIGURE 6** Social loafing is the tendency of someone to put less effort into their work when placed in a group setting compared to when they are working alone.

### 8.3 CHECK YOUR LEARNING

#### Describe and explain

- 1 Define the term “conformity”.
- 2 Identify the two main reasons Asch believed to be the cause of participants conforming in his first experiment.
- 3 Explain what the term “social loafing” refers to and describe how it could have affected the levels of conformity in Asch's first experiment.

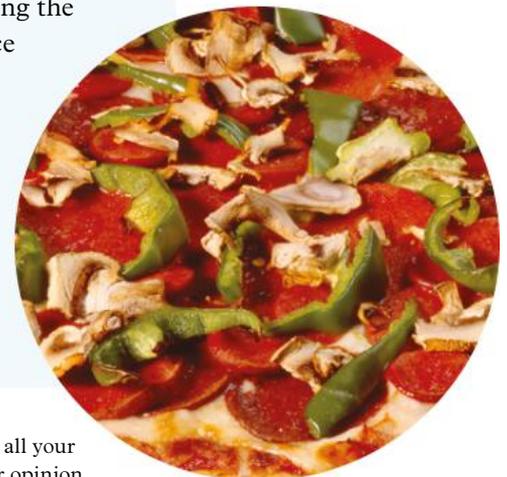
#### Apply, analyse and compare

- 4 Describe what a social norm is and provide two examples of social norms that you have adhered to in your life.
- 5 Compare normative influence and informational influence.

- 6 Contrast collectivist and individualist cultures and comment on whether each is more likely to increase or decrease the likelihood of conforming. Justify your response.

#### Design and discuss

- 7 Discuss the ethical criticisms of Asch's experiment and provide recommendations for altering the experiment design to reduce any ethical breaches.
- 8 Discuss the limitations of Asch's experiment and provide recommendations for altering the experiment design to improve the validity of results.



**FIGURE 7** If you felt like pizza for dinner but all your friends wanted sushi you might not voice your opinion.

# 8.4

## The influence of media on individual and group behaviour

### KEY IDEAS

- + Our engagement with media, such as social media and video games, can have positive and negative influences on our individual and group behaviour.
- + Social media can influence our social connectedness, information access and social comparisons.
- + Video games can influence our social connectedness and addictive behaviours.



### media

a platform, service or physical record of information that is communicated to the wider population

## The influence of media

**Media** is a collective term used to describe platforms that can mass communicate information. Television, advertising, social media and video games are just a few examples of media we commonly engage with. Interacting with media helps us obtain information and communicate with others. Over the last few decades, the evolution of technology and the internet has significantly increased our ability to engage with media. New platforms are continually being created to entertain us and connect us to others. In this topic, we will examine how social media and video games can positively and negatively influence individual and group behaviour.

## Social media

### social media

a form of media that uses the internet to provide electronic communication of information

**Social media** describes websites and online-based applications that allow users to create and share information or content with other users or the public. Common examples of social media include Instagram, Facebook, YouTube, TikTok, Snapchat and Reddit. Our interactions with social media can have both positive and negative influences on our behaviour. Understanding how social media can influence the way we feel and behave can help us make more informed choices about how we choose to engage with these platforms.

## Positive influences on behaviour

Positive influences of social media include improving social connectedness, information access and contributing to healthy social comparison.

## The changing nature of social connections

### social connection

the bond, tie or connection that an individual forms with other people

**Social connections** are the relationships we form with people around us. Social connections are important to establish as they can improve our wellbeing and overall life satisfaction.

**Social connectedness** is the sense of belonging that comes from being part of a group or network.

### social connectedness

the sense of closeness and belonging to other people or groups

In past decades the nature of social connections has changed and continues to change. The introduction and improvement of technologies such as computers and smartphones have altered the nature of social connections so that people do not need to rely as much on in-person contact to establish connections. For example, social media platforms allow users to instantly communicate information such as videos, photos, music and messages to others. Many social media users will use a platform to present an identity of themselves online.

How we engage with social media can work to positively influence our behaviour by creating and strengthening social connections. The exchange of comments, messages and likes with other users can establish new friendships or strengthen existing ones. For example, friendship groups often have a private “group chat” where only members can exchange messages and media. This interaction can provide a sense of belonging through membership of the group and build trust between members.

### Information access

Social media has increased our ability to access and engage with more information about the world. For example, if you needed help understanding a psychology concept, you might search YouTube for videos that help explain that concept. This sort of access can be highly beneficial to us and help us develop new skills, learn new things and improve our day-to-day lives as it can provide access to comprehensive information.

Information sharing on social media can also help bring awareness to important issues. In 2017, the #MeToo movement on Twitter helped empower survivors of sexual violence and bring awareness to a wider audience. In 2013, the #BlackLivesMatter movement was created to increase awareness and draw attention to the high levels of racism and discrimination directed at Black people in the United States and around the world.

### Healthy social comparisons

Social media platforms offer users the ability to view the lives and experiences of others on the same platform. Recent years have seen the rise of **social media influencers** – individuals who have a form of social power (for example, referent, informational, expert or legitimate) and use social media to share content about their lifestyle or expertise (for example, style, fitness, food, gaming). Some influencers can amass thousands or millions of followers. When exposed to social media and influencers, we not only pay attention to the image or content on display, but also engage in a process of comparing ourselves to who or what we see. This process is called **social comparison**.

Festinger (1954) proposed that social comparison is necessary for us to make stable and accurate evaluations of ourselves. These comparisons are normally made against people who are similar to ourselves in ability, traits or knowledge. For example, comparing your kicking skills when playing footy against your friends to assess your competency at the game, or comparing what you are wearing against what your friends are wearing at a party to assess your appearance.

Social comparison theory states that there are two types of comparisons we use to evaluate ourselves. **Upward comparisons** are when we compare ourselves to those who have abilities, traits or knowledge that we perceive to be better than our own. These comparisons can motivate us to improve. For example, watching a video of a semi-professional footballer with more finesse and skill than you may encourage you to improve your own skills.



**FIGURE 1** Social media can be used to establish new or strengthen our existing social connections.

#### social media influencer

a person with authority or expertise in an area that uses their position to engage with a large number of followers

#### social comparison

assessing or evaluating ourselves through comparing our own traits against those of other people

#### upward comparison

the act of comparing ourselves to those who have abilities, traits or knowledge that are slightly better than our own

### downward comparison

the act of comparing ourselves to those who have traits, knowledge or abilities that are worse than our own

### Downward comparisons

are when we compare ourselves to others with abilities, circumstances, traits or knowledge we perceive as worse than our own. These comparisons can make us feel better about our lives or more secure. For example, travelling to a developing country and witnessing extreme poverty may make you feel more grateful for the comforts of your own life.

Comparisons made when browsing social media can positively influence our behaviour. If you observe a realistic and relevant comparison to your abilities, knowledge and traits, the outcome might be that it drives you to improve yourself or makes you feel grateful for what you have. These outcomes can lead to constructive behaviours that benefit our lives and the people around us.



ClickView

Self-esteem and social media

## Negative influences on behaviour

Negative influences of social media include contributing to unhealthy social comparison, social disconnect, cyberbullying and spread of misinformation.

### Unhealthy social comparisons

Unfortunately, not all social comparisons using social media result in positive outcomes. For the most part, comparisons against posts on social media often assess us against people who are not realistic or relevant to our lives. For example, imagine you watch the exercise regime of an influencer without being shown the costly procedures and strict diet that influencer also uses to improve their appearance. If you strive to improve your appearance following the same regime and do not see similar results, it may make you feel worse about yourself because the comparison was not fair.

What we view online is often highly curated and does not always provide the whole picture or context behind what we see. Some content is also highly edited or may use filters to alter what is shown. When social comparisons are made against unrealistic individuals viewed on social media it can threaten our self-esteem.

### cyberbullying

the use of electronic media to bully or intimidate a person

### Social disconnect

While social media can keep us connected to people online, overuse of social media may leave us feeling more isolated. Research has shown that people who spend more than two hours on social media daily were two times more likely to report social isolation compared to those who spend less than 30 minutes on social media daily (Primack et al., 2017). Using social media to substitute in-person contact with online contact can also limit the positive effects that come from in-person interactions, such as the release of dopamine and endorphins that help improve our mood and relieve stress.

### Cyberbullying

Not all interactions with others on social media are positive. Unfortunately, some people use social media to engage in antisocial or aggressive behaviours. **Cyberbullying** is the act of using an online communication platform to bully or intimidate a person.

The highly connective nature of social media has provided a platform for people to instantly ridicule others, as well as post and share hurtful information. While most social media platforms have functionality to report or ban users for these types of behaviour, these measures to moderate behaviour often only come after the damage has been inflicted onto a victim. Cyberbullying can lower victims' self-esteem, confidence and even result in self-harm and suicidal thoughts (Islam et al., 2022).



FIGURE 2

Cyberbullying can have a significant impact on mental wellbeing.

## Misinformation

As discussed earlier, access to information on social media can positively affect our lives by informing us or teaching us new skills. However, social media platforms can also spread **misinformation** (inaccurate information spread due to ignorance) and **disinformation** (inaccurate information spread with malicious intent). For example, **fake news** refers to fictional news stories or misleading information that is used to support an agenda. Fake news can be particularly harmful when it concerns issues around health and safety. During the COVID-19 pandemic social media platforms were flooded with misinformation about certain treatments for the virus. This encouraged some people to stock up on ineffective medications and, in some cases, place themselves and others in vulnerable positions.

**misinformation**  
inaccurate information spread due to ignorance

**disinformation**  
inaccurate information spread with malicious intent

**fake news**  
false or misleading stories presented in a way to come off as authentic or to push an agenda

**video game**  
game played on a personal electronic device or console

**mass multiplayer online role-playing game (MMORPG)**  
online game with a large collective of players that involves players taking on a character role in the game

## Video games

**Video games** are games played electronically through a computer, mobile or console. The nature of video games can vary from being a solo activity where a player works through a campaign alone to a shared activity where a player requires others to either work alongside or play against them. The evolution of technology has opened video games up to be more immersive and social than ever. Our engagement with video games can have both positive and negative effects on behaviour.

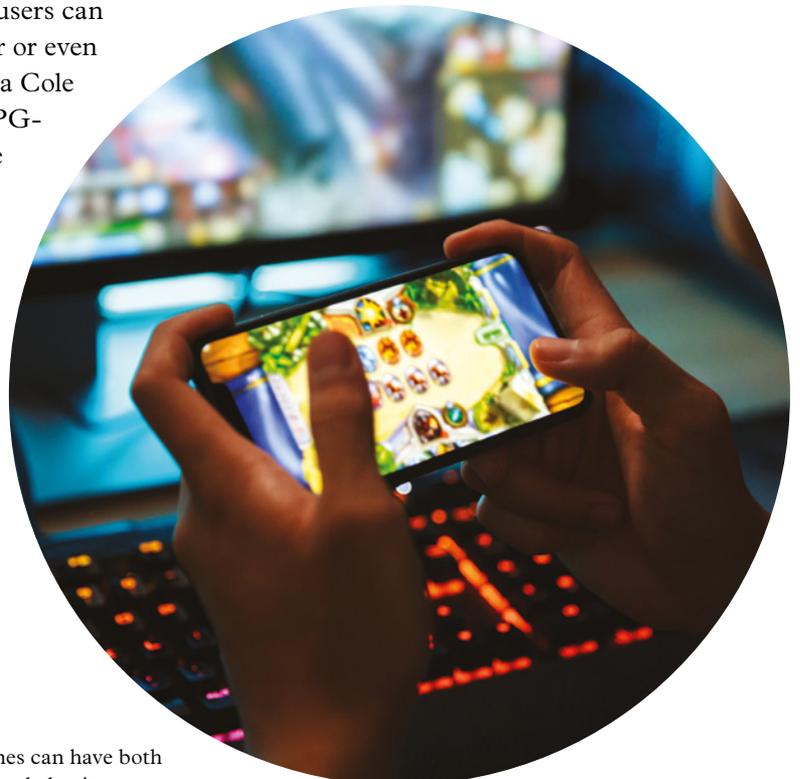
## Positive influences on behaviour

### Social connectedness

Video games can be used to improve our social connectedness. **Mass multiplayer online role-playing games (MMORPGs)** such as Minecraft, Call of Duty, League of Legends and Fortnite have amassed millions of players worldwide. These games allow users to either compete against each other or work cooperatively to achieve objectives relevant to the game. New friendships between users can develop from bonding over cooperating together or even competing against each other. A study by Helena Cole and Mark Griffiths (2007) found that MMORPG-type games were highly socially interactive. The results of their study showed that:

- 75 per cent of respondents made good friends within the video games they played
- 39.3 per cent of respondents discussed sensitive issues with other online players that they otherwise would not discuss with their friends
- 42.8 per cent of participants had met online friends in real-life situations or activities.

Cole and Griffiths' research highlights the sense of membership and connectedness users can obtain from gaming communities.

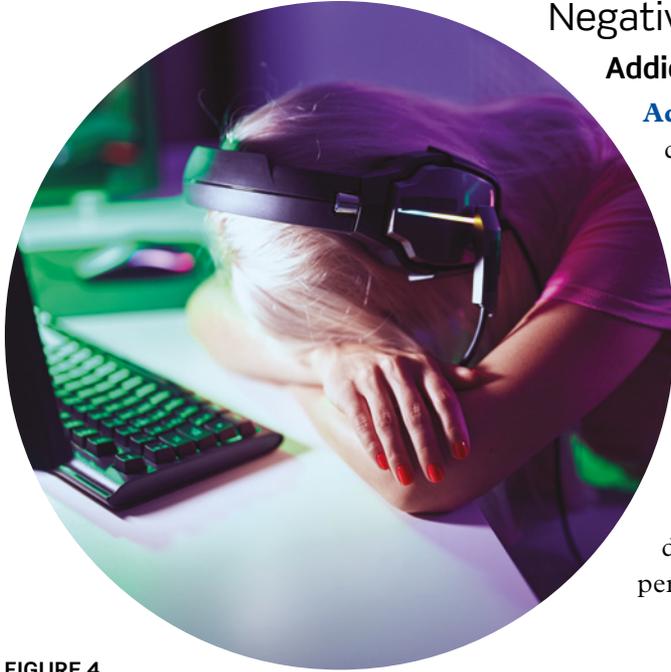


**FIGURE 3** Playing video games can have both positive and negative effects on behaviour.

## Negative influences on behaviour

### Addiction

**Addiction** is a state of physical or psychological dependence on a substance or behaviour despite harmful consequences. **Internet gaming disorder (IGD)** is a behavioural disorder characterised by an addiction to video games that causes significant distress or impairment to a person's life. In 2013, IGD was formally recognised and added to the DSM-5-TR. Table 1 shows the nine criteria used to diagnose IGD. These criteria help differentiate healthy engagement with video games from maladaptive and addictive engagement. Five of the nine criteria must be met to establish an IGD diagnosis, all of which must have been present for a period of 12 months, minimum.



**FIGURE 4**

IGD is characterised by an addiction to gaming that causes distress or impairs a person's life.

#### addiction

a compulsive, chronic, physiological or psychological need for a substance, behaviour or activity that is difficult to control or stop despite harmful effects

#### internet gaming disorder (IGD)

addiction to video games characterised by a lack of control of gaming habits that leads to disrupted behaviour

**TABLE 1** Criteria used to assess internet gaming addiction

Criteria	Description
1 Preoccupation with video games	Ongoing and excessive thoughts about video games
2 Withdrawal symptoms when video gaming is taken away	Experiencing significant sadness, anxiety and irritability when the video games are taken away
3 Tolerance	The amount of time spent gaming needed to satisfy urge increases over time
4 Unsuccessful attempts to control participation in video games	Inability to reduce or quit playing video games
5 Loss of interest in previous hobbies and/or entertainment (excluding video games)	Giving up or losing interest in activities that were previously enjoyed due to video gaming
6 Continued excessive use of video games despite awareness of psychosocial problems	Continuing to game despite having awareness and understanding of the negative effects gaming can cause
7 Deception of family members, friends or others regarding the amount of gaming	Taking active steps to conceal from friends, family, therapists and/or others the amount of time spent playing video games
8 Use of video games to escape or relieve negative feelings	Using video games to alleviate negative moods such as guilt, hopelessness, anxiety, sadness or other negative mood states
9 Jeopardising or losing a significant relationship, job, education or career opportunity because of gaming	Has lost a job, relationship, career or education opportunity as a result of playing video games

Table 1 shows how IGD can be incredibly detrimental to a person's overall health and wellbeing. Like any addiction, break down of relationships, loss of interests and loss of opportunities can all stem from IGD if addiction to video games becomes severe.

## 8.4 CHALLENGE

### Recognising signs of video game addiction

Kevin is a 14-year-old male who has started to display aggressive behaviours to his parents. Concerned, Kevin's parents bring him to a psychologist. Kevin's parents explain to the psychologist that over the past six months:

- Kevin has shown decreasing interest in doing his homework and going to school
- Kevin has shown reduced interest in playing basketball and attending training, which he used to enjoy
- Kevin has spent an increasing amount of time playing video games where he often chats to his friends online.

The psychologist asks Kevin about how things have been going for him, to which he replies that he loves video games, especially a recent sequel to a game that he particularly enjoys. Kevin acknowledges that he has been playing video games more often, but he also says that it is one of the main ways that he can spend time with his friends. Kevin fears that if he reduces his play time his friends will not speak to him as much at school. Kevin also acknowledges that he has been watching a lot of broadcasts on Twitch, as well as reading posts on Reddit about the game he is playing. When Kevin is asked if he would be able to reduce the amount of time that he spends playing his game, Kevin replies "... Yeah, probably, but not if my parents keep nagging me about it."

- 1 Does Kevin appear to have an addiction to video gaming? Use the concepts that have been addressed in this chapter to justify your response.
- 2 Outline the possible social consequences if Kevin were to completely stop playing video games. Propose solutions to reduce any adverse consequences that may occur if he were to completely stop playing video games.

## 8.4 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain how video games can help enhance social connectedness.
- 2 Identify what conditions must be met for a person to be diagnosed with internet gaming disorder.
- 3 Explain how social media can positively and negatively affect social connectedness.

### Apply, analyse and compare

- 4 Compare upward and downward comparisons and explain the effects these comparisons can have on individual behaviour.
- 5 Describe how social media can lead to the spread of misinformation and provide an example of how misinformation can negatively affect a person's health.

### Design and discuss

- 6 Social media addiction is not formally recognised in the DSM-5-TR. However, many researchers have noted the addictive nature of social media platforms, including a study showing the neural similarities that occur between social media addiction and substance addiction (Turel et al., 2018).

Research social media addiction and construct a balanced discussion on whether or not social media addiction should be added to the DSM-5-TR as a behavioural disorder.

# 8.5

## Empowering individual decision-making through anticonformity and independence

### KEY IDEAS

- ✦ Anticonformity is directly opposing or challenging the majority.
- ✦ Independence is the ability to resist the majority.
- ✦ Anticonformity and independence help contribute to diverse thinking, and better problem-solving and decision-making in groups.



**FIGURE 1** Going against group norms can be difficult at times and may make you stand out like this person and their brightly coloured umbrella, but it can also improve the decision-making and outcomes of the group.

### Going against the trend

Throughout this chapter, we explored a range of factors that can influence people to conform and obey others in group settings. From Milgram's research with teachers and learners to Asch's studies on conformity, research has made it clear that specific circumstances can encourage people to change behaviours, thoughts and attitudes to match others'. However, many of these circumstances have only been observed in experimental and laboratory settings. This means they might not always accurately reflect group interactions that individuals experience in everyday life.

Sometimes challenging or resisting conformity and obedience can improve group decision-making. For example, individual members of a hockey team may voice an alternative plan to the team captain's counterattack plan. Or consider a board member of a large corporation who challenges the corporation's strategic plan to propose a different strategy that will improve sales and revenue. Such examples highlight that conformity and obedience are not guaranteed to occur in groups.

When all group members obey or conform to the majority, it can cause the group to be biased (as illustrated by groupthink). Groups that have minority opinions to challenge

the majority tend to generate more unbiased and divergent ways of thinking. Through **dissenting** (voicing a minority opinion against a majority opinion), a sole member of a group can challenge singular, biased perspectives. Voicing an alternative opinion might not always lead to prevailing over the majority, and at times could even lead to being disliked or scrutinised, but the mere presence of dissent can help encourage thinking that differs from the majority. When this happens, more creative thinking and decision-making within the group is likely to occur and this can result in improved group outcomes.

**dissenting**  
providing an  
alternative opinion

## Anticonformity and independence in decision-making

Psychological research exploring how opinions can influence groups has often focused on conformity and the benefits that conforming provides to individuals and the group. These studies often neglected to explore the effect that **nonconformity**, or the refusal to conform, could have on individuals and groups, as well as the factors that compel people to nonconform. There are two types of nonconformity:

- **anticonformity** – deliberately or consciously challenging the majority
- **independence** – resisting the influence of the majority.

Social psychologist Richard Crutchfield (1962) suggested that an individual could choose one of three decision-making positions when involved in a group: conformity, anticonformity or independence (Figure 2).

Consider the following example of a major gas company planning to develop a mine in remote Australia. When researching the area, the company finds that it is rich in natural minerals and gas. The board and owners of the company are excited and continue to develop plans to mine the area. One team member raises concerns about how the mining could affect native species of the area, but the team member’s concerns are disregarded by the company, whose primary focus is to mine resources for profit.

The concerned team member continues to voice their concerns, with which other members of the team begin to agree. The team member and others decide to draw attention to the lack of concern for the environment by going on strike and protesting the excavation. Another team member who also disagrees with the plan but does not want to risk their position in the company asks to be transferred to another project. In this scenario, Crutchfield’s (1962) equilateral triangle model can visually represent the group dynamics as in Figure 3.

Crutchfield’s model proposes that people can be measured to the degree that they conform, anticonform or are independent from the majority. In this example, there would be workers and team members who completely agree with the company’s actions without any consideration or thought for anticonformist views. There may also be workers and team members who are silently concerned about the company’s actions, but do not voice their concerns or protest the mining plan, or ask to transfer.

This scenario also highlights the possible problems that can occur if groups only follow the majority. Group members that propose anticonformist or independent opinions encourage the consideration of alternative options that are unbiased and divergent. Even if such opinions are disliked or disregarded, the mere statement of a divergent opinion can encourage others to consider other opportunities and opinions that they would otherwise not have considered.

**nonconformity**  
expressing opinions, judgments or actions that differ from the norms of a social group or situation

**anticonformity**  
an individual's position or opinion in relation to the group that directly opposes the group majority

**independence**  
an individual's decision or opinion in a group that is not influenced by the group's position or opinion

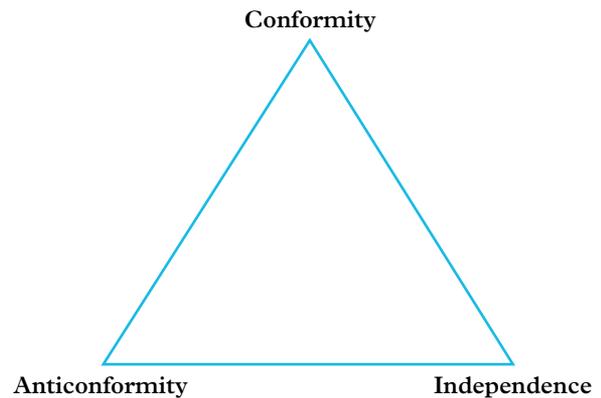


FIGURE 2 Crutchfield’s equilateral triangle model

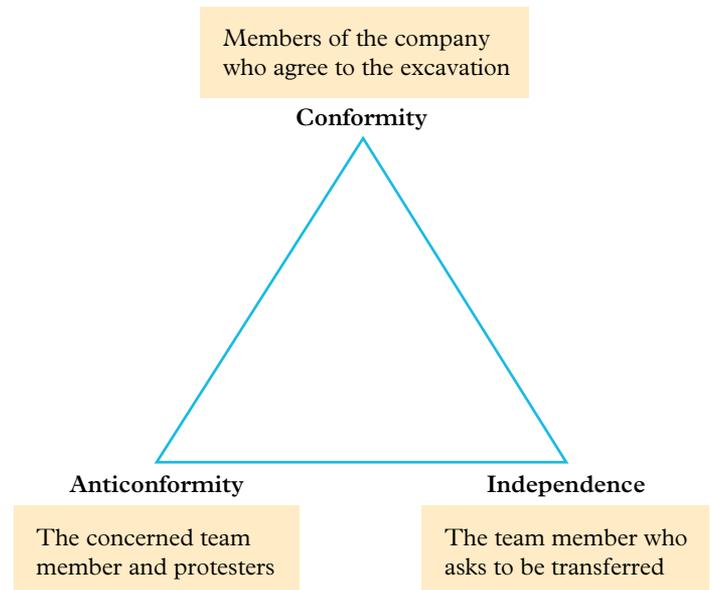


FIGURE 3 The equilateral triangle model visually representing group dynamics

**8.5 WORKED EXAMPLE****Interpreting data and calculating percentages**

Question: A researcher is investigating the variance of conformist, anticonformist and independent opinions of students in response to rules set for a school formal. The researcher interviews 50 Year 11 students from an all-girls school. Participants are asked to select the response below that best describes how they would respond to a dress code that did not allow students to wear an outfit to the school formal that showed their midriff:

- Statement A: “I would abide by the dress code like most students.”
- Statement B: “I would challenge the dress code and everyone else by wearing an outfit that shows the midriff.”
- Statement C: “I would not attend the formal.”

The results were as follows:

Statement	No. of student responses
A	36
B	13
C	1

- a** Determine which statements align to being conformist, anticonformist or independent opinions. (1 mark)
- b** Calculate the percentage of students from the sample that had conformist, anticonformist and independent opinions in response to the dress code. (1 mark)

Think	Do
Step 1: Assign each statement as being either conformist, anticonformist or independent.	<b>a</b> Statement A describes going along with the majority, so is therefore conformist. Statement B directly challenges the majority, so is therefore anticonformist. Statement C does not regard what the majority are doing and is therefore independent.
Step 2: Calculate the percentage of each type of response. The formula for calculating percentages is explained in Topic 1.6.	<b>b</b> Statement A (Conformist): $\frac{36}{50} \times 100 = 72\%$ of students Statement B (Anticonformist): $\frac{13}{50} \times 100 = 26\%$ of students Statement C (Independent): $\frac{1}{50} \times 100 = 2\%$ of students

## 8.5 CHECK YOUR LEARNING



### Describe and explain

- 1 Explain the effects of anticonformity in group decisions.
- 2 Describe the concept of “independence” in relation to conformity.
- 3 Outline how dissent may affect group decision-making.
- 4 Identify the three positions a person can take in group decision-making, according to Crutchfield.

### Apply, analyse and compare

- 5 Contrast the concepts of conformity, anticonformity and independence.
- 6 Comment on why nonconformity, even if it is ignored or disliked, is important in addressing groupthink.

### Design and discuss

- 7 Design a classroom debate on a contentious topic of your choice. Prior to the debate, record the perspectives of your classmates using a survey or open-ended questions of your design. Once the debate has concluded, conduct the same survey or open-ended questions and respond to the following:
  - a Was there any evidence of change in conformity, anticonformity and/or independence? Discuss your response.
  - b Was there any evidence of groupthink or group shift? Discuss your response.

**FIGURE 4** Standing out may not always be easy but it in some instances it can result in better outcomes for your group.



## Chapter summary

- 8.1** • Members of social groups can have varying levels of status and power, both of which can influence individual behaviour and group behaviour.
  - Groupthink and group shift are two phenomena that can influence decision-making in groups.
  - Cultural norms can both encourage and discourage us to behave and think in certain ways.
  - The Stanford prison experiment highlighted the effect of status and power on individual behaviour and group dynamics.
- 8.2** • Individuals' decision-making and behaviour can be directly affected by obedience to authority figures.
  - Obedience occurs when a person in a lower position in a hierarchal social relationship follows the commands of those in a higher social position.
  - The extent to which obedience may affect individual behaviour was highlighted in Milgram's studies into obedience.
  - Proximity, legitimacy of the authority figure and group pressure are three factors that affect the likelihood of someone displaying obedience.
- 8.3** • Conformity refers to the act of changing one's behaviour to match the responses or expectations of others.
  - Asch's studies highlighted how different social factors influence conformity.
  - Factors that influence conformity include normative influence, informational influence, culture, group size, unanimity, deindividuation and social loafing.
- 8.4** • Our engagement with media such as social media and video games can have positive and negative influences on our individual and group behaviour.
  - Social media can influence social connectedness, information access and social comparisons.
  - Video games can influence social connectedness and addictive behaviours.
- 8.5** • Anticonformity is directly opposing or challenging the majority.
  - Independence is the ability to resist the majority.
  - Anticonformity and independence help contribute to diverse thinking, and better problem-solving and decision-making in groups.

## Revision questions

### Multiple choice

- 1 The ability to give negative consequences or remove positive consequences is known as:
  - A legitimate power.
  - B coercive power.
  - C informational power.
  - D reward power.
- 2 A person buying their first car is more likely to conform to the advice given to them from their mechanic friend due to:
  - A normative influence.
  - B group size.
  - C informational influence.
  - D unanimity.
- 3 One inference that can be made from Zimbardo's Stanford prison experiment is that:
  - A the type of role expectation that is not assigned to a person will influence their behaviours towards others.
  - B the type of role expectation that is given to an individual will have minimal effect on their behaviour towards others.
  - C roles and role expectations that are assigned to a person will have a direct influence on their power over others.
  - D power that is assigned to a person will have a direct influence on their roles and role expectations.
- 4 In the Stanford experiment the guards wore military uniform and dark glasses and carried batons. What was the purpose of this?
  - A Depersonalisation
  - B Deindividuation
  - C Detachment
  - D Desensitisation

Use the following information to answer questions 5 and 6.



Avi's basketball team is one point down with possession of the ball in the last time-out in a game. In the group huddle, the team captain, Craig, suggests that they use a specific combination of passes to lead up to taking a shot from the three-point line. Everybody in the team agrees with this except Avi. Avi does not think it is a good idea as the team's accuracy at shooting three-pointers is poor. Avi thinks they would have a better chance of winning by taking a shot closer to the ring. When Avi sees everyone else agree with Craig, he keeps quiet about his opinion.

- 5 Avi's choice to keep his opinion to himself is an example of:
  - A obedience.
  - B conformity.
  - C culture.
  - D social norms.
- 6 Avi voicing his opinion to the team would be an example of:
  - A dissent.
  - B anticonformity.
  - C independence.
  - D rebellion.
- 7 Which of the following best describes the concept of social connectedness?
  - A The sense of belonging that comes from membership of groups and relationships
  - B The number of social connections we have
  - C The quality of interaction that is engaged in with others both close and far in proximity
  - D The degree of conformity we display in group settings to attain close social connections

- 8 In a variation of his original experiment, Asch altered the number of confederates involved in the group and ordered one confederate to consistently provide an opinion about the lines that differed from the opinion of the other confederates.
- This variation would result in:
- A a significant decrease in obedience to the majority opinion.
  - B an increase in conformity to the minority.
  - C participants being more likely to adopt the role of an individual in the decision-making process.
  - D a decrease in conformity to the minority.
- 9 Which of the following conditions is likely to result in groupthink and suppression of individual opinion?
- A The group is tight-knit and cohesive, with the belief that all members think alike.
  - B The group is liberal in its thinking and accepting of dissent.
  - C The group leader takes a clear position towards the end of the decision-making process.
  - D The group members have different ranges of morality and self-confidence.
- 10 Milgram conducted his experiment with a number of variations. In which version was obedience the lowest?
- A When the authority figure was in the room with the teacher
  - B When the authority figure gave instructions by telephone
  - C When the teacher had seen another teacher administer high-level shocks
  - D When the learner was in the room with the teacher

### **Short answer**

#### **Describe and explain**

- 11 Explain how culture can influence a person's individual behaviour, using an example.
- 12 Define informational influence and provide an example of how this can influence conformity.
- 13 Describe how proximity can result in an increased likelihood of obedience occurring and describe the circumstances of proximity that could decrease the likelihood of obedience.
- 14 With the use of examples, describe how information access through social media can have both positive and negative influences on behaviour.
- 15 List the types of powers that can affect individual behaviour.
- 16 Identify the three characteristics that constitute a group.
- 17 Explain how video games can contribute to improved social connectedness.
- 18 Describe social loafing and provide an example from your own life of when social loafing may occur.

#### **Apply, analyse and compare**

- 19 Elijah is a 17-year-old student who wants to form a career as a social media influencer. Elijah's parents and school careers counsellor advise him that this might not be the best career pathway for him. When he discusses his career ambition with others, Elijah insists that social media influencers play an important role in providing information and opinions on a range of topics, as well as enhancing social connectedness among their followers.
- a Consider Elijah's perspective and outline the benefits of social media with reference to Festinger's social comparison theory.
  - b Consider the careers counsellor's perspective and outline the problems of social media with reference to Festinger's social comparison theory.
- 20 Compare the concepts of normative influence and informational influence.

**21** Gina is a Year 7 teacher who has just started working at a new school. In the first lesson with her Year 7 class, Gina notices her class is rowdy. A number of students are misbehaving and disregard instructions that Gina provides to them.

- a** Use your understanding of conformity, obedience, status and role expectations to comment on why the students may be acting in this manner in Gina's class.
- b** Use your understanding of the factors that affect obedience and types of power to outline three strategies Gina could use to reduce the likelihood of students misbehaving and disregarding her instructions in class.

**22** The notion of a person being “anticonformist” is often associated with engaging in negative behaviours.

Using a real-world example of your choice, analyse the concepts of anticonformity and independence and discuss how these concepts can benefit group decision-making without resulting in negative behaviour.

**23** Distinguish between group shift and groupthink.

**24** Analyse how Milgram measured the concept of obedience and comment on the extent to which individuals are likely to follow commands, even if the commands are known to cause significant harm to others.

**25** Though Zimbardo's Stanford prison experiment focused upon the effects of status, power, roles and role expectations, his research can also be used to assess the concept of obedience.

With reference to elements of Zimbardo's Stanford prison experiment, analyse which factors that can contribute to obedience were evident in the interactions that took place between the “prisoners” and the “guards”.

**26** Differentiate between expert, informational and referent power.

**27** Explain one ethical principle that was violated in the Stanford prison experiment. Assess whether this experiment could be replicated today with the elimination of this ethical concern.

### Design and discuss

**28** Deindividuation allows people to perform actions that they would be unlikely to perform if they were on their own and could be individually identified. In the past, police would sometimes remove their identifying number, wear reflective sunglasses and become violent when engaging in crowd control. Provide another example from real life where people have shown socially unacceptable behaviour as a result of deindividuation. Discuss how your example demonstrates deindividuation.

**29** Discuss the ethical concepts that were violated in Milgram's experiment.

**30** Discuss the different types of power that exist within prison environments and how different powers can contribute to conformity and obedience occurring.

You can find the following resources for this section in your [obook pro](#):

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

## AREA OF STUDY 1

### UNIT

# 2

# Checkpoint

## Part A – Assessment support for Unit 2 Area of Study 1

In Unit 2 Area of Study 1, you will be required to complete **one** task from the following options:

- analysis and evaluation of an experiment or case study
- a data analysis of generated primary and/or collated secondary data
- reflective annotations of a logbook of practical activities
- media analysis of one or more contemporary media texts
- a literature review
- response to a psychological issue or ethical dilemma
- a modelling or simulation activity
- problem-solving involving psychological concepts, skills and/or issues
- a report of a scientific investigation, including the generation, analysis and evaluation of primary data.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

The assessment support provided in this section models one way of approaching the following task for Outcome 1:

- media analysis of one or more contemporary media texts.

### Important notice to students

Your teacher may select one of the other task options above for you to complete as assessment for this outcome. If so, refer to the table of contents to find the assessment support related to that task.

**The advice, sample assessment, and sample response provided should be used as an example only and should not be completed as part of your formal assessment. Instead, your teacher will create a new task for your class to complete.**

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### Overview of Assessment 1 – Media analysis

In this sample assessment for Unit 2 Area of Study 1, you will need to analyse one or more contemporary media texts. This task is designed to help you practise comparing the credibility of information and ideas presented in different media sources and use ideas from media to demonstrate understanding of psychological concepts.

This assessment will require you to carefully read through six media articles related to social media and its impacts on adolescents. You will need to extract necessary information from the articles to answer questions to analyse how social cognition influences individuals.

### **A step-by-step guide to completing Assessment 1**

The information provided in this section is designed to help you prepare and practise for Assessment 1. The tips and advice included are broad and should help you successfully complete a media analysis of one or more contemporary media texts regardless of the specific requirements of the task your teacher or school have created.

#### **Step 1: Familiarise yourself with related media**

The best way to set yourself up for success on Assessment 1 is to familiarise yourself with media related to concepts covered in Chapters 7 and 8. You can achieve this by regularly reading through news articles, podcasts and other media sources that relate to psychological concepts.

#### **Step 2: Re-read/re-watch or re-listen to the media stimulus if possible**

When we read, watch or listen to media just once we can often miss points or key ideas presented to us. Engaging with the media source more than once can ensure we do not miss important pieces of information that could be key in our analysis. If your teacher provides you with the stimulus material for your media analysis prior to you sitting your assessment, making the effort to engage with it more than once can increase your chance of success.

#### **Step 3: Develop an annotation or note-taking style that works for you**

Media analyses can often require you to read through passages of text and pick up on psychological ideas, data and arguments presented by the author and then analyse this information. A good annotation style can help you efficiently locate key points of information you might need to refer back to. Colour coding with a highlighter can help you quickly find points. For example, you might like to colour code the following:

- reputable data (evidence)
- anecdotes
- opinions
- arguments
- tone
- psychological terminology
- psychological concepts
- generalisations
- scientific ideas
- non-scientific ideas.

If you are analysing more than one media source, it is also useful to highlight passages or note down the ideas that are contradictory or aligned across the sources.

Now that you have learned about some key steps to follow to achieve success on Assessment 1, it is a good time to practise putting this theory into action. In Part A, we examine:

- a sample assessment
- a high-scoring student response for the assessment (complete with tips and annotations to show you how to maximise your marks)
- the marking criteria for the sample assessment.

## Sample Assessment 1

Read each of the following articles before answering the questions.



### Article 1

Increased social media use associated with lower self-esteem and eating disorders in teens



### Article 2

Is 13 too young to have a TikTok or Instagram account?



### Article 3

New bill would add mandatory age verification to social networks



### Article 4

The Unintended Consequences of Banning Social Media



### Article 5

Why social media makes you feel bad – and what to do about it



### Article 6

APA chief scientist outlines potential harms, benefits of social media for kids

- 1 For each article, summarise the main argument/ideas/message the author has presented to their audience.
  - a Article 1
  - b Article 2
  - c Article 3
  - d Article 4
  - e Article 5
  - f Article 6

(6 marks)
- 2 a Differentiate between the terms “opinion”, “anecdote” and “evidence”. (3 marks)
- b State whether each article is based on opinion, anecdote, evidence or a combination of these. Justify your assessments. (12 marks)
- c State which of the articles you believe has the least credibility. Justify your response. (2 marks)
- 3 Provide two examples from the articles of how social media can positively affect a person’s life. (2 marks)
- 4 Provide two examples from the articles of how social media can negatively affect a person’s life. (2 marks)

- 5 a Explain how engagement on social media can lead to an increase of social comparisons. (2 marks)
- b Distinguish between upward and downward comparisons. (2 marks)
- c Provide examples of how upward comparisons on social media can both positively and negatively affect self-esteem. (2 marks)
- d What does evidence from the articles suggest about the relationship between comparisons made on social media and self-esteem? (2 marks)
- 6 Some of the articles argue that the age that young people are permitted to join social media should be increased, or argue that interventions should be made to limit young people’s use of social media. Use information from the articles to evaluate whether you believe the age to access social media should be increased.

In your evaluation make sure to include:

- discussion of the benefits and risks of young people using social media
- consideration of the impacts and effectiveness of increasing the age to access social media
- consideration of the credibility of claims and statements made in the articles
- a clear argument expressing your view
- clear linking between ideas
- recommendations on what actions should be taken to limit the risks social media can have on young people. (12 marks)

Now that you have completed the practice assessment for Unit 1 Area of Study 2, see how well you performed by checking your answers against a high-scoring annotated response and the marking criteria in your obook pro.

You can find the following resources for this section in your obook pro:

pro



### Annotated response and marking criteria

Once you’ve completed the practice SAC use this resource to assess your response.

## Part B – Checkpoint questions

### Multiple choice

Use the following information to answer questions 1 and 2.

When attending a party, Eloise is introduced to a person with rainbow-highlighted hair. Eloise perceives that this person must be a lot of fun, based on their hair colour.

#### Question 1

In this scenario, the rainbow hair colour is an example of:

- A person perception.
- B a physical cue.
- C attitude.
- D attribution.

#### Question 2

Eloise's idea that the person she met is fun based on their hair colour is an example of:

- A person perception.
- B a physical cue.
- C attitude.
- D attribution.

#### Question 3

Asch found that by increasing the number of people in the majority, more people were likely to conform. Which of the following best describes the factor responsible for influencing conformity in this variation of Asch's study?

- A Group size
- B Informational influence
- C Culture
- D Social loafing

Use the following information to answer questions 4 to 8.

Milgram's first study (1963) aimed to investigate whether individuals would obey an authority figure that instructed them to inflict pain on another person. Forty males aged between 20 and 50 were selected for the study. A confederate was used during the study.

#### Question 4

Which of the following best describes a confederate?

- A Someone, often another experimenter, who knows exactly what is about to occur in the experiment

- B Someone who unknowingly takes part in a psychological study

- C Someone who actively works against participants within the study

- D Someone who has been deceived about the true nature of the study

#### Question 5

What was the dependent variable in the study?

- A The intensity of the electric shock
- B The number of incorrect responses provided by the participants
- C Whether participants were assigned the role of "teacher" or "learner"
- D The level of obedience

#### Question 6

Which of the following is a suitable conclusion based on the results obtained from the experiment?

- A Individuals are less likely to administer electric shocks to another individual when an authority figure commands them to do so.
- B Moral judgment will often be followed, despite being given commands by an authority figure.
- C Average individuals are less likely to follow the commands of an authority figure when they are provided with knowledge about how a behaviour or choice could cause harm to another.
- D Even when provided with knowledge about how a behaviour or choice could cause harm to another, average individuals are still likely to follow the commands of an authority figure.

#### Question 7

Milgram's (1963) experiment has been criticised for its limitations in its experimental design, particularly the lack of diversity in the sample. It cannot be assumed that the same results would occur in naturalistic settings. This means the experiment lacks:

- A external validity.
- B internal validity.
- C precision.
- D accuracy.

### Question 8

In Milgram's (1963) experiment, some participants protested their involvement in the research, and despite requesting they be allowed to stop they were told they had to continue. What is this a violation of?

- A Animal ethics
- B Withdrawal rights
- C Confidentiality
- D Debriefing

### Question 9

Pepe is considered an "early bird" by his friends and family. He consistently wakes up early and likes to arrive at least ten minutes early to appointments and events. One day, Pepe sleeps past his alarm and arrives late to his brother's birthday. Pepe's brother is likely to assign Pepe's behaviour as:

- A external distinctiveness.
- B internal consistency.
- C external consistency.
- D internal distinctiveness.

### Question 10

Andre is talking to his best friend about a sensitive family issue when Max, another friend, sits down close to them. Andre immediately changes the topic of conversation when Max arrives as he knows Max likes to gossip. Andre's decision to switch conversations is an example of:

- A a representativeness heuristic.
- B an availability heuristic.
- C an affect heuristic.
- D base-rate fallacy.

### Short answer

#### Question 1 (10 marks)

Read the scenarios and identify which type of cognitive bias they best represent. Justify your responses.

- a** After Priya rolls a six on a die, her friend tells her, "I knew you'd roll a six." (2 marks)

- b** An amateur bike rider believes they could easily win the Tour de France. (2 marks)
- c** When witnessing a person trip on a set of steps, you think they are clumsy; however, when you trip on the same set of steps, you blame your fall on the slipperiness of the steps. (2 marks)
- d** Lionel believes that left-handed people are more creative than right-handed people. In their art class, Lionel focuses on all the left-handed artists that are creative to confirm their belief but does not acknowledge all the right-handed creative people in the class. (2 marks)
- e** Dimitri walks into a shop and sees a set of kitchen knives priced at \$700. He then sees another set of knives priced at \$180. Dimitri views the second pair of knives as inferior to the first set he looked at. (2 marks)

#### Question 2 (7 marks)

Marielle has just started a job as a marketing executive for a chocolate company. The team she is part of believes their marketing campaigns are the best in the industry. Marielle asks her new team to complete an open-ended survey about their views on marketing campaigns. Nine of the ten team members believe specialisation and niche targeting is the most effective form of marketing strategy for their brand. When Marielle offers alternative strategies to use, group members will often ignore or disregard her ideas.

- a** Describe aspects of Marielle's new workplace that make it susceptible to groupthink. (3 marks)
- b** Identify the type of data obtained via the open-ended survey. Outline one advantage and one disadvantage of this data type. (3 marks)
- c** One day, Marielle strongly disagrees with the ideas put forward by her team. Marielle decides to voice her opinion over the group majority. Identify the term that is used to describe voicing a minority opinion over a majority opinion. (1 mark)

**Question 3** (6 marks)

In 1971, US psychologist Philip Zimbardo conducted the Stanford prison experiment to observe how status and power influenced people in a simulated prison environment.

- a** During the experiment, the guards controlled the behaviour of prisoners by ordering them to clean bathrooms with their bare hands, refrain from smiling or laughing, stay awake when sleep deprived, spend time in solitary confinement and do push-ups. Identify and explain the type of power this involves. (2 marks)
- b** Explain whether the Stanford prison experiment possessed external validity. (2 marks)
- c** Throughout the study the prisoners suffered severe distress. Identify and describe the participants' right that was violated. (2 marks)

**Question 4** (5 marks)

Hamdessa understands that recycling is good for the planet as it can minimise waste and depletion of resources. Dropping soft-plastic recycling and old mobile phones off at recycling collection points makes Hamdessa feel as if he is making a difference. Hamdessa constantly encourages his friends to recycle.

- a** Using the tri-component model of attitudes, identify the affect, behaviour and cognition components of Hamdessa's attitude towards recycling. (3 marks)
- b** While driving home from work one day, Hamdessa sees a group of school students throw their rubbish onto the street. Hamdessa thinks to himself, "Young people don't care about our planet." Explain whether Hamdessa's thought is an example of prejudice or discrimination. Justify your response. (2 marks)

**Question 5** (6 marks)

Marco enjoys playing video games. During a typical gaming session, he gets to work together with and talk to two of his close friends who also enjoy gaming.

- a** Define social connectedness and explain how video games can positively influence Marco's sense of social connectedness. (2 marks)
- b** One afternoon when Marco's friends are busy, he decides to join a random team to compete with. Marco's new teammates are significantly better players than him and Marco barely contributes to their victory. This makes Marco feel insecure and less confident about his gaming ability. Explain what type of social comparison Marco is making and describe how the comparison could affect Marco's self-esteem. (2 marks)
- c** The following week Marco plays with his usual friends again. During this session Marco plays significantly better than his friends, which makes him feel better about his gaming ability. Explain what type of social comparison Marco is making and describe how the comparison could affect Marco's self-esteem. (2 marks)

**Question 6** (6 marks)

Asch conducted a series of experiments to assess the strength of a person's independence under different conditions. The aim of his first experiment (1952) was to investigate the extent to which an individual within a group will conform to the majority opinion. Several other researchers reproduced Asch's original experiment in different countries to observe whether other factors would affect conformity.

- a** Identify the dependent variable in Asch's first experiment (1952). (1 mark)
- b** Explain the importance of reproducing science experiments. (1 mark)
- c** Numerous factors have been found to influence conformity. Contrast informational influence and normative influence. Provide an example of each. (4 marks)

CHAPTER

# 9

# Perception

## KEY KNOWLEDGE

The following key knowledge is covered in this chapter:

- the role of attention (sustained, divided, selective) in making sense of the world around us
- the role of perception in the processing and interpretation of sensory information, as demonstrated through top-down and bottom-up processing
- the influence of biological, psychological and social factors on visual perception and gustatory perception.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

## GROUNDWORK

This chapter will build on concepts you have come across in Chapter 8. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



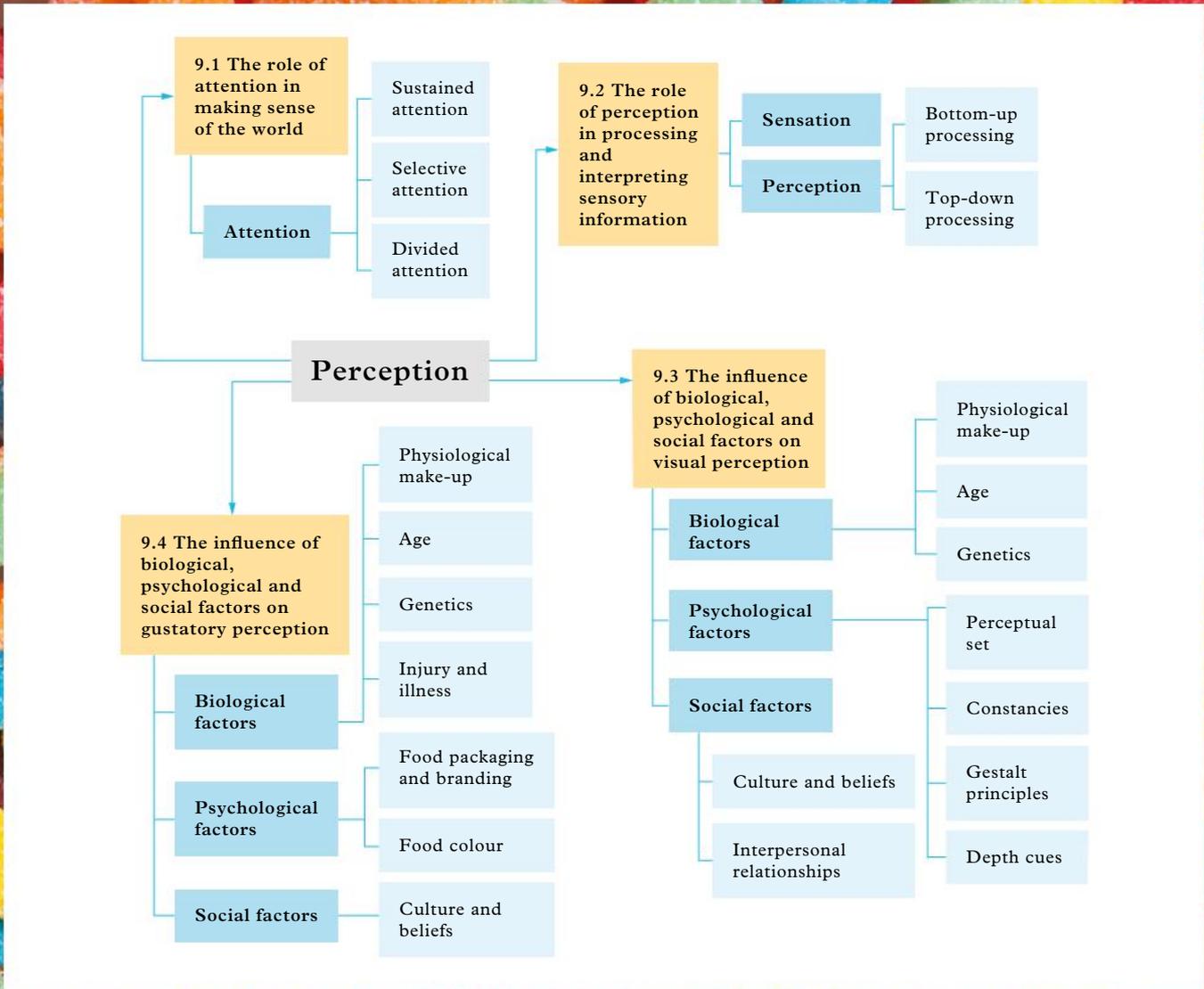
Groundwork quiz  
Chapter 9

## INVESTIGATIONS

9.1	INVESTIGATION: FIELDWORK	Have you been paying attention?	Page 488
9.2	INVESTIGATION: CONTROLLED EXPERIMENT	How does perceptual set affect your perception of rat-man?	Page 489
9.3	INVESTIGATION: SIMULATION	What does the world look like with red–green colour vision deficiency?	Page 491

**FIGURE 1** When you look at this photo of sour worms, your brain might draw on your sensory memory and produce a sour taste in your mouth.

# CONCEPT MAP



# 9.1

## The role of attention in making sense of the world

### KEY IDEAS

- ✦ Sustained attention is directed to stimulus for the duration of a cognitive task.
- ✦ Selective attention involves tuning out stimuli to focus on one specific item.
- ✦ Divided attention is directed at two or more tasks at the same time.



Think about the kinds of information you are receiving from your surroundings right now. Your eyes are scanning the words on this page. Your fingers might be fiddling with your pens and the back of the plastic chair you are sitting on might feel hard. You might be hearing the birds chirping outside the window, or smelling the sausage roll that your friend just had for lunch. You may be aware of all these things, but your ability to ignore most of this and read this paragraph is because of your ability to focus your awareness and attention.

## Attention

**attention**  
the behavioural and cognitive ability to process specific information actively, while ignoring other competing information

**Attention** is the behavioural and cognitive ability to actively process (or become consciously aware of) specific stimuli, while ignoring other competing information. It allows us to navigate the internal stimuli stored in our memory and the enormous amount of incoming external stimuli from the outside world to experience events and complete behavioural and cognitive tasks.

The stimuli that attract our attention are usually:

- novel (something new or unusual)
- changes in stimulation (such as a sudden movement or sound, a bright colour or large object entering your field of vision)
- meaningful or important to us (such as our name being mentioned in a crowded room)
- internal stimuli (thoughts, feelings and physiological changes).

By determining which stimuli we should focus our attention on, such as identifying a potential threat, we are able to survive. Attention also allows us to learn and form, retain and recall meaningful memories.



**FIGURE 1** You need to focus your attention on **a** where you are walking so that you do not bump into anyone on a busy street, and **b** information stored in your memory to remember the combination of your lock to open your locker.

The amount of information we can give our attention to at one time (capacity) and how long we can hold this attention for (duration) is limited. Therefore, we must develop useful ways to manage our attention. In this topic, we will explore three types of attention.



**FIGURE 2** You will learn about sustained, selective and divided attention.

## Sustained attention

When you are working on a task in class or reading an interesting article online, you are demonstrating **sustained attention**. This is the ability to maintain focus on one particular stimulus or cognitive task for an extended period of time, without being distracted.

Sustained attention involves vigilance (alertness or being “switched on”) and concentration (focus of attention). It is a specific focus directed to a stimulus for the duration of a cognitive task. It plays an important functional role because it allows us to pursue and complete goal-directed cognitive activities. What would be the point in baking a cake if you were unable to follow and focus on the instructions or place the cake in the oven? What if you had a flat tyre on your bicycle and became distracted halfway through the repair process?

Some everyday tasks that require sustained attention are:

- completing your homework
- watching a YouTube video
- playing a game of sport
- having a conversation
- driving a car.

As sustained attention helps us function every day, difficulty in completing tasks that require extended attention can signal cognitive conditions. Some neurodevelopmental disorders can interfere with attention, such as attention deficit hyperactivity disorder (ADHD). People with ADHD may find it challenging to maintain sustained attention on tasks. This can affect their learning if, for example, they struggle to focus on teacher instructions or completing a task.

### **sustained attention**

a specific focus directed to a stimulus for the duration of a cognitive task



**FIGURE 3** Sustained attention is required to play (and win) a game of basketball.

**selective attention**

the limited ability to focus on specific stimuli, while filtering out others



**FIGURE 4** You can tune out the conversations of other tourists at a scenic lookout to focus on the magnificent view.

**divided attention**

the ability to direct focus towards two or more tasks at the same time

**cognitive load**

the amount of information that our brains can handle at one time

**automatic process**

motor/procedural action or cognitive process that requires little mental effort, such as walking or riding a bike

**controlled process**

action that requires significant focus and mental effort to be performed, such as writing an essay or talking to a friend

## Selective attention

Attention operates at a very limited capacity. At any given moment, your conscious awareness and attention can only be focused on specific stimuli, while filtering out others. This is referred to as **selective attention**. For example, you might be able to tune out the neighbour’s dog’s barking to attend to your homework or focus on the conversation you are having with your brother in a noisy restaurant.

Successful use of selective attention allows us to focus our attention on things that are interesting or meaningful. It helps us to keep on track in the presence of distractions and unpleasant or upsetting stimuli, avoid becoming overwhelmed, and keep us safe.

Selective attention is key to learning and has also been shown to improve retention of information compared to divided attention, which you will learn about next.

At the same time, if we encounter new stimuli that is more relevant or important than what we were initially focused on, our selective attention will shift. When you are hungry, you might find it very difficult to focus on your homework. The stimulus can drive you to take an action or modify your behaviour to address a need. In this case, you might take a break from your work to get a snack.

## Divided attention

Although our attention is selective, we have the capacity to attend to and perform two or more tasks at the same time. This is called **divided attention**. You might be familiar with its more common term, “multitasking”. We can do this because different tasks require different levels of conscious effort. The level of conscious effort, and therefore **cognitive load**, depends on:

- how complex the task is
- how familiar or experienced we are with the task.

For example, walking is a motor-based action that typically has a low cognitive load. It is an **automatic process** that relies on muscle memory. Automatic processes can also be cognitive tasks that require lower levels of conscious awareness and less mental effort to complete, such as reading in your first language. On the other hand, learning to chop vegetables for the first time, having a conversation or writing an essay exerts a greater cognitive load. These **controlled processes** are more complex tasks that require higher levels of conscious awareness or mental effort.

Examples of automatic and controlled processes are shown in Table 1.

**TABLE 1** Examples of automatic and controlled processes

Automatic processes	Controlled processes
<ul style="list-style-type: none"> <li>• knitting or sewing</li> <li>• walking</li> <li>• riding a bike</li> <li>• playing the piano</li> <li>• reading in your first language</li> <li>• operating a car</li> </ul>	<ul style="list-style-type: none"> <li>• having a conversation with a friend</li> <li>• writing an assignment</li> <li>• reading a newspaper article</li> <li>• painting your nails</li> <li>• learning to chop vegetables for the first time</li> <li>• listening to a podcast</li> </ul>

You may have the capacity to divide your attention between two or more automatic processes, or one automatic process and one controlled process. You can easily walk down the street and talk to a friend on your phone, or prepare a salad while discussing the latest news with a guardian. You may have noticed that your guardian is able to drive you to school while talking about tonight's dinner menu. These examples demonstrate divided attention where tasks can be performed simultaneously, without significant difficulty.

### Study tip

Automatic processes can start as controlled processes because they were initially unfamiliar or challenging tasks that required mental effort and a high level of awareness. With time and practice, they can become automatic processes.



**FIGURE 5** An online streamer can divide their attention between playing a video game and responding to their audience.

It is much more difficult to perform two controlled processes at the same time, especially when you are trying to use the same sense to process multiple stimuli. For example, at a party, you might be trying to listen to two people talking to you at the same time. Your friend Lily wants to tell you about her weekend, while your other friend Hamil is hoping to discuss a psychology concept for an assessment task on Monday. Although it is a quiet gathering, you are unable to listen to both Lily and Hamil simultaneously. This is because conversations require high levels of attention and mental effort. You find that you begin to switch from one to the other and will most likely end up with a patchy understanding of each conversation.

Attempting to multitask can have negative consequences, such as making a greater number of errors or performing tasks more slowly. At the party, your relationships with Lily and Hamil may be damaged by your divided attention. In other situations, you might be putting yourself and others in great danger by trying to focus on more than one thing at once.

**FIGURE 6** If you try to text and drive at the same time, you are six times more likely to cause an accident compared to driving while drunk.



## 9.1 REAL-WORLD PSYCHOLOGY

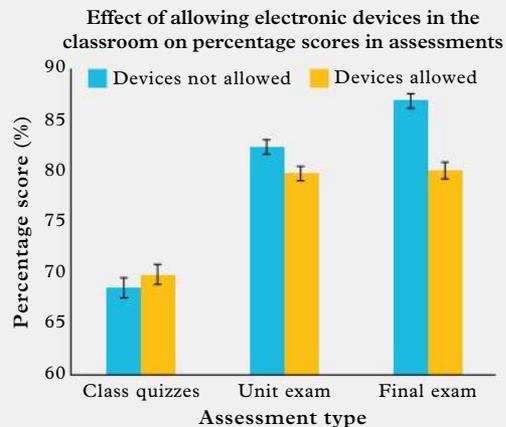
### Divided attention in the classroom reduces exam performance

In 2018, a study by Glass and Kang specifically explored the effect of electronic device usage for non-academic purposes during class on the academic performance of 116 university students (34 males, 82 females) all aged between 18 and 36. In a two-part university course, students were allowed access to electronic devices in half of the lectures. The effect of the devices was assessed using repeated measures (the same students) and within-subjects counterbalanced experimental design. Students self-reported on whether or not they had used an electronic device in each class.

Dividing attention between an electronic device and the classroom lecture did not reduce understanding of the lecture material, as measured by class quizzes. However, it reduced long-term retention of knowledge, which negatively affected unit and final exam grades. Overall, performance in exams was significantly poorer compared to students who were not permitted devices in lectures.

#### Apply your understanding

- 1 Write a hypothesis for this investigation.
- 2 Explain how divided attention has been used in this experiment.
- 3 Based on the researchers' conclusions in this study, suggest how this data could be applied to the real world (that is, describe its implication).



**FIGURE 7** The effect of allowing electronic devices in the classroom on percentage scores of classroom quizzes, the unit exam and final exam

## 9.1 CHECK YOUR LEARNING

### Describe and explain

- 1 Explain the role of attention in making sense of the world around us.
- 2 Describe the different types of attention.
- 3 Explain why divided attention is also referred to as multitasking.
- 4 Describe the difference between controlled and automatic processes in relation to divided attention.

### Apply, analyse and compare

- 5 Iris is walking down the street, talking with a friend on the phone. Identify the controlled and automatic processes and explain why Iris can walk and talk at the same time.
- 6 Edwin spent three hours studying for an upcoming VCE Psychology test and continued until he had completed all the items on his test checklist. Identify the type of attention that Edwin is demonstrating. Justify your response.
- 7 Explain why attention is important for day-to-day functioning. Use a real-life example to demonstrate your understanding.

### Design and discuss

- 8 You have been asked to draft an article for the school's newsletter on homework strategies. To do this, you conduct some research on the internet to include in your article. While you are conducting your research, you take notes in a separate document and listen to music. It takes you a couple of hours to analyse your research and complete the article.
  - a Explain how divided attention is evident in this scenario.
  - b Explain how sustained attention is evident in this scenario.
  - c Identify the type of attention that had the greatest impact on the time it took you to complete your draft. Justify your answer.



# 9.2

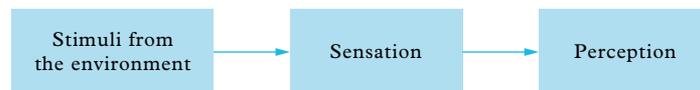
## The role of perception in processing and interpreting sensory information

### KEY IDEAS



- ✦ Sensation is the process whereby our sense organs detect stimuli from the environment and transmit it to the brain.
- ✦ Perception is the process whereby the brain organises and interprets sensory information.
- ✦ In bottom-up processing, the brain pieces together incoming stimuli and works upwards to form a mental representation.
- ✦ In top-down processing, the brain relies on existing representations to make inferences about what is being presented, then checks this against the incoming stimuli.

Before we can focus our attention on different stimuli, our bodies must first sense the stimuli (through sensation) and our brains must then make sense of them (through perception).



**FIGURE 1** Stimuli from the environment is sensed and then perceived.

In Chapter 4, you learnt about which regions of the brain are engaged when your body senses stimuli in the environment. Each sense is then processed in a complex way, so that we can experience it.

### Sensation

To experience the external environment, we detect stimuli using our five senses. For example, when you are served a bowl of phở at a restaurant, you will use your sense of:

- hearing to listen to the wait staff confirm your order
- sight to observe the design on the serving bowl
- smell to detect the scent of the herbs served with the dish
- taste to perceive the rich flavour of the broth
- touch to experience the smooth texture of the noodles.



**FIGURE 2** You use your five senses to experience a bowl of phở at a restaurant.

**stimulus energy**  
the form of energy that is detected by receptors in our sense organs; for example, light or chemical energy

Each of the five senses uses specialised sense organs containing receptor cells that respond to a particular **stimulus energy** (form of energy that is detected).

**TABLE 1** Senses, sense organs and receptors

Sense	Stimulus energy	Sense organ	Location of receptors	Sense receptor
Sight	Light or electromagnetic	Eye	Retina	Photoreceptors: rods and cones
Taste	Chemical	Tongue	Taste buds	Taste receptors
Touch	Kinetic	Skin	Skin	Receptors for pressure, heat and cold
Smell	Chemical	Nose	Nasal epithelium	Olfactory cilia
Hearing	Sound	Ear	Cochlea	Hair cells

**sensation**

the process by which our brains receive and process stimulus energy into sensory information

**absolute threshold**

the minimum strength or amount of stimulus required to perceive a stimulus, in ideal conditions, 50 per cent of the time

The process of **sensation** refers to the biological aspect of how we receive and process each sense's stimulus energy. For our bodies to detect a sensation, enough stimulus energy must reach the sense organ to activate the sense receptors. This process is called reception. The minimum strength, or amount of stimulus energy, needed to perceive a stimulus, in ideal conditions, 50 per cent of the time, is called the **absolute threshold**. The absolute thresholds for the five senses are shown in Table 2.

**TABLE 2** Absolute thresholds for the senses

Sense	Absolute threshold
Sight	The flame of a candle 50 kilometres away on a dark, clear night
Taste	One teaspoon of sugar dissolved in 10 litres of water
Touch	The wing of a fly falling on a cheek from a height of 1 centimetre
Smell	One drop of perfume in a large house
Hearing	The ticking of a watch 6 metres away

Receptors in the sense organs receive the stimulus energy and convert it into neural impulses (transduction), which are then sent to the brain (transmission) for further processing. This allows us to interpret and understand what we see, taste, touch, smell or hear.

**Study tip**

While the processes involved in sensation may be the same, our perception of them may differ.

## Perception

The cognitive process in which the brain receives, organises and interprets sensory information, and then enables us to experience it with conscious awareness and give it meaning, is called **perception**.

While sensation consists of a series of biological processes, perception allows us to add personal meaning to what we see, hear, taste, smell or touch. Perception can be broken down into:

- selection: picking the stimuli that are important to us and that we should pay attention to
- organisation: sorting the stimuli in a way in which we can make sense of it
- interpretation: giving personal meaning to the stimuli.

Our interpretation of sensory information depends more on psychological and social influences than biological influences. For everything that we perceive, we develop mental representations, or schemata. These schemata are stored in our long-term memory and allow us to understand and assign meaning to what we have sensed, then take any required actions to respond quickly. What influences our perception of visual stimuli (what we see) and gustatory stimuli (what we taste) is explored in Topics 9.3 and 9.4, respectively.

**perception**

the process by which our brains organise and interpret sensory information; allows us to consciously experience the information

There are two, initially competing, theories that explain how a perception is formed. James Gibson (1966) suggested that we operate in our world using bottom-up processing, while Richard Gregory (1970) refuted this theory and believed that we use a top-down process. Both bottom-up and top-down processes are now understood to work together, rather than independently.



Video

Top-down and bottom-up processing

## Bottom-up processing

Imagine that you are on a school trip to Phillip Island to see the little penguin parade in the evening. The friend you are sharing a room with is unwell and has stayed behind at the camp site. When you return from the outing, you find that the room is completely dark. To avoid waking your friend, you leave your shoes outside the door and enter the room quietly. Without any source of light, you feel your way around the unfamiliar space using the sensory stimuli from the environment to guide you. The information from the new environment is built up in your brain to guide your movement towards finding your bed and you form a schema of the room.

This is an example of **bottom-up processing**. It does not rely on previous knowledge. Instead, the raw, sensory data is received by our senses, converted into neural impulses, and then transmitted to our brain, where understanding is constructed. For Gibson, “sensation” and “perception” were the same.

The bottom-up theory is based on the idea that perception is an innate, survival-driven, evolutionary mechanism that does not require significant analysis or interpretation. For example, Gibson suggested that there was sufficient environmental evidence about the size, shape or distance from an object to allow us to make a direct assessment about the object.

However, after consciously experiencing the stimuli, we often need to rely, to some extent, on schemata to make sense of the incoming information and add meaning to it. For example, we might detect a citrusy aroma and see an orange-coloured, fruit-like object. Our ability to recognise it as a mandarin is because we have seen and smelled one in the past. We can match the profile built up using our senses with information in our memory. If we have not seen or smelled a mandarin previously then we may not recognise it, but we will still be able to bring together the sensory data and form new meaning around what we have experienced.

### bottom-up processing

a type of perceptual processing that involves gathering all the sensory information before adding meaning to it

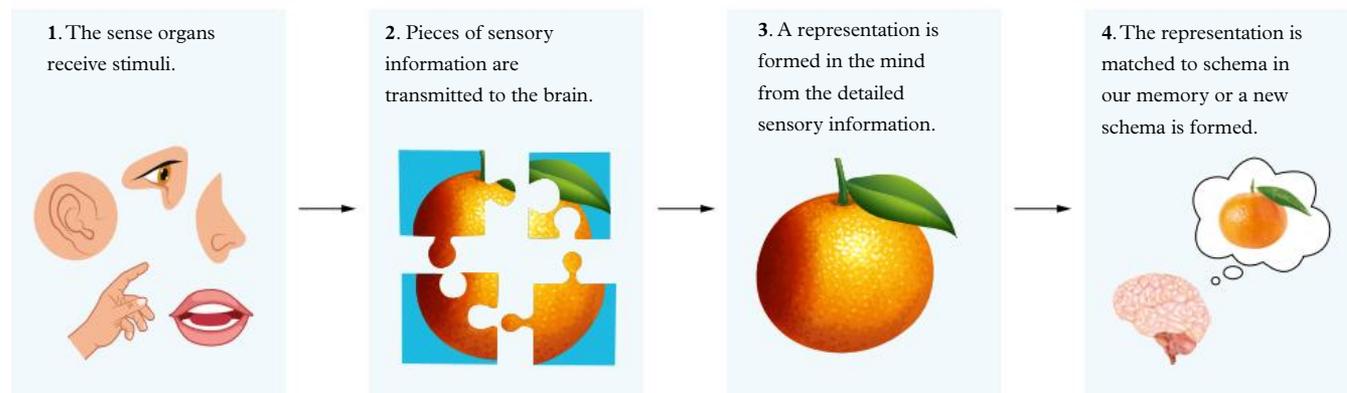


FIGURE 3 Bottom-up processing

Use Skill drill 9.2 to explore how bottom-up processing is involved in a blind taste test.

## 9.2 SKILL DRILL

### Analysing the results of a blind taste test

#### Key science skill: Analyse and evaluate data and investigation methods

At a family gathering, you and your cousins (10 subjects in total) decide to have a blind taste test competition using several flavours of ice cream. Each of you is blindfolded and given one small spoonful of each ice cream to taste. The results are shown in Table 3.

**TABLE 3** Results from the ice cream blind taste tests

Flavour	Number of correct guesses
Vanilla	8
Strawberry	3
Chocolate	8
Cookies and cream	9
Mint chocolate	10
Boysenberry	2

#### Practise your skills

- 1 Plot the data on an appropriate graph.
- 2 Describe the steps involved in perception of the ice cream.
- 3 Explain how bottom-up processing is used to identify the ice cream flavours.
- 4 Suggest a reason why there were so few correct guesses for boysenberry ice cream.

Need help analysing and evaluating data and investigation methods? See Topic 1.7 in your Psychology toolkit.



**FIGURE 4** Different flavours of ice cream

## Top-down processing

*Aoccdrnig to rscheearch at Cmabrigde Uinerovtisy, it deosn't mtttaer in waht oredr the ltteers in a wrod are, the olny iprmoetnt tihng is taht the frist and lsat ltteer be at the rghit pclae. The rset can be a toatl mses and you can sitll raed it wouthit porbelm. Tihs is bcuseae the huamn mnid deos not raed ervey lteter by istlef, but the wrod as a wlohe.*

While Gibson believed that perception was a bottom-up process, Gregory's theory of **top-down processing** is based on the belief that we actively construct our perceptions of the world from the vast array of stimuli received through our senses using **perceptual set**. This is a unique combination of past experiences, knowledge, expectations, motivations, culture, beliefs and emotions that, put together, guides how we experience the sensations we receive from our environment. You will learn more about perceptual set in Topic 9.3.

Processing information from the top down enables us to interpret information that has been received by our senses. Consider the mandarin example again. Sense organs receive the stimuli and send it to our brain. Instead of building up a representation from stimuli alone, top-down processing relies on existing schemata stored in the memory to make predictions or hypotheses about what we are perceiving. As we take in the stimulus information, our brains use hypothesis-testing to synthesise (build up) a schema.

Going back to the scrambled words at the start of this section, you may realise that you have used context and past experience to make predictions or a **perceptual hypothesis** about what each word is in order to form a coherent sentence. In top-down processing, we check this hypothesis against the incoming sensory data and what we have stored in our memory.

### top-down processing

a type of perceptual processing that involves making inferences about what is being presented, based on our perceptual set

### perceptual set

a unique combination of past experiences, knowledge, expectations, motivations, culture, beliefs and emotions that determine how we perceive sensory information

### perceptual hypothesis

a prediction about what we are perceiving

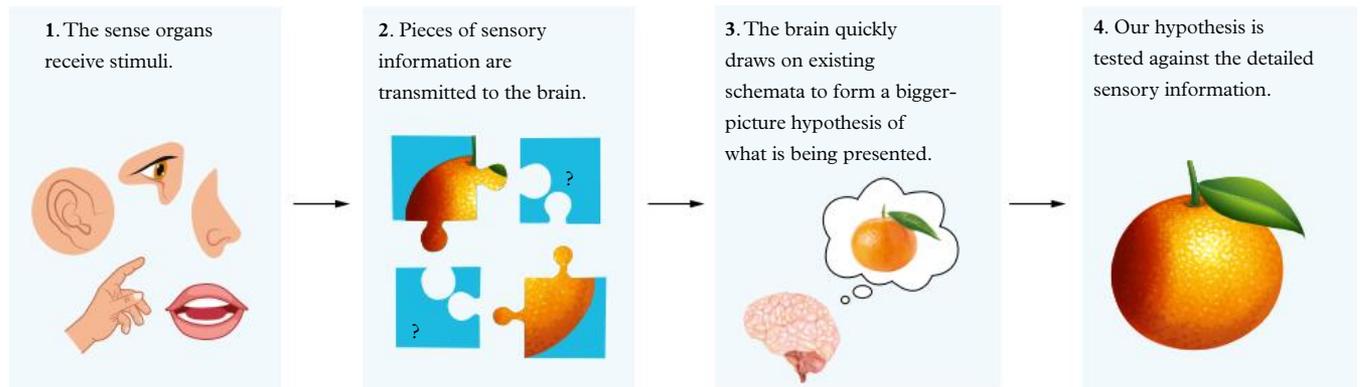


FIGURE 5 Top-down processing

Top-down processing allows us to operate in our environment more efficiently and function on a day-to-day basis because we are using existing schemata, past experiences, prior knowledge, expectations, values and emotions. This is particularly important as we are said to lose up to 90 per cent of incoming data between our senses and the brain. Consequently, when our sensory receptors receive information from our environment, it is then merged with previously stored information about the world, which we have developed as a result of experience.

Sometimes our hypotheses are correct, while at other times, we can form incorrect hypotheses which lead to **perceptual errors**. An important example is visual illusions, where what we perceive does not correspond to the physical characteristics of what we see. You will explore this in Topic 9.3.

### perceptual error

mistakes made during the perception of a stimulus

The ability to operate in the world requires both bottom-up and top-down processing. The biologically driven reception of sensory stimuli from the environment to the brain for lower-level processing works together with the psychological and sociocultural factors that allow us to interpret and respond efficiently due to past experience, context, motivation and knowledge. Even though bottom-up processing and top-down processing have been discussed as separate phenomena, the reality is that there is a strong interaction and interdependence between these two models because it is difficult to determine at which point the reception and processing of sensory stimuli are influenced by psychological and cultural experiences.

## 9.2 WORKED EXAMPLE

### Identifying the type of perceptual processing in the Stroop effect

A page of words is printed in different colours and participants are asked to name the colour of each word.

In most cases, people are more likely to read the words than identify their colour. This is because the brain is generally able to process the written word faster than it can process colour. This is a phenomenon called the Stroop effect. Identify whether the Stroop effect is caused by bottom-up or top-down processing and justify your response. (2 marks)

PURPLE YELLOW RED  
 BLACK RED GREEN  
 RED YELLOW ORANGE  
 BLUE PURPLE BLACK  
 RED GREEN ORANGE

**FIGURE 6** This list of words can be used to demonstrate the Stroop effect.

### Solution

Think	Do
Step 1: Identify whether there are any command terms in the question and determine what is required to address the command terms used (a glossary of command terms is provided in Topic 1.12).	The question uses the command terms “identify” and “justify”. This requires you to first name the type of processing involved, then provide reasoning for your choice.
Step 2: Look at the mark allocation to determine how many pieces of information are required. Link this back to what the command terms are requesting.	There are two marks allocated to this question. One must be related to the <b>identification</b> of the correct process, and one to the <b>justification</b> of the choice.
Step 3: Recall your understanding of bottom-up and top-down processing.	Bottom-up: Sensory stimulus to the brain, then the brain interprets the sensory information to make sense of the stimulus Top-down: Sensory stimulus to the brain, then the brain draws on existing schemata to fill in gaps
Step 4: Carefully read the question and any context that has been given for clues to construct your response.	“This is because the brain is generally able to process the written word faster than it can process colour.” This sentence indicates that the brain is not considering all of the sensory data and relying on existing schemata to form a perception.
Step 5: Construct your answer.	The Stroop effect is caused by top-down processing (1 mark) because it occurs from the brain using existing knowledge (understanding of the written word) to make sense of sensory information (words presented) without considering all sensory data (colour of the word) (1 mark).

**TABLE 4** Summary of bottom-up and top-down processing

	Bottom-up processing	Top-down processing
<b>Driven by</b>	Data	Hypotheses
<b>Interpretation of sensory information</b>	Does not require previous knowledge	Relies on context, perceptual set and existing schemata
<b>Processing level</b>	Lower; slower	Higher; faster
<b>After sensing incoming stimuli</b>	The brain pieces stimuli together and works upwards to form a schema, then matches this against our perceptual set	The brain relies on existing schemata to anticipate what is being presented to us, then checks this against sensory information
<b>Direction</b>	One; from sense organs to the brain	Two; from sense organs to the brain and from the brain back to the sense organs

**Study tip**

Bottom-up processing occurs in one direction: from the sense organs to the brain for more complex analysis. Top-down processing occurs in two directions: from the sense organs to the brain where an inference is made, and back to the sense organs to test our hypotheses.

**9.2 CHECK YOUR LEARNING****Describe and explain**

- 1 Define the terms “sensation” and “perception”.
- 2 Explain the role of absolute threshold in perception.
- 3 Describe two key characteristics of bottom-up processing.
- 4 Describe two key characteristics of top-down processing.

**Apply, analyse and compare**

- 5 Contrast the bottom-up and top-down processing theories.
- 6 “Who’s that Pokémon?” is a game featured in the television series Pokémon, where viewers are asked to identify a Pokémon based on its silhouette. The game can also be played with animal silhouettes.
  - a Look at the silhouette in Figure 7 and name the animal.

**FIGURE 7** What’s that animal?

- b Jessica successfully identified the animal, but her lab partner, Omar, was unable to. Explain these results, using the terms “schema”, “top-down processing” and “bottom-up processing” in your response.

**Design and discuss**

- 7 Work in groups of three to design a series of flashcards with examples of bottom-up and top-down processing characteristics on one side and notes explaining whether these characteristics are examples of bottom-up or top-down processing on the other side. Use your flash cards to test another group and discuss how perceptual set might affect perception.
- 8 As academic researchers, you have been invited to participate in a debate around the following statement: “We use bottom-up processing to make sense of the world. There is no need for top-down processing.” Select three people for each debating team, three adjudicators (who will make the decision) and a timekeeper. Allow each person on the team 2 to 3 minutes to present their position.

# 9.3

## The influence of biological, psychological and social factors on visual perception

### KEY IDEAS

Visual perception is affected by:

- + biological factors: physiological make-up, age, genetics
- + psychological factors: perceptual set, perceptual constancies, Gestalt principles, depth cues
- + social factors: culture.

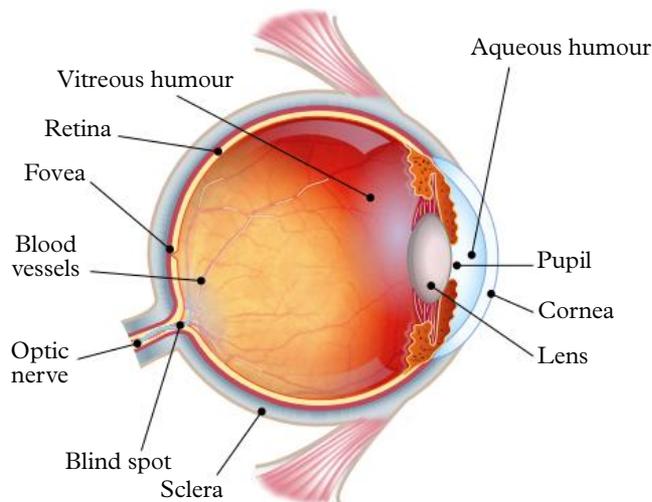


The saying “you have eyes in the back of your head” implies that a person has the ability to notice everything around them. If applied to perception, this saying becomes literal because the area that processes visual information and interprets what we see is in the visual cortex, located at the back of our brain. In this topic, you will learn about how different biological, psychological and social factors affect your visual perception.

### Visual perception

**visual perception**  
the ability to interpret the surrounding environment to make sense of what we see

**Visual perception** is the ability to see and interpret the surrounding environment and make sense of what we see. The biological aspects of vision are part of “sensation”, where the electromagnetic (light) energy enters the eye and reaches the visual cortex located in the occipital lobe of the brain. Once the visual information is received by the visual cortex, we can interpret what we see due to past experiences, knowledge, perceptual set and existing schemata. This part of the visual process is referred to as “perception”.

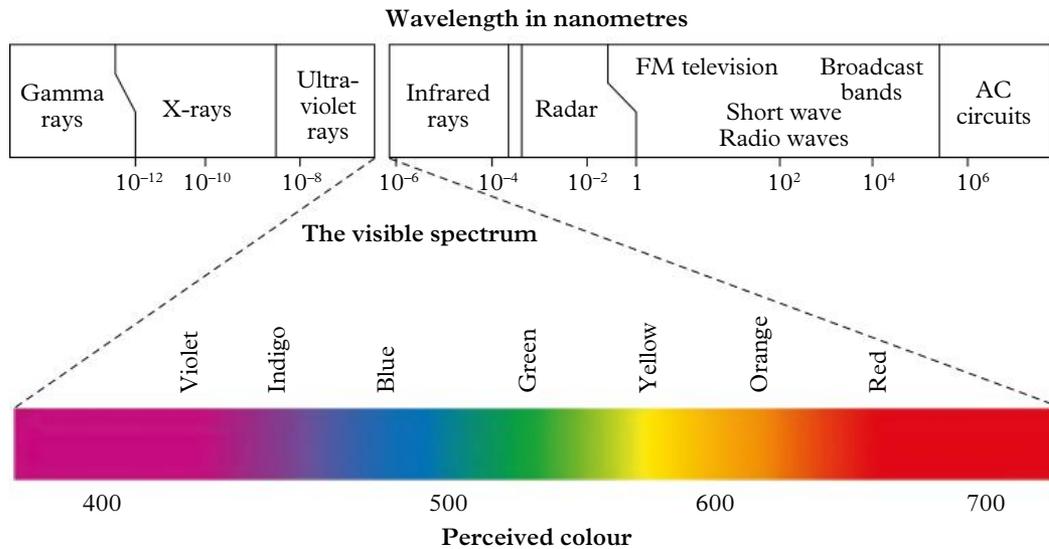


**FIGURE 1** The eye is where our sensation of visual stimuli begins.

Seeing and interpreting a visual stimulus involves an interaction between the biological processes in sensation and the psychological and sociocultural influences that guide our perception.

## Biological factors affecting visual perception

To trigger our sensory pathway, the stimulus energy must be at or above the absolute threshold. For vision, this is the detection of the flame of a candle from 50 kilometres away on a dark, clear night. The light energy must also be within the **visible light region** of the electromagnetic spectrum: 360 to 760 nanometres (Figure 2).



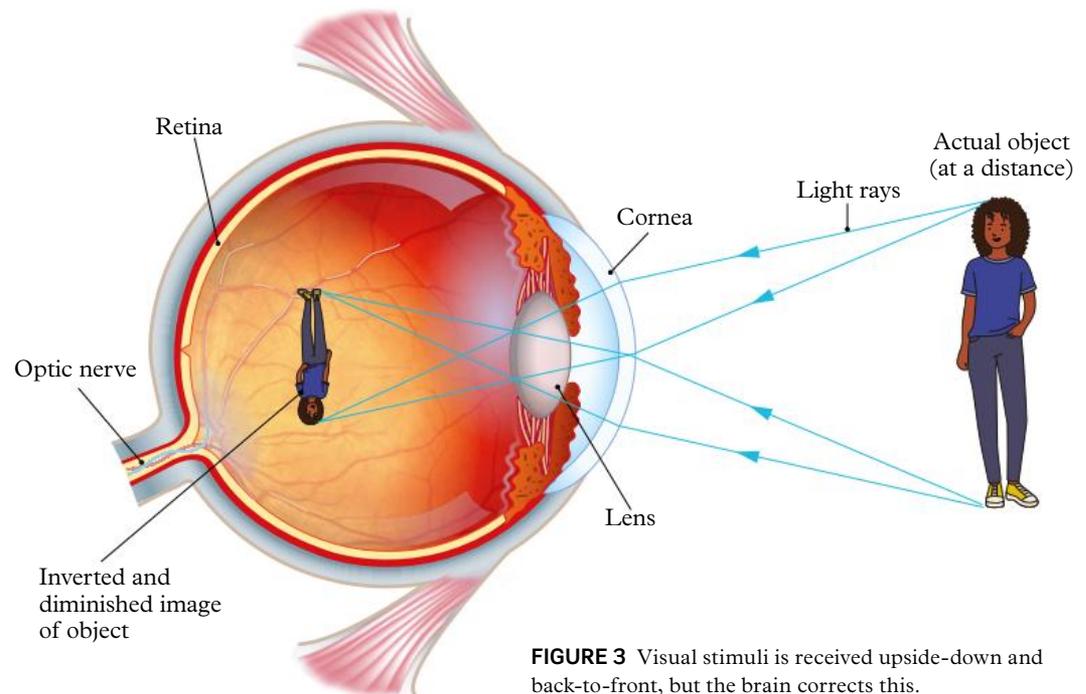
**visible light region**  
the wavelength region of the electromagnetic spectrum that is visible to the human eye; 360–760 nanometres

**FIGURE 2** The visible light region of the electromagnetic spectrum is between 360 and 760 nm.

The visual sensation pathway involves the following processes:

- 1 **Reception:** Light enters the eye via the cornea (the tough, transparent tissue covering the front of the eye) and passes through the pupil (the hole in the middle of the coloured part of the eye). The lens focuses the light on the retina, which contains photoreceptors called rods (sensitive to black and white) and cones (sensitive to colour). The image we receive on our retina is upside-down and back-to-front (Figure 3).

**reception**  
the process in which stimulus energy enters the sense organ



**FIGURE 3** Visual stimuli is received upside-down and back-to-front, but the brain corrects this.

**transduction**

the process in which stimulus energy is converted to nerve impulses

**transmission**

the process in which the nerve impulses are sent to the correct regions or cortices of the brain

**ClickView**  
Processing visual information

**Study tip**

The biological factors affecting visual perception relate to how structural or anatomical differences in the body affect how we see and, therefore, how we make sense of what we see.

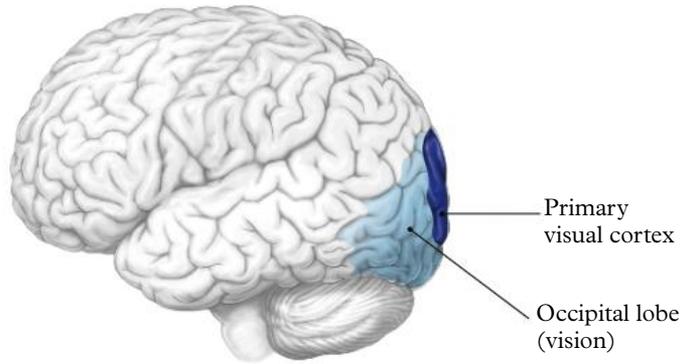
**colour vision deficiency**

an eye condition in which sensitivity to certain wavelengths of light is reduced; previously known as “colour blindness”

**congenital achromotopsia**

an eye condition in which individuals are born with black and white vision

- 2 **Transduction:** The light energy is converted by the photoreceptors into nerve impulses, which travel along the optic nerve to the brain.
- 3 **Transmission:** The nerve impulses are sent to the primary visual cortex in the occipital lobe (Figure 4). The optic nerves from each eye intersect, allowing visual information from the left eye to cross over to the right visual cortex, and vice versa.



**FIGURE 4** The visual cortex is located in the occipital lobe.

This is an example of bottom-up processing because incoming visual information travels from our environment until it is received by our brain. Little analysis is required, and the biological processes involved follow the same sequence for all individuals, as long as they do not suffer from a visual impairment.

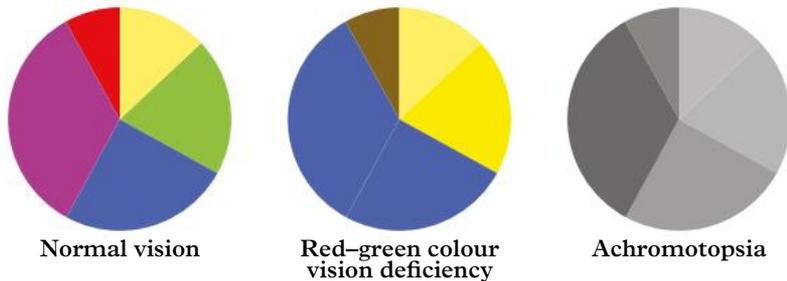
The biological factors that influence visual perception include physiological make-up, genetics, age and injury. These factors relate specifically to the structural features our body possesses and how they work.

**Physiological make-up**

The presence and absence of and damage to anatomical structures involved in visual processing can affect our visual perception. For example, a person who lacks one or more cone cell types may not be able to perceive specific wavelengths of light. This is called **colour vision deficiency**.

A complete absence of cone cells results in monochromatic (black-and-white) vision. People born without cone cells have a condition called **congenital achromotopsia**. Achromotopsia can also be acquired by damaging the neural pathways between the eyes and the brain, or can result from injury to regions of the brain that are involved in the perception of colour. This makes it difficult to distinguish between colours. Figure 5 shows how the same pie chart would look to someone with normal vision, red–green colour vision deficiency and achromotopsia.

A study by Ozates and colleagues (2019) also found that colour vision deficiency affects depth perception, which you will learn more about later in this topic.



**FIGURE 5** A pie chart seen via normal, red–green colour vision deficiency and achromotopsia vision



**FIGURE 6** A fly’s eye differs in many ways to a human’s. For example, it has many more lenses than humans (who only possess one lens), allowing the fly to see the world very differently from the way in which humans do.

## Age

The natural maturation and deterioration of our sense organs leads to eye conditions that affect how we perceive visual stimuli. For example, as you age, you might find that you need reading glasses. This is due to a condition called **presbyopia**, where the lenses of our eyes weaken and become less flexible over time, making it more challenging to focus on close objects. If uncorrected, presbyopia can greatly reduce our ability to detect and perceive visual stimuli.

The number and sensitivity of cone cells in our eyes also decreases as part of the normal ageing process. This makes colours appear dimmer and reduces contrast between them. Difficulty differentiating between colours may make it more challenging to locate objects in our environment. We may have difficulty attending to daily activities and also encounter problems identifying hazards if we cannot pick them out from the background environment.

Other age-related eye conditions such as cataracts, macular degeneration and glaucoma also cause a decline in vision and affect our visual perception.

Cognitive decline also occurs with natural ageing. Explore how this affects visual perception in Challenge 9.3.

### **presbyopia**

an eye condition in which the lens of the eyes lose their flexibility over time, making it more difficult to focus on close objects



FIGURE 7 Macular degeneration results in a black spot in the centre of your vision.

## 9.3 CHALLENGE

### Exploring how cognitive decline affects visual perception

In addition to structural changes that occur in your eyes, your brain's ability to process information can subtly decline with normal ageing. Your speed of processing, memory and higher cognitive functions (such as analytical and evaluation skills) may decrease. Discuss how this may affect your visual perception.

### Study tip

If our ability to sense visual information is changed, our perception will also differ.

## Genetics

Our physiological make-up is often closely tied to genetics. We may inherit visual disorders or have genes that predispose us to them. Congenital achromatopsia and glaucoma are two examples. Another example is **retinis pigmentosa**, an inherited disease where the retina degenerates, causing night blindness and loss of peripheral vision. It is caused by genetic mutations (abnormal changes) that inhibit the production of proteins required by **photoreceptors** in the eyes. The photoreceptors are unable to survive and vision is lost. This reduces the amount of visual stimuli we receive.

### **retinis pigmentosa**

an eye condition in which the retina degenerates and causes loss of peripheral vision and night blindness

### **photoreceptor**

receptor located in the retina that senses details in black and white (rods) and colour (cones)

## Psychological factors affecting visual perception

The biological factors described limit the amount of visual information available for our brains to work with. In addition, when you are looking out at the school yard, you are unlikely to be aware of everything that is within your field of view. What our attention is directed to depends on several psychological factors that predispose us to what we then perceive. Importantly, these factors also affect how (the specific ways in which) we perceive the information.

We assemble and interpret what we see in a way that is unique to ourselves using our perceptual set and the three principles of visual perception (perceptual constancies, Gestalt principles and depth cues).

### Perceptual set

Past experiences, context, motives, emotions and cultural expectations are involved in the process where the stimulus is given meaning. When we combine these factors, they form a unique perceptual set. Use of perceptual set is considered a top-down process, as we bring together what we are seeing and what we already know to create a story that makes sense to us.

The factors that can influence our perceptual set in visual perception are shown in Table 1.

**TABLE 1** Factors affecting perceptual set in visual perception

Factor	Description	Example
Past experiences	The same stimulus can be interpreted differently by different people, based on what they have encountered previously (including those that hold significant personal meaning).	Images of bananas shown in black and white were perceived as yellow (Hansen et al., 2006).
Context	The environment in which the perceived stimulus is observed, which can sometimes have an immediate effect on our expectations.	Participants perceived a clip of an actor's neutral face as happy when the next clip was of a little girl playing with a doll, sad when the clip was of a dead woman in a coffin, and hungry when the clip was of a bowl of soup (Kuleshov & Kuleshov, 1974; Barratt et al., 2016).
Motivation	Very often, we see what we want to see. This depends on a number of factors, such as our interests, desires, and even hunger and thirst.	After being trained to associate letters with delicious food, a larger proportion of participants reported perceiving the following stimulus as the letter "B" rather than the number "13" (Balcatas & Dunning, 2006). 
Emotions	Our interpretations can differ depending on how we ourselves are feeling.	Participants in a heightened (positive or negative) mood were more likely to perceive an emotional face over a neutral object (Anderson, Siegel & Barrett, 2011).
Cultural experiences and expectations	The country we live in, our community membership, socioeconomic status, cultural background, family, friendship groups and religious beliefs affect how we see the world.	Canadian, US and Japanese participants took different amounts of times to identify the odd one out from a set of lines (different length or angle), which could be related to the written language systems that they are familiar with (Ueda et al., 2018).

## Constancies

**Perceptual constancy** refers to the ability to maintain a stable (or constant) perception of a familiar stimulus, although the image on the retina may change. The different types of constancies are summarised in Table 2.

### perceptual constancy

the ability to maintain a constant perception of familiar stimulus, even if the image projected onto the retina changes

**TABLE 2** Factors affecting perceptual constancy

Factor	Description	Example
Orientation	The orientation of a familiar object can be perceived, regardless of what direction we see it in.	When we are lying on the couch, we still see our television the correct way up.
Size	The size of a familiar object is maintained, regardless of how close or far away it is.	We are walking along the road and see two identical trucks. One is further away. Even though the one further away appears smaller, we know that it is the same size as the one nearby.
Shape	A familiar object is perceived to maintain its known shape, despite observing it from a different perspective.	We know the classroom wall clock is round, even though it appears oval when we look at it from the side.
Brightness/colour	Familiar objects have the same level of brightness or colour, regardless of changes in the level of light in the surroundings.	You know that your school jumper is a particular shade of red or blue and will perceive it as being the same, regardless of whether you see it in the light or dark.

Perceptual constancy is usually learnt early in childhood. The more familiar we are with the observed object, the more likely it is that we will maintain perceptual constancy of it.



**FIGURE 8** The woman casts a larger image on the retina as she moves closer to us, but we know she remains the same size, so we use this information to establish her distance from us.

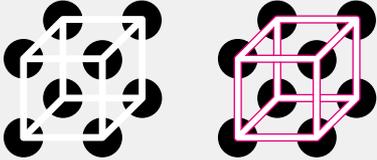
## Gestalt principles

“Gestalt” is a German word that means “good form”. Gestalt psychology is based on the principle that “the whole is greater than the sum of its parts”. In terms of sight, it refers to the tendency for our visual system to perceive what we see as a meaningful whole. Some examples of **Gestalt principles** include figure–ground organisation (including camouflage), closure, similarity and proximity.

### Gestalt principle

the principles of visual perception that describe our ability to make sense of visual information by treating it as a meaningful whole

**TABLE 3** Gestalt principles of visual perception

Factor	Description	Example
Figure–ground organisation	The part of the visual field being attended to and focused on is the figure and its surroundings are the ground. They are contrasted by an imagined contour (line).	In the exit sign, the “figure” is the white arrow and image of the person passing through the doorway. The green background is the “ground”. 
Closure	We perceive an object as being whole, despite it being incomplete. Our brain fills in the gaps.	When we look at the object as a whole, we might notice that there is a cube placed over eight black dots. Our brain fills in the missing lines (shown in red). 
Similarity	When individual parts of a stimulus are similar (for example, in size, shape or colour), we tend to group them together as a meaningful “whole” – a single unit.	On the left, the dots of the same colour are interpreted as belonging together. On the right, we may perceive rows of “A”, “B” and “C”. 
Proximity	When individual parts of a stimulus pattern are close to each other, we tend to group them together as a meaningful whole.	On the left, the dots are perceived as three rows due to their closeness to each other; one row is one “whole”. On the right, they may be perceived as five columns; one column is one “whole”. 

**camouflage**

the blending of figures into the background by breaking up contour lines

**depth perception**

the ability to perceive distance and judge three-dimensional spaces

**depth cue**

a stimulus that allows us to perceive depth



**FIGURE 9** The grey treefrog (*Hyla versicolor*) blends in with stone.

**Camouflage** makes use of the Gestalt principle of figure–ground by intentionally using patterns of colours that break up the contour of a figure. This causes it to blend into the background, making the figure more difficult to see. Camouflage can be seen in nature, for example, with leopards, tigers and giraffes. You can see an example of this in Figure 9 with frogs. Soldiers may also wear camouflage uniforms to blend into their surroundings and avoid detection.

**Depth cues**

**Depth perception** relates to our ability to judge three-dimensional space and distances, based on information obtained from the surroundings or from within our bodies. These pieces of information are called **depth cues**. We use both monocular (mono = one, ocular = related to the eye) and binocular (bi = two) depth cues to help us navigate the world around us. Both monocular and binocular depth cues play key roles in our visual perception.

## Monocular depth cues

**Monocular depth cues** are pieces of information provided from our environment that enable us to judge depth and distance, which require just one eye. There are two types: pictorial cues and accommodation.

**Pictorial** (or monocular) **cues** are given this name because they are used by artists to create a three-dimensional perception of something that exists on a two-dimensional surface. These cues help us judge distance.

Texture gradient and linear perspective are invariant cues that allows us to determine the depth and distance without the need for analysis.

### monocular depth cue

a depth cue that can be made sense of by our brains using information from just one eye

### pictorial cue

depth cue that allows us to judge distance; also known as monocular cue

TABLE 4 Pictorial cues

Pictorial cue	Example
<b>Linear perspective</b> – where parallel lines are made to converge as they extend along the page to an imaginary focal point on the horizon	In Figure 10a, the parallel lines of the St Kilda Pier in Melbourne converge in the distance to a focal point, the kiosk.
<b>Texture gradient</b> – where the detail of an object or surface decreases with increasing distance	You can see each blade of grass if you look at the grass at your feet. It is more difficult to see the detail when viewing the lawn in the distance (Figure 10b).
<b>Interposition/overlap</b> – where objects that are closer overlap objects that are further away	Because the bike overlaps with the tree trunk, we perceive the bike as being closer and the tree as being further away (Figure 10c).
<b>Height in the visual field</b> – where objects closer to the horizon are perceived to be further away than those lower or higher to the horizon	The Melbourne skyline close to the horizon is viewed as far away and the people and beach huts on Brighton beach are recognised to be closer because they are lower to the horizon (Figure 10d).
<b>Relative size</b> – where familiar objects that appear smaller are perceived as further away	In Figure 10e, the hot air balloons that appear to be smaller are interpreted as being further away than those that appear larger.



FIGURE 10 Examples demonstrating **a** linear perspective, **b** texture gradient, **c** interposition, **d** height in the visual field and **e** relative size.

### Study tip

Monocular depth cues require information from only one eye to make judgments about distance. Binocular depth cues require both eyes working together to form our depth perception.

**accommodation**

the ability of the lens to change shape to focus light on the retina

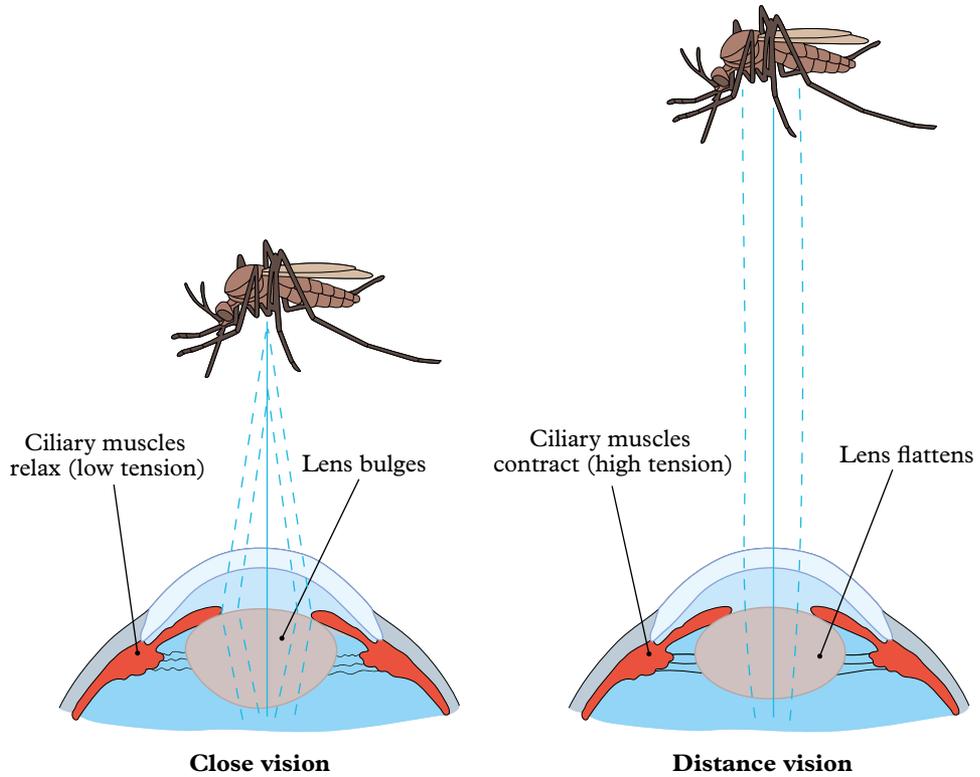
**Accommodation** involves the physiological ability of the lens to change shape so that it can focus light rays onto the retina. Small muscles called ciliary muscles control whether the lens bulges (for closer objects) or flattens (for more distant objects). At the same time, the tension in the ciliary muscles is received by the brain to confirm the location of the object being viewed – the greater the tension, the closer the object (Figure 11).

**binocular depth cue**

a depth cue that requires information from both eyes to be made sense of by our brains

**retinal disparity**

the difference in visual information received in each retina



**FIGURE 11** The ciliary muscles change the shape of the lens to accommodate close and distant vision (and help you make sense of how close the mosquito is to your face).

**9.3 WORKED EXAMPLE**

**Applying depth cues to create art**

Elleora is asked to paint an image of the Friday basketball game from one end of the schoolyard court. Name and describe three ways that Elleora can create the appearance of depth in her painting. (6 marks)

**Solution**

Think	Do
Step 1: Identify whether there are any command terms in the question and determine what is required to address the command terms used (a glossary of command terms is provided in Topic 1.12).	The question uses the command terms “name” and “describe”. This requires you to first identify three ways that Elleora can create depth in her painting, then provide the key features of each of these ways.
Step 2: Look at the mark allocation to determine how many pieces of information are required. Link this back to what the command terms are requesting.	There are six marks allocated to this question. One must be related to the correct <b>naming</b> of each way and one mark for the correct <b>description</b> .

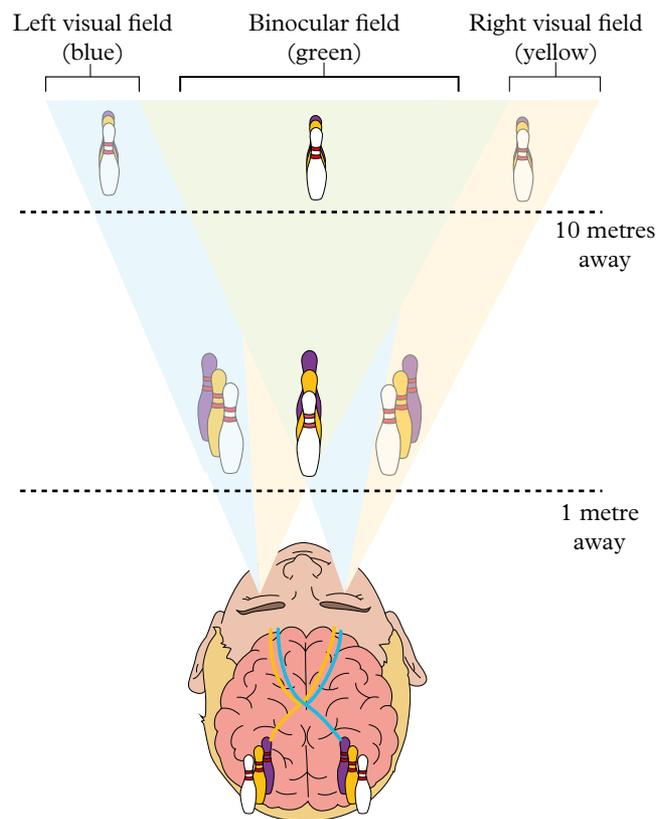
Think	Do
Step 3: Recall your understanding of depth cues.	Elleora needs to show depth (three dimensions) in her painting (two dimensions). Therefore, the pictorial cues must be relevant here. This includes linear perspective, texture gradient, interposition, height in the visual field and relative size.
Step 4: Carefully read the question and any context that has been given for clues to construct your response.	The question asks for ways in which Elleora can create the appearance of depth in her painting. Therefore, specifically describing what she must do in her painting of the basketball court will best demonstrate her understanding. For example, Elleora can use relative size and paint the basketball hoop on the opposite end of the court smaller.
Step 5: Construct your answer.	To paint the image, Elleora can use: <ul style="list-style-type: none"> <li>• relative size (1 mark): objects in the distance are smaller in size; paint the basketball hoop on the opposite end of the court smaller (1 mark).</li> <li>• linear perspective (1 mark): parallel lines converge to depict distance; show the parallel basketball court boundaries converging in the distance (1 mark).</li> <li>• interposition (1 mark): objects further away in the background are obscured by objects closer in the foreground; draw the team members on the other side of the court slightly obscured by the team members who are closer (1 mark).</li> </ul>

### Binocular depth cues

**Binocular depth cues** also help us to judge depth and distance but require both eyes working together. They enable us to make sense of the three-dimensional world. Binocular depth cues include retinal disparity and convergence.

**Retinal disparity** refers to the difference in visual information received in each retina. To construct the left visual field (blue shading in Figure 12), sensory information from both eyes is required. Remember that this information is processed in the right visual cortex. Both eyes also need to put together the right visual field (yellow shading in Figure 12), which occurs in the left visual cortex. These two fields of vision are combined in our brain to produce a final image – the binocular field.

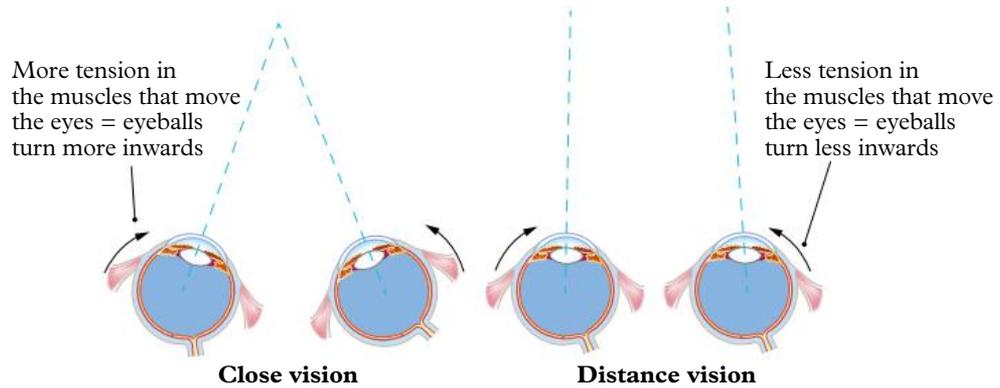
Due to the distance between our eyes (approximately 6 centimetres), we experience a disparity (or difference) between images projected onto each retina. The closer the object, the greater the disparity in visual image received in each retina. The further away the visual stimulus, the less disparity. In Figure 12, there will be the least disparity between how our eyes perceive the bowling pins that are 10 metres away and the most disparity between how we perceive the bowling pins that are only 1 metre away.



**FIGURE 12** The brain combines the images from each visual field to form a binocular view.

**convergence**  
the ability of the eyeballs to relax or turn inwards to focus on objects at different distances

When we bring an object close to our nose and focus on it, we often experience discomfort in our eyes if we try to hold that position for too long. This is because we are using **convergence**, a binocular depth cue relating to the amount our eyeballs turn inwards to focus on an object that is close to our face or relax to focus on objects in the distance (Figure 13). The brain detects the amount that our eyeballs turn from the tension of the muscles that move the eyes and uses this to make distance judgments. The more they turn, the closer the object is to the viewer; the more relaxed, the further the object.



**FIGURE 13** Convergence allows us to judge how far away an object is from our eyes.

**Study tip**

Biological factors involve bottom-up processing, whereas psychological and social factors involve top-down processing.

## Social factors affecting visual perception

There are several social factors that influence the way we see the world. These include the country we live in, community membership, socioeconomic status, cultural background, family, friendship groups and religious beliefs. Our individual social landscapes are complex and unique to ourselves. These factors are also highly interconnected; it can be difficult to separate how individual factors shape our perception.

### Culture and beliefs

Remember from Chapter 8 that culture includes many different elements, such as customs, values, beliefs, knowledges, behaviours and other characteristics shared among members of a group or society. These factors all affect where our attention is directed (selection) and how we make sense of and relate to what we are seeing (interpretation).

In many cultures, we use language to describe experiences and communicate our thoughts and feelings. This can limit our cognition and affect the way we add meaning to visual stimuli. For example, some cultures describe how they see the world in absolute terms, where the features of a subject are independent and unchanging (for example, there are two dogs in Figure 14). In other cultures, relative terms are used, which involves a comparison to something else, and perception depends on the features of other subjects in the visual field (for example, there are more sheep than dogs in Figure 14).



**FIGURE 14** In absolute terms, there are two dogs in the photo. In relative terms, there are fewer dogs than sheep.

The Pormpuraaw people in the western edge of Cape York Peninsula in Queensland use absolute cardinal directions (north, south, east and west) when describing space in their native language, Kuuk Thaayorre (Boroditsky & Gaby, 2010). We might be more familiar with talking about right, left, forwards and backwards. This affects our ability to make sense of geography (our spatial awareness) and therefore, navigation.

A study by Stachoň and colleagues (2018) has also suggested that different regions of the brain are activated when performing figure–ground recognition tasks, depending on whether participants were raised in Asian or Western cultures. Both groups were able to efficiently locate symbols on a map (the “figure”, as shown in Figure 15). However, participants raised in East and South-East Asian cultures were found to more quickly locate background segments of the map (the “ground”). One possible explanation is that language used in Asian cultures, particularly Chinese, uses complex characters where it is important to note the subtle differences in the strokes. The differences in processing affect where our attention is directed when we observe our environment.



**FIGURE 15** Subjects raised in Asian cultures identified background segments of a map more quickly than those raised in Western cultures. Similar maps were used in the study by Stachoň et al.

## The effect of interpersonal relationships

The people we surround ourselves with also affect how we perceive the world. Biases and preconceptions we may have learnt from our family and friends (for example, from observing their behaviour or hearing their stories) will affect how we add meaning to what we see. These allow us to pick up patterns in visual cues from the environment, relate them to what we have been taught and use them to guide our behaviour in new situations.

The nature of our relationships with them also affect how we see the world. Research by Schnall and colleagues (2008) found that the presence (or even the thought) of a supportive friend affected how participants estimated the steepness of a hill. Participants who were with or thinking of a supportive friend perceived the hill to be less steep compared to participants who thought of a neutral person or a person they disliked. Go to Real-world psychology 9.3 to explore how family environment affects visual perception.

## 9.3 REAL-WORLD PSYCHOLOGY

### Reaction speed to visual stimuli is increased in teenagers living with families in conflict

A study by Chraif and Aniței (2011) looked at how teenagers performed in a peripheral perception test, which involved them reacting to stimuli coming from the left and right sides of their field of vision (periphery). They found that teenagers living with families in conflict or a “negative family climate” reacted more quickly to the moving stimuli compared to those living in a “positive family climate”.

#### Apply your understanding

- 1 Write a hypothesis for this investigation.
- 2 Identify whether the influence investigated is a biological, psychological or social factor.
- 3 Suggest an explanation for the results of this investigation.

## 9.3 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe two differences between sensation and perception in visual perception.
- 2 Describe the role of photoreceptors in the retina. Make sure you refer to both rods and cones.
- 3 Explain the role of Gestalt principles in visual perception.

### Apply, analyse and compare

- 4 Explain why perceptual constancies are examples of top-down processing.
- 5 Gina attended the National Gallery of Victoria and was impressed with how the artists could create depth and distance in landscape paintings. Explain how pictorial cues could be used to create a three-dimensional image on a two-dimensional surface.
- 6 Contrast binocular and monocular depth cues.
- 7 For each of the photos shown, identify and explain the biological, psychological and social factors that allow us to perceive them:



### Design and discuss

- 8 Select one of the images from question 7 and discuss how problems with our ability to make sense of monocular depth cues might affect our perception of the image.
- 9 Design a mind map about perceptual set and how different aspects are connected to it (such as experience, mood, emotions, context and culture). You may undertake additional research to complete this task.
- 10 Discuss, using examples, how biological, psychological and social factors might interact with each other to affect how we perceive visual stimuli.

# 9.4

## The influence of biological, psychological and social factors on gustatory perception

### KEY IDEAS

Gustatory perception is affected by:

- + biological factors: psychological make-up, age, genetics
- + psychological factors: perceptual set, including food appearance, packaging and branding
- + social factors: culture.



**sensory memory**  
the collection of schema stored in your memory relating to how the elements of the world look, sound, feel, smell and taste

**gustatory perception**  
the ability to experience and interpret what we have consumed; also known as taste perception

**taste**  
the sensation experienced by the mouth and tongue when we consume food and drinks

**taste bud**  
a structure on the tongue that contains taste receptor cells; a taste sense organ

**chemoreceptor**  
a protein or cell in the body that responds to chemical stimuli

Taste is, in some ways, more complex than vision. In the same ways, it makes use of our interpretation of sensory information in real-time (bottom-up processing) and **sensory memory** stored in our brains (top-down processing). However, unlike vision, where the eyes are the sole sense organ from which perception is crafted, taste combines a range of senses to create a perception.

### Gustatory perception

**Gustatory** (taste) **perception** refers to the experience in which taste buds in the tongue and throat send information about the chemical composition of a soluble stimulus to the brain, which is then interpreted. Just like visual perception, taste perception is influenced by biological, psychological and social factors. However, unlike visual perception where most people undergo the same biological processes, the ability to taste varies from person to person.



**FIGURE 1** Our perception of taste is influenced by a range of biopsychosocial factors.

### Biological factors affecting gustatory perception

**Taste** involves the perception of chemicals by specialised cells located on our tongue and throat known as our **taste buds**. We can have up to 10,000 of these on our tongue, which contain 50 to 150 taste receptor cells each.

The gustatory sensation pathway involves the following processes:

- 1 Reception: when we consume something, chemical compounds in the substance bind to the specialised sensory receptors on our taste buds, called **chemoreceptors**, which are responsible for taste perception.
- 2 Transduction: the chemical energy is converted by the chemoreceptors into nerve impulses, which travel from the tongue to the brain.
- 3 Transmission: the nerve impulses are sent to the primary gustatory cortex near the border of the frontal and parietal lobes.

**flavour**

a complex system of perception that involves taste, smell, vision and touch

**primary taste**

sweet, salty, sour, bitter and umami

**Study tip**

Gustatory perception involves more than just taste. For example, the brain will even include pain as part of the flavour profile for hot and spicy food.

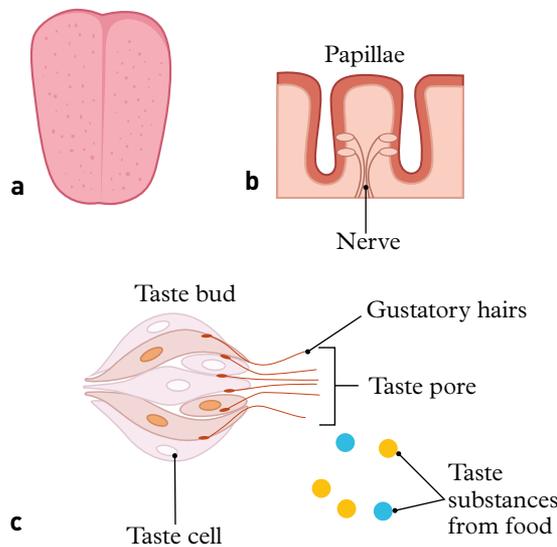
Most of us confuse taste with **flavour**, a more complex part of gustatory perception that involves multiple senses. Our brain not only interprets the taste stimuli, but also the smell of the food, its temperature, and the texture of what we are eating. What the food looks like also plays a role in our perception. This allows us to experience the five **primary tastes**, which are considered the building blocks of flavour:

- sweet
- salty
- sour
- bitter
- umami (savoury).

Each flavour provides clues about whether food is safe or harmful to eat, which foods provide important vitamins and minerals, and which might be poisonous. Generally, sweet foods are important for energy, salty foods provide nutrients, sour foods could be healthy (lemons and oranges) or spoiled (soured milk), while bitter-tasting foods are often poisonous. These days, it is more difficult for us to determine the nutritional value of some processed foods as many contain flavour enhancers, sugar and salt. Our perception of taste also leads us to have an appropriate emotional and/or behavioural response, such as spitting out a bitter-tasting food or a food that might make us nauseated.

**Physiological make-up**

The taste cells on our tongues have spindly protrusions called gustatory hairs that reach out of an opening called a taste pore (Figure 2). When we eat something, our saliva helps dissolve and release taste substances from our food. These chemical compounds can then enter the taste pore and interact with the gustatory hairs, which then stimulate the sensation for taste.



**FIGURE 2** a The tongue contains many small bumps called b papillae. c Each papilla contains taste buds made of taste cells, gustatory hairs and a taste pore.

Our sense of smell also plays a vital role in gustatory perception. Think about the last time you had a blocked nose. You may have noticed that your food was boring or tasteless. This is because our senses of smell and taste work together to finetune our overall experience

of taste (Figure 3). The close links between taste and smell are linked to our survival. Most of the time, we are able to use our sense of smell to detect whether food is spoiled. This prevents potential food poisoning.

## Age

Age is another biological factor that influences our sense of taste. Newborn babies are programmed to like sweet tastes. This could provide an evolutionary advantage because sweet foods are typically rich in energy. As we mature, we develop a tolerance and even a liking for more bitter tastes (such as coffee or beer).

From the age of about 40, our taste buds do not regenerate as fast as they die, so we gradually lose taste sensitivity. As we age, our production of saliva also decreases. This may explain why older people require more seasoning on their food to achieve the same taste sensation.

## Genetics

Many people enjoy the taste of coriander, but for approximately 20 per cent of people, it tastes like detergent. The interpretation of the “soapy” taste is linked to a person’s genes (Figure 4). Genes may also explain why brussels sprouts and broccoli taste extremely bitter to some people.

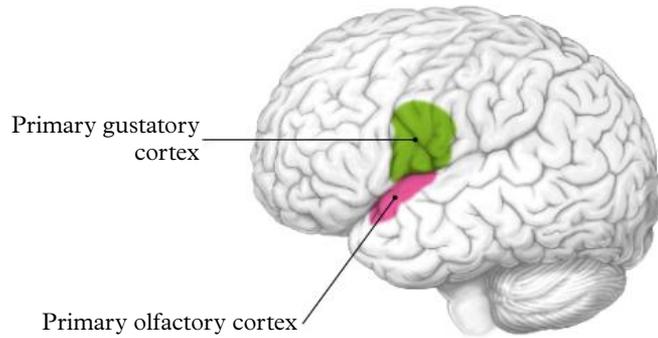
The links between genetics and taste perception are also supported by research. Eighty per cent of identical twins (who share the same genetic blueprints) perceived bitter tastes in the same way, while only 50 per cent of fraternal twins shared the taste preference (Callaway, 2012).

Another taste difference was discovered by chemist Arthur Fox in 1931. When he poured some powdered phenylthiocarbamide (PTC) into a bottle, it accidentally blew into the air. An assistant who was standing close to the airborne powder complained that it tasted bitter. Fox was surprised because he could not taste the bitter compound. We now know that this is because Fox had a low taste sensitivity, making him a **non-taster**. Research has since shown that about 25 per cent of people are non-tasters. Now, PTC is used to determine whether a person is a non-taster.

On the opposite side of the spectrum from non-tasters are **supertasters**, who have more taste receptors and, therefore, a “super” taste sensitivity. This is suggested to be linked to the presence of a specific gene that causes them to have more taste buds. Supertasters experience the different tastes with greater intensity. A cake might be too sweet, a coffee too bitter or chilli in their food too hot.

Most people are somewhere in between non-tasters and supertasters. You will learn more about supertasters in Chapter 10.

The biological processes involved in how we taste food are connected to our sense of smell, age, genetics and the number of taste buds on our tongue. Sensory information from our environment initiates a bottom-up process. However, psychological and social factors also influence what we like to eat, in a top-down process.



**FIGURE 3** Gustatory stimuli are processed in the primary gustatory cortex, located next to the primary olfactory cortex.



**FIGURE 4** Our like, or dislike, of coriander can be linked to our genes.

### **non-taster**

an individual who has a decreased sensitivity to taste due to less sensitive taste perception

### **supertaster**

an individual who has an increased sensitivity to taste

### **Study tip**

Biological factors contribute to our gustatory perception through bottom-up processing. The psychological and social factors contribute via top-down processing.

## Injury and illness

Like visual processing, changes to structures involved in gustatory processing will affect how we perceive taste. Death of taste cells, such as from infection by certain COVID-19 variants or a burn to the tongue, can result in a loss of taste. However, our taste cells usually regenerate quickly. This is essential, otherwise loss of taste cells would result in a permanent loss of taste.

As saliva is important for release of taste substances, changes to saliva production and quality will also affect our perception of taste. Some medications and medical treatments such as chemotherapy can reduce saliva production. In one study by Zabernigg et al. (2010), almost 70 per cent of patients undergoing chemotherapy reported some change to their perception of taste.

Damage to nerve cells that transmit information from our taste buds to the brain will also affect taste. For example, one of the nerves important for taste perception is the cranial nerve. Because this nerve extends from our tongue through the middle ear then to the brain, damage to the ear can affect taste.



## Psychological factors that affect gustatory perception

As with vision, perceptual set in taste perception refers to a predisposition to taste something in a particular way or to select only certain parts of the taste to attend to. Seeing food triggers memories and establishes expectations of the food we look at. Sometimes you might even taste the food you are thinking about because this information is stored in your memory. When going to our favourite fast-food restaurant, we know what to expect from the hot dog we usually order with mustard and tomato sauce. This is driven by top-down processing. The factors that can affect our perceptual set in gustatory perception are summarised in Table 1.

**TABLE 1** Factors affecting perceptual set in gustatory perception

Factor	Description	Example
Food packaging and appearance	We are more likely to purchase and eat food that looks attractive.	Eighty-eight per cent of children preferred the taste of snacks with cartoon characters on the packaging compared to packaging that had a plain label or label advertising the health benefits of the snack (Enax et al., 2015).
Education and upbringing	Our educational experiences around food, along with our upbringing, can influence gustatory perception.	Children more familiar with different food categories were more skilled at identifying tastes and categorising foods (Mustonen et al., 2008).
Past experiences	Our expectations are built from past experiences. If we have consumed something we like in the past, we are likely to consume it again in the future.	Participants who had tasted squid before and disliked it were more likely to give squid chowder a low rating (Urban et al., 1977).
Mood	Food and drinks tend to taste better if we are in a good mood. If we are sad, angry or upset, this can alter our perception of food.	A mixed juice was perceived to be less sweet after watching a horror movie (Zushi et al., 2021).



**FIGURE 5** The different coloured rainbow fruit loops are actually all the same flavour.

## Food packaging and branding

Various studies have reported that visual elements such as colour, shape and familiar branding all influenced a person's perception of a product. For example, images displayed on juice packages influenced the consumer's judgment of the product's flavour before they had tried it. Even when the image was not related to the product, bright or fresh-looking images created the perception that the juice would be fresher or sweeter than juices with plain or image-free packaging (Mizutani et al., 2010).

**Brands** can also have a significant impact on the perception of a food item's quality. Marketing of brands is important to establish reputation and product positioning. For example, you may think the new range of Lindt chocolates is a higher quality than the home-brand chocolate at your local supermarket, even if you have never tried it. This may be because you have prior experience with Lindt chocolate or because advertising or word of mouth has led you to believe it is a brand associated with a high-quality product. The advertising that accompanies brands and their reputations is often carefully crafted to affect perceived quality, by directly or indirectly mentioning quality in their marketing materials.

Similarly, the price on a product can also affect how we perceive its quality. In a study by Plassmann and colleagues (2008), adult participants reported that wine believed to be sold for a higher price tasted more pleasant than wine thought to be sold for less. We draw on our existing knowledge through top-down processing to associate more expensive products with better quality.

## Food colour

Did you know that more than 50 per cent of our brain is devoted to visual processing while only 2 per cent is involved in taste perception? We rely heavily on visual information, especially colour, to anticipate our experiences of different foods. We use visual cues and existing schema to inform our gustatory experiences.

When we eat, the first thing we do is look at our food and make assumptions about how it will taste, based on colour and presentation. In a way, we eat with our eyes. For example, if we see a bright red apple, we assume that it will taste sweet. If the apple is not as sweet as we expect, our brain might modify our taste experience and trick us into thinking the apple tastes better than it does in reality. We draw on memories and our perceptual set to shape this gustatory perception.

Different foods are also associated with different colours and flavours. Depending on culture and past experiences, we may assume that a red drink is most likely cherry- or strawberry-flavoured, while a yellow-coloured jelly may be pineapple or lemon. These expectations also include food that appears "off" in colour. **Off-colouring** refers to a conflict between what we expect a food to look like and how it appears. For example, if we see a yellow capsicum that contains black, green and white discolouration, we may recognise this as mould and understand that the capsicum is off and unsafe to eat (Figure 7).

### brand

the unique name or identity of a company selling a product



**FIGURE 6** Which do you prefer: Vegemite™ (Australian) or Marmite (British)?



**FIGURE 7** A rotten yellow capsicum

### off-colouring

the discrepancy between our expectation of a food's appearance and its actual appearance

Unnatural, artificial colouring of food that does not align with our expectations may signal to us to be wary of – or even avoid – the product. But on the other hand, enhancing colour could add excitement and interest to a plain-coloured food (Figure 8).

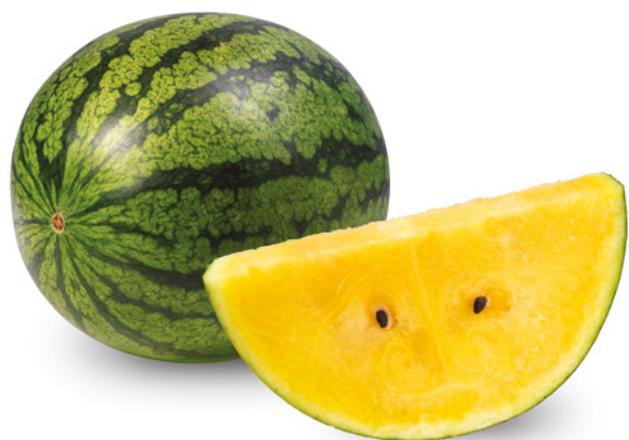


**FIGURE 8** a Would you eat a blue–green burger? b How about green tomato sauce?

Similarly, some of us may not be familiar with foods available in colours that are unusual to us, such as the black diamond apple grown in Tibet (Figure 9) and the yellow watermelon native to Africa (Figure 10). We may perceive them to be genetically modified or even fake, but both are natural fruits!



**FIGURE 9** A black diamond apple



**FIGURE 10** Yellow watermelon

## Social factors that affect gustatory perception

The same social factors discussed in Topic 9.3 play a significant role in what we can, cannot or will not eat and drink. This includes our cultural background, social groups, socioeconomic status and financial situations, the country we live in and our religious beliefs. These factors determine the foods we are exposed to and shape our perceptions around them. Our preferences then affect our dietary choices.

### Culture and beliefs

We adopt dietary habits learnt from our cultures. Growing up, we gain exposure to different types of foods depending on our culture. We are more likely to enjoy flavours that we have grown up with, and this is then reflected in our preferences as we move through life.

The effect of familiarity on taste perception has also been shown in various **cross-cultural studies**. Torrico and colleagues (2019) asked participants with Asian and Western backgrounds to evaluate 10 different foods: tortoise jelly, chilli slices, beef jerky, dried tofu, Vegemite, durian cake, octopus chips, chocolate, corn chips and wasabi-coated peas. There were clear differences in the foods familiar to Asian and Western participants, but in both groups, participants preferred the taste of foods that they had been exposed to before.

**cross-cultural study**  
an investigation comparing two or more different cultures

Foods consumed normally as part of a culture may be perceived as unusual (or even taboo) in other cultures. For example, you might be used to filling your tortillas with pork, but if you practise Judaism or Islam, pork products are prohibited and you might replace them with beef. If you were a local of Oaxaco, Mexico, you might prefer the taste of deep-fried grasshoppers, which are a popular filling for tortillas (Figure 11). Many typically view insects as pests but in some cultures, they are also tasty treats if prepared appropriately. The idea of eating insects may sound unpleasant to you, but we become more receptive to trying new things as we get older. This means that, even if you are not open to trying deep-fried grasshopper now, you might be in a few years' time!

Language also plays a role in the perception of taste as it limits the vocabulary we can use to describe our experience. Most of us match the flavours we taste to the five primary terms, but this is not the case in all cultures, such as European cultures where umami is not so widely acknowledged. In Wejewa, a language spoken in Indonesia, seven terms are used: bitter, bland, sour, sweet, salty, pungent and tart. In Malay, salty flavours are described in greater complexity: “like sea water”, “like salt”, “like soy sauce” and “obnoxious”.



**FIGURE 11** Your culture could influence your preferred filling for tortillas.

### Study tip

Culture affects our perception in very complex ways. It may even be the factor that has the biggest impact on our perception.

A study by Drake (1989) listed 54 English terms to describe texture of foods. While in English, the terms “rigid”, “stiff”, “hard”, “firm” and “tough” are used and have slightly different meanings, Japanese uses a single term, “katai”, to describe foods of that texture. This could affect a person’s ability to perceive the finer differences between foods.

This is not only relevant between languages, but also within languages. Research has suggested that the use of detailed descriptions and regional names for food was perceived as more appealing (Wansink et al., 2001). Another study noted that expectations (positive and negative) were positively correlated to levels of enjoyment of the food (Cardello et al., 2000).

## 9.4 SKILL DRILL

### Drawing conclusions from a study comparing spicy preference and taste perception

#### Key science skill: Analyse, evaluate and communicate scientific ideas

In a Thai–Japanese cross-cultural study (Trachootham et al., 2018), the impact of spicy preference on threshold for detecting taste was investigated. Using the filter paper disc method, where 5-millimetre discs of filter paper were saturated with flavour, recognition threshold (RT) of sweet, salty, sour, bitter and umami flavours were measured. This was combined with a questionnaire survey of spicy preference.

The Thai participants had significantly higher RTs compared to the Japanese participants; they required a higher concentration of stimulus to identify all flavours. In both groups, sweet, salty,

sour and bitter samples were identified more readily than umami samples.

The Thai participants preferred a higher degree of spiciness, with 70 per cent reporting that they were mild to moderate lovers of spicy food and 10 per cent strong lovers. More than 90 per cent of the Japanese participants were non- or mild-spicy lovers. The frequency of spicy food intake also differed – weekly for 70 per cent of the Thai participants and monthly for 80 per cent of the Japanese participants.

#### Practise your skills

- 1 Write a hypothesis for the experiment.
- 2 Write a conclusion for the experiment and provide an explanation for the results.

Need help analysing, evaluating and communicating scientific ideas? See Topics 1.9 and 1.10 in your Psychology toolkit.

## 9.4 CHALLENGE

### Temperature and taste

Research and discuss how temperature might affect your perception of what you have consumed. Use what you have learnt to suggest why many foods are considered tastier when served hot and why water is often considered to taste better cold.

## 9.4 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe the biological processes involved in taste perception.
- 2 Explain how perceptual set affects taste perception, using at least two examples.
- 3 Describe the role of culture on our taste preferences.
- 4 Explain how the following biological factors affect gustatory perception, using two examples for each:
  - a age
  - b genetics
  - c illness.

### Apply, analyse and compare

- 5 Explain how bottom-up and top-down processing work together to form our gustatory perception.
- 6 Based on your understanding of bottom-up and top-down processing, write a scenario to demonstrate these concepts.

### Design and discuss

- 7 Evaluate the following statement and explain whether you agree or disagree: "Taste perception is experienced in exactly the same way for all people."

- 8 Research one factor affecting gustatory perception that is not discussed in this topic and use examples to explain its role in making sense of what you have consumed.
- 9 You have been placed in charge of the marketing of a new cereal product. The company gives you the go-ahead to create three different designs for the product packaging: one aimed towards children aged 4 to 10, one aimed towards teenagers aged 16 to 18, and one aimed towards adults aged 30 to 45.
  - a Describe how you would design the packaging for the product aimed towards children.
  - b Identify a design feature that may differ between the product aimed towards children compared to the one aimed towards adults. Justify your response.
  - c The company decides to enter a partnership with another company to help boost sales of the product. Describe the type of company that would be the best partner for this product. Justify your response.

**FIGURE 12** How would you design a box of cereal to appeal to small children?

## Chapter summary

- 9.1**
- Attention is the ability to process specific information actively and consciously in our environment, while ignoring competing information.
  - Sustained attention is specific focus directed to a stimulus for the duration of the task.
  - Selective attention is the limitation placed on our attention, meaning that our conscious awareness can only be focused on specific stimuli while the others are ignored.
  - Divided attention is the ability to give attention to and complete two or more tasks at the same time. This can only be done without too much difficulty when each task does not require a high level of conscious effort. For example, one automatic process and one controlled process, rather than two controlled processes.
- 9.2**
- Sensation involves the biological process in which we receive and process sensory information (what we see, taste, touch, hear and smell) from the environment.
  - Perception refers to the process in which the brain organises and interprets sensory information, based on psychological and social influences.
  - In order to perceive a stimulus, the absolute threshold must be met. This is the minimum amount of stimulus energy needed for an observer to perceive a stimulus, in ideal conditions, 50 per cent of the time.
  - Schemata are mental representations of things in the environment that we have developed through experience.
  - Bottom-up processing is an innate, evolutionary mechanism that draws raw information from our environment, is important for survival and does not rely on prior knowledge and schemata.
  - Perceptual set is the unique combination of past experiences, knowledge, expectations, motivations, culture, beliefs and emotions that guides how we experience and perceive stimuli from our environment, using top-down processing.
  - Top-down processing is the construction of perception based on existing information stored in our memory, including schemata and perceptual set.
- 9.3**
- Visual perception is the ability to see and interpret the surrounding environment and make sense of what we see.
  - Sensation of visual stimuli involves light entering the pupil of the eyes, the lens focusing the light onto the retina, and the conversion of light energy into nerve impulses which are relayed to the brain via the optic nerve.
  - The biological factors that affect how we see the world include our physiological make-up (anatomical structures involved in vision), our age and genetics.
  - The psychological factors that affect how we see the world include our perceptual set (such as past experiences, context, motivation and emotion), perceptual constancies (such as orientation, size, shape and brightness), Gestalt principles (for example, figure-ground organisation, closure, similarity and proximity) and depth cues (monocular and binocular).
  - The social factors that affect how we see the world include our culture, the country we live in, the social groups we are a part of, our socioeconomic status and religious beliefs.

9.4

- Gustatory or taste perception is the ability to experience, interpret and make sense of what we have consumed.
- Sensation of taste stimuli involves the binding of chemical substances from our food to taste receptors on our taste buds, and the conversion of chemical energy into nerve impulses which are relayed to the brain. Unlike vision, the perception of taste integrates sensory information from our other senses, including smell, touch and sight, to construct a perception.
- The primary tastes are sweet, salty, sour, bitter and umami.
- The biological factors that affect our gustatory perception include our physiological make-up (anatomical structures involved in taste, smell, touch and sight), our age and genetics.
- The psychological factors that affect our gustatory perception include our perceptual set (for example, food packaging, branding and appearance, education and upbringing, past experiences and mood).
- Gustatory perception is strongly influenced by social factors such as culture.

## Revision questions

### Multiple choice

- The way we actively focus on our internal and external environment is best described as:
  - perception.
  - attention.
  - a cognitive process.
  - a bottom-up process.
- Perception is a complex process that enables us to receive information from our internal and external world and to add meaning.
 

When we receive incoming information through our senses, sensory data is converted into electrical signals and sent to our cerebral cortex for processing. Once there, we are able to respond. Which of the following best describes this process?

  - Bottom-up processing
  - Top-down processing
  - Both bottom-up and top-down processing
  - Sensation
- When we receive and process incoming information, we can use past experiences to help interpret and assign meaning to what we see, hear or taste. This process is:
  - an example of perceptual set.
  - a psychological factor that is influenced by genetics.
  - a bottom-up process where biological factors are involved.
  - a top-down process where psychological factors are involved.
- When light energy enters our eye, it passes through the structures in the order of:
  - lens, pupil, cornea, retina, optic nerve, visual cortex.
  - cornea, pupil, lens, retina, optic nerve, occipital lobe.
  - pupil, cornea, lens, retina, optic nerve, brain.
  - retina, cornea, lens, optic nerve, visual cortex.
- A psychological factor involved in visual perception is perceptual set. This concept includes the elements:
  - motivation and transduction.
  - emotional responses and sensation.
  - cultural influences.
  - mood and individual expectations.
- Depth perception allows us to see our world in three dimensions. Which of the following is a monocular depth cue?
  - Retinal disparity
  - Accommodation
  - Convergence
  - Schema

- 7 A pictorial depth cue is used to give the impression of a three-dimensional image on a two-dimensional medium like a photograph or painting. Artists use interposition as a method of showing depth and distance. Interposition occurs when:
- A objects closest to the horizon appear further away.
  - B a surface becomes more detailed the closer it is.
  - C imaginary lines converge to a focal point.
  - D an object that overlaps another object is seen as closer.
- 8 Which of the following structures act as sense organs in taste perception? (More than one response may be correct.)
- A Tongue
  - B Throat
  - C Taste buds
  - D Papillae
- 9 Bettina and Jarish enjoy different types of food. Bettina loves to eat curries and casseroles while Jarish prefers fish and chips or meat pies. When they were asked to participate in a taste perception experiment, measurements were collected based on their sensitivity to the five primary tastes: sweet, salty, sour, bitter and umami. Their ability to detect the intensity of these tastes was shown to vary. This is because:
- A everyone's taste perception is slightly different.
  - B they had different experiences with food due to their diet.
  - C one of them may have had fewer taste buds.
  - D the perception of different tastes can be confusing.

- 10 Jack cannot stand the taste of coriander and claims that it is like eating soap. This is most likely due to:
- A ageing.
  - B product branding and packaging.
  - C cultural background.
  - D genetics.

**Short answer**

**Describe and explain**

- 11 Explain the role of attention in daily life, using an example to illustrate your understanding.
- 12 Describe the difference between controlled and automatic processes.
- 13 Explain how the selection process of visual perception influences how we interpret a visual stimulus.
- 14 Explain the Gestalt principle of closure and how we use it to interpret an image. Use a real-life example to illustrate your understanding.
- 15 Visual perception is broadly divided into sensation and perception. Identify and explain two differences between these concepts.

**Apply, analyse and compare**

- 16 Explain why Jasmine is unable to listen to both her friends speaking to her at the same time.
- 17 We experience the world using our different senses. Explain why absolute thresholds are important to how we perceive our environment.
- 18 Copy and complete Table 1 showing the key characteristics and examples of bottom-up and top-down processing.

**TABLE 1** Characteristics and examples of bottom-up and top-down processing

Bottom-up processing		Top-down processing	
Characteristics	Real-life examples	Characteristics	Real-life examples

- 19** Brittany and Halisto are studying for a psychology test. Brittany is in the school library while Halisto is working from home on the kitchen bench while his family are cooking dinner. Explain the role of sustained and divided attention in these scenarios.
- 20** Contrast attention and perception.
- 21** You have a football practice after school during winter and your coach wants you to play until it is almost dark. Identify the photoreceptor that is better suited to low-light conditions.
- 22** Josie’s grandma is busy knitting her a lovely warm scarf. She is sitting in her lounge room with a bright light beside her, as she needs to focus on what she is doing.
- Identify the type of attention she is using. Justify your answer.
  - Identify the type of photoreceptor that Josie’s grandma is using that gives her clear vision.
- 23** We consider visual perception in terms of biological, psychological and social factors. Use your understanding of these factors to copy and complete Table 2.

**TABLE 2** Factors affecting visual perception

Factors that influence visual perception	Explanation of factor	Example of factor
Biological		
Psychological		
Social		

- 24** Explain whether the Stroop effect demonstrates bottom-up or top-down processing.
- 25** Explain the effects of ageing on our taste perception.

**Design and discuss**

- 26** Discuss the following statement: “Gustatory perception is a complex sensory system that is not as accurate without the functioning of other senses.”
- 27** Our culture and past experiences can influence our taste preferences and how we experience different food. Discuss, using a real-life example from your own research.
- 28** Discuss how the appearance of food influences our gustatory perception.

You can find the following resources for this section in your obook pro:

pro

**Quizlet**

Compete in teams or against yourself to test your knowledge.



**Chapter quiz**

Test your understanding of key knowledge in this chapter.



**Chapter checklist**

Rate your understanding of key knowledge in this chapter.

CHAPTER

# 10

## Distortions of perception

### KEY KNOWLEDGE

- the fallibility of visual perceptual systems, for example, visual illusions and agnosia
- the fallibility of gustatory perception, for example, supertasters, exposure to miraculin and the judgment of flavours
- distortions of perception of taste and vision in healthy individuals, such as synaesthesia and spatial neglect.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

### GROUNDWORK

This chapter will build on concepts you have come across in Chapter 9. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



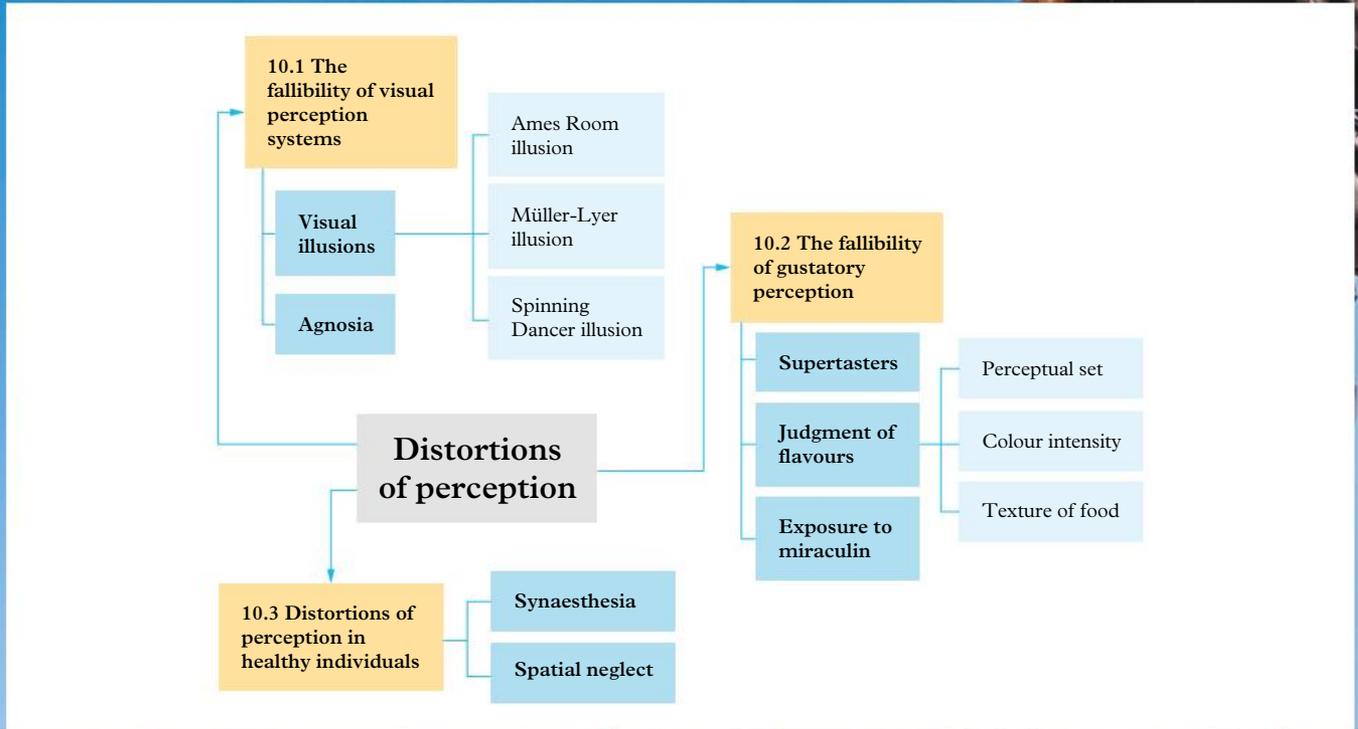
Groundwork quiz  
Chapter 10

### INVESTIGATIONS

10.2	INVESTIGATION: CONTROLLED EXPERIMENT	Does perceptual set influence our judgment of flavours?	Page 494
10.3	INVESTIGATION: LITERATURE REVIEW	How can a non-synaesthete acquire synaesthesia?	Page 496

**FIGURE 1** Visual illusions are caused by a misinterpretation of visual stimuli; in this photo the man appears to be giant compared to his two friends because he is closer to the camera.

## CONCEPT MAP



# 10.1

## The fallibility of visual perception systems

### KEY IDEAS

- Visual illusions distort real sensory stimuli to create a mismatch between the real-world visual stimulus and the brain's interpretation of that stimulus.
- Damage to the brain's cortex can cause conditions such as visual agnosia, resulting in an inability to recognise objects or familiar faces.



### fallible

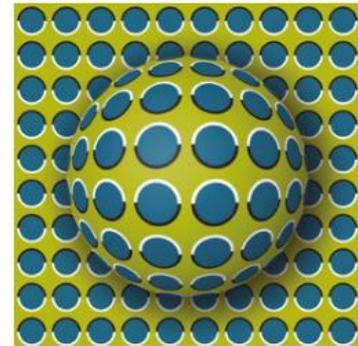
prone to error, which can occur when judging sensory stimuli



ClickView  
The science of illusion

## Fallibility of visual perception

Perception is a complex process. To visually perceive something, the brain must be able to interpret sensory stimuli. Visual perception can be **fallible** when sensory stimuli are mistakenly interpreted – this in turn can lead to an altered perception. Misinterpretation of visual stimuli can be due to normal brain function when viewing optical illusions (Figure 1) or due to abnormal brain function from neurological conditions. Understanding the fallibility of visual perception from illusions and agnosia can help better inform us about how the brain processes visual stimuli.



**FIGURE 1** This illusion causes our brain to misinterpret the image and think the background is moving.

## Visual illusions

A **visual illusion** occurs when we misinterpret real sensory stimuli, creating a mismatch between the real-world visual stimulus and the perception formed in our brain. This phenomenon happens when our perceptions of a stimulus are consistently different to what is really shown. Even if we become aware that what we are perceiving is an illusion, we cannot help but perceive the distorted image. Illusions are created by psychological factors, where the way we interpret stimuli is influenced by the constructs in our brain that usually help us make sense of the world. Three common visual illusions we will explore in this topic are:

- the Ames room illusion
- the Müller-Lyer illusion
- the Spinning Dancer illusion.

### Ames room illusion

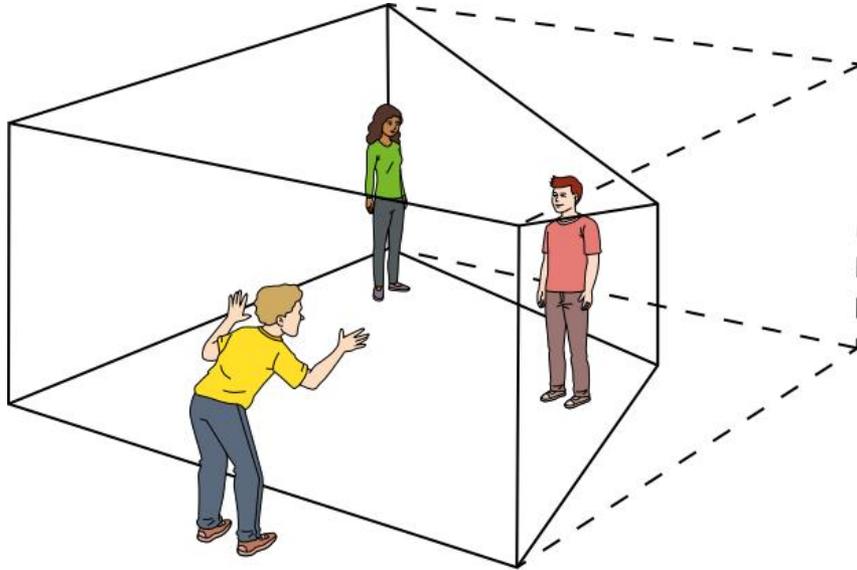
The **Ames room illusion** is a visual illusion that deliberately distorts a viewer's perception to give them the impression that someone is growing or shrinking in size as they walk across a room. The illusion was invented by Adelbert Ames Jr in 1946. Ames created a trapezoidal-shaped room that appeared to be rectangular when viewed through a peephole with one eye. This created the perception that the room was a normal right-angled room when it was actually distorted. The actual shape of the room was irregular, with one corner a greater distance away from the viewer than the other (Figure 2). What the viewer does not perceive without access to depth perception is that the floor and ceiling in one corner of the room are closer to each other than in the corner on the other side of the room.

### visual illusion

when we misinterpret real sensory stimuli to create a mismatch between the real-world stimulus and our perception

### Ames room illusion

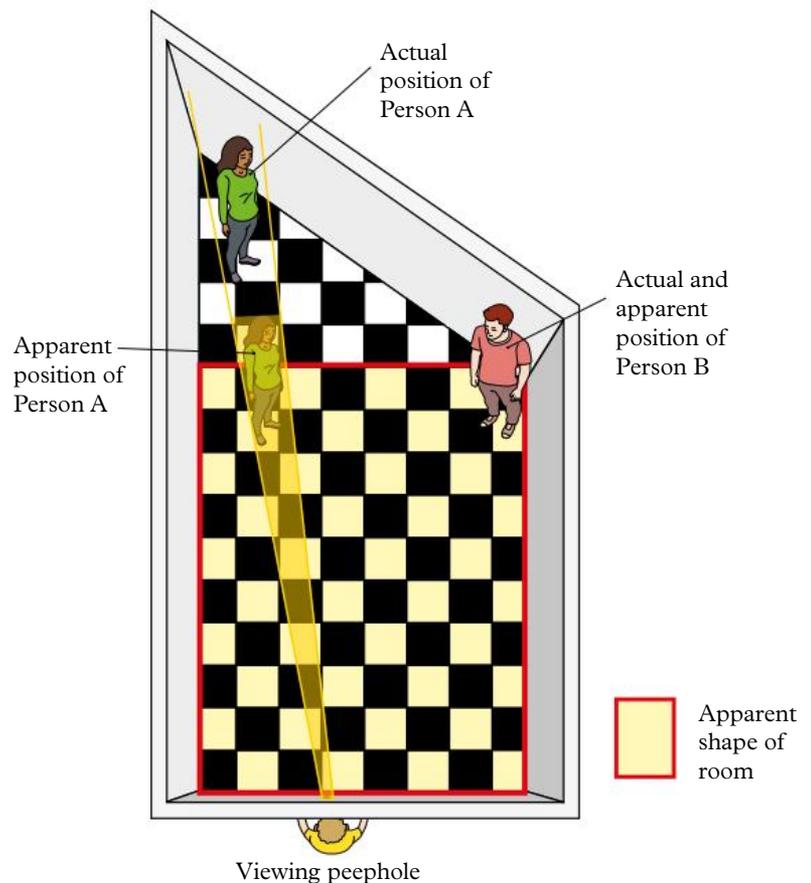
an illusion created by a deliberately misshapen trapezoidal room where people walking across the room appear to be growing and shrinking in size



**FIGURE 2** From the peephole, the Ames room appeared to be a regular rectangular-shaped room, but it was actually an irregular shape.

To experience the Ames room illusion, the viewer needs to look through a peephole from a specific location, which makes the room appear to be a regular rectangular shape (Figure 3). The viewer is also required to use only one eye to view through the peephole – this prevents the viewer using binocular depth cues that would normally enable them to perceive depth and judge distance. As the viewer observes a person inside the room through the peephole, the person appears to get bigger as they move across what appears to be a regular-shaped room (Figure 4). Our brain perceives this person as starting on one side of a normal-shaped room with right-angled corners and a normally positioned floor and ceiling, because our experience tells us that rooms are regularly shaped. We are therefore unaware that the person begins in a position further away from us.

The Ames room illusion distorts our perception of depth and distance. In the illusion, a person is placed in an irregularly shaped room that is designed to distort our visual cues. As a person walks from one side of the room to the other, our brain mistakenly perceives them to be staying the same distance from us while they move. Realistically, the room is constructed in such a way that the back wall is not parallel to the viewer, but angled. This creates an optical illusion that makes the room appear perfectly rectangular when viewed from the peephole with one eye closed.



**FIGURE 3** How the Ames room illusion is perceived by the viewer



**FIGURE 4** The view from the peephole of an Ames room makes the room appear to be a regular shape. In this image, the person in the right corner is positioned further away from the viewer than the person in the left corner, leading to the perception that one person is giant-sized and the other is tiny.

As a person walks from one side of the room to the other, they are really moving closer or further away from us due to the angle of the back wall, despite our perception telling us otherwise. Our brain relies on the assumption that the room is rectangular, and the person is at a constant distance as we interpret what we see. Since our brain expects the person to remain the same distance away, the retinal image of the person on our eyes changes from small to large, leading us to perceive the person walking as growing (if they are moving closer to us) or shrinking (if they are moving further away from us).

If you entered an Ames room, the structure of the room would become obvious because it can be seen for what it is rather than what it appears to be through the peephole. This is due to the outside viewer's inability to use their binocular depth cues when looking through the peephole with one eye. Even if we become fully aware of the room's shape and distortions, the effect is so powerful that if we looked through the peephole to view someone walking again, we would still perceive them to be growing or shrinking in size. Movie set designers use this illusion to their advantage to create special effects. For example, in the *Lord of the Rings* movies this illusion was used to make Gandalf appear larger than the hobbits (Figure 5).



**FIGURE 5** The *Lord of the Rings* trilogy used the illusions of depth and distance to make Gandalf appear larger than the hobbits.

## 10.1 CHALLENGE

### Putting the Ames room into practice

Movie set designers have used the Ames room illusion to their advantage for creating special effects in movies. Imagine you need to direct a scene for a movie where you need to make the Hulk appear large and Antman appear miniature.

- 1 Draw an Ames room diagram showing where you would place the Hulk and where you would place Antman to achieve the intended effect.
- 2 Explain how the positioning of your characters in the Ames room set-up affects how they are perceived by the viewer.



FIGURE 6 The Incredible Hulk

### Müller-Lyer illusion

The **Müller-Lyer illusion** is an illusion where two lines of the same length are given different ends, leading the viewer to misinterpret their length. The visual illusion was created by German psychologist Franz Carl Müller-Lyer in 1889. The difference between the two lines is the pattern at each end – one line has regular arrowheads while the other has feather tails (inverted arrowheads), as shown in Figure 7. To most people, the line with the arrowheads appears shorter than the line with feathertails, even though they are the same length.

One explanation to help us understand this illusion is based around depth cues that normally help us to judge distance. This idea suggests that we are fooled by the Müller-Lyer illusion due to our experiences with rectangular buildings, where the lines of floors and ceilings extending away from us create a sense of depth (Figure 8). Richard Gregory (1969) proposed the **carpentered world hypothesis** based on this idea. Gregory believed that when we view a two-dimensional image such as the Müller-Lyer illusion, we automatically apply depth cues as if we are viewing the three-dimensional images of buildings.

According to Gregory, when we observe the arrowheads pointing away from the central line in the Müller-Lyer illusion, our perception interprets the line as the vertical edge of a building's external walls (Figure 8a). On the other hand, the line with a feathertail line (inverted arrows) is perceived as representing the edge of two internal walls, in a similar manner to the inner corner of a room (Figure 8b).

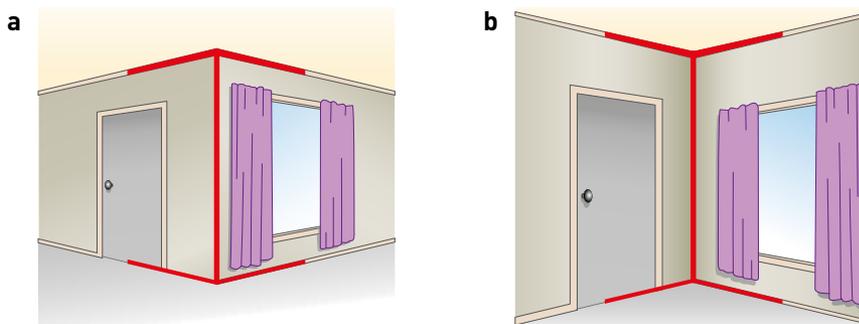


FIGURE 8 Which room (a or b) has higher walls? The Müller-Lyer illusion is affected by our judgment of depth.

When we apply depth cues and our understanding of spatial arrangement to this two-dimensional image, the arrowhead line appears to be shorter than the feathertail line. Our brain assumes that the arrowhead line is projecting towards us and is therefore closer than the feathertail line, which is projecting away from us.

### Müller-Lyer illusion

an illusion created by a misinterpretation of two identical length lines that appear to be different due to differently shaped ends

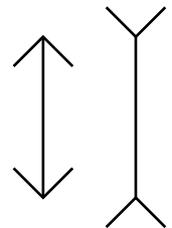


FIGURE 7 The Müller-Lyer illusion; which line appears longer and which appears shorter?

### carpentered world hypothesis

a theory applied to the Müller-Lyer illusion that proposes that our familiarity with the straight lines and angles of buildings informs our interpretation of linear perspective in pictorial depth perception

Since our experience of the world tells us that objects in the distance are expected to be smaller than when closer to us, our perception tricks us into perceiving the feathertail line as longer. This is despite the reality that both lines are the same length.

Another explanation to help us understand this previous idea suggests that we perceive the illusion due to the **misapplication of size constancy**. When applying size constancy, we usually perceive three-dimensional objects as actually being the same size when viewed from different distances, despite the retinal image being different. However, when we apply this same principle to a two-dimensional image such as the Müller-Lyer illusion, we inaccurately apply these rules to perceive the two lines at different distances. Because of this, we perceive the lines to be of two different lengths, despite them being the same.

Studies have been conducted in different cultures to determine if this illusion is based upon experience. Some have been conducted on participants in African nations that have a mix of rectangular architecture in urban centres as well as round huts in rural areas. When the illusion was shown to rural Zambians who had no exposure to rectangular buildings, they were not fooled by the illusion and tended to perceive the lines as the same length. However, Zambians living in urban areas did perceive the lines to be different lengths (Ahluwalia, 1978). This supports the idea that experience with buildings can influence our perception of the Müller-Lyer illusion.

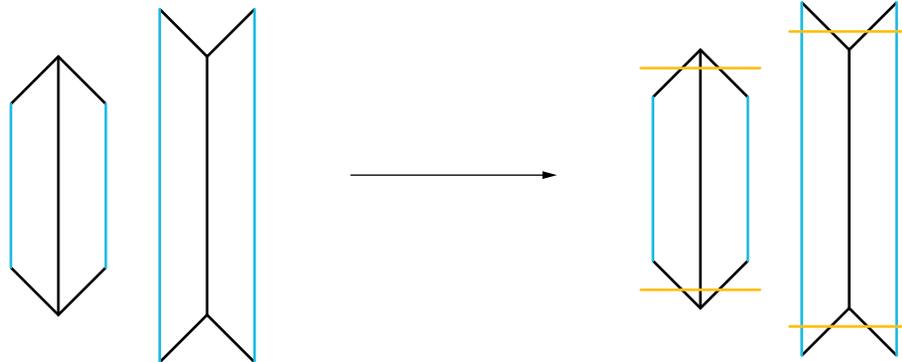
An alternative explanation for the Müller-Lyer illusion is the **perceptual compromise theory** proposed by Australian psychologist R.H. Day (1989). This theory suggests that when we look at the lines of the Müller-Lyer illusion, we are influenced by both the length of the line and the overall length of the figure. The line with the feathertails at each end has a total length longer than the line with arrowheads, so we are influenced by the overall length and therefore perceive the feathertail line as longer. When looking at these figures, Day believed that our perception is conflicted and makes a compromise to judge the longer overall figure as being a longer line.

**misapplication of size constancy**

the incorrect use of cues that would normally assist us in accurately perceiving properties such as size

**perceptual compromise theory**

an explanation for the Müller-Lyer illusion that proposes that we perceive the line with the feathertail ends as being longer than the arrowhead line due to application of the Gestalt principle of closure



1. When viewing the open figures in the Müller-Lyer illusion, our mind applies the Gestalt principle of closure (blue lines).

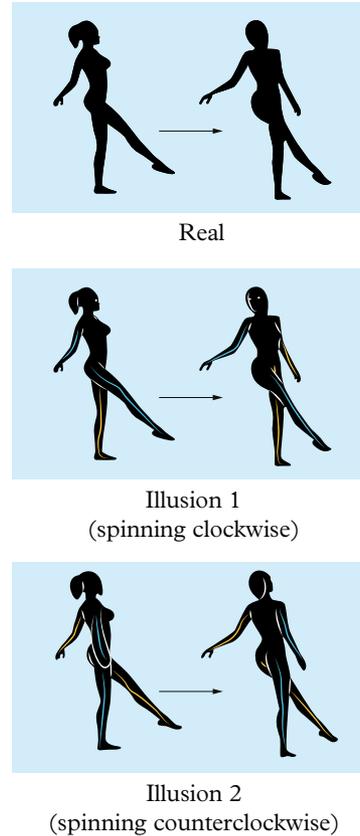
2. Our mind then averages out the blue and black lines and we perceive the length of each figure as the average length (distance between yellow lines).

**FIGURE 9** How we view the Müller-Lyer illusion according to perceptual compromise theory.

## Spinning Dancer illusion

In 2003, Japanese web designer Nobuyuki Kayahara created the **Spinning Dancer illusion**. The illusion shows a spinning silhouette of a dancer that is perceived by some viewers to be spinning clockwise, and by others to be spinning counterclockwise. It is also possible to see the dancer spinning one way and then the other. A change in direction can be activated by blinking, tilting your head or focusing on a specific part of the image.

This illusion is believed to happen because the dancer is an ambiguous two-dimensional figure that can be seen from two different perspectives. This ambiguity presents our visual perception with different interpretations (Figure 10). The image of the dancer also lacks visual depth cues, which prevents our brain from interpreting it as a three-dimensional image where some parts of the body are seen as closer to the viewer than others. If the image included depth cues, our brain would be able to process and interpret it as a dancer spinning in one specific direction.



### Spinning Dancer illusion

a spinning dancer silhouette that appears to spin both clockwise and counterclockwise

**FIGURE 10** Diagram showing the clockwise and counterclockwise perspectives of the spinning dancer – the ambiguity and lack of depth cues in the real image show how our brain can perceive the dancer spinning in one direction or the other.

## Agnosia

**Agnosia** is a rare neurological condition that disrupts the brain’s ability to process sensory information. This results in difficulty recognising objects, faces, voices or places. Agnosia usually only affects a single sensory pathway, which means most affected individuals are still able to interact with the world using their other senses. The name “agnosia” is derived from the Greek “gnosis”, or “not knowing”.

Agnosia usually occurs from damage to the brain caused by conditions including stroke, dementia or traumatic brain injury (TBI). Neuroimaging tests such as CT and MRI scans can be used to help diagnose agnosia. While there is no specific treatment for agnosia itself, the underlying cause of agnosia can sometimes be treated. For example, if a brain tumour has caused agnosia, then radiation therapy or surgery on the tumour may reduce the effects of agnosia. Living with agnosia can be challenging, but familiar routines, predictable environments and labelling items may assist with managing the disorder on a daily basis.

### Visual agnosia

**Visual agnosia** is the inability to name, recognise or describe the use for an object when looking at it. It occurs when the brain is damaged along neural pathways that connect the occipital lobe (which processes visual stimuli) to the parietal or temporal lobes (which allow us to understand the visual stimuli).

Typically, if we were to look at a flower, the visual stimulus of the flower would be sent to the occipital lobe at the rear of our brain. To understand what this stimulus is, information would then be sent to our parietal and temporal lobes. We could then recognise the flower and give it a name. For those who have visual agnosia, this pathway to the parietal and

### agnosia

neurological disorder resulting in difficulty recognising objects, faces, voices or places

### visual agnosia

a condition that results in the inability to describe, recognise or name an object seen

temporal lobes is damaged and results in the inability to recognise an object, such as a flower, from visual sensory information alone. As agnosia typically only affects one sensory pathway, a person with visual agnosia who is asked to touch the flower and feel its texture would likely be able to recognise it as a flower. This is because the neural pathways that allow us to process sensory information from touch are not damaged or affected.

**prosopagnosia**  
a condition that results in the inability to recognise faces

**Prosopagnosia** is a specific form of visual agnosia that results in a person being unable to recognise the faces of people they know very well, or even of themselves. It occurs when the neural pathway leading from the occipital lobe to the specific region in the temporal lobe responsible for recognising faces is damaged. Perception of this visual stimuli (a person's face) is therefore unable to be processed regularly. People with prosopagnosia can also mistake a person's face with an object and vice versa. Prosopagnosia often occurs with neurological conditions that interfere with neural pathways, such as Alzheimer's disease.



**FIGURE 11** Prosopagnosia is a form of visual agnosia where a person is unable to recognise people from looking at their faces.



**Resource**  
Ames room  
template

## 10.1 CHECK YOUR LEARNING



### Describe and explain

- 1 Define the term “visual illusion”.
- 2 Describe the Ames room illusion.
- 3 Explain why a figure appears to shrink and grow as it moves across an Ames room.
- 4 Identify the distortion we perceive when looking at the Müller-Lyer illusion.
- 5 Explain how the lack of visual depth cues leads to the Spinning Dancer illusion.
- 6 Outline what causes a person to experience visual agnosia.

### Apply, analyse and compare

- 7 Apply your understanding of depth cues to explain the Müller-Lyer illusion.

### Design and discuss

- 8 Discuss how a person with prosopagnosia might respond when asked to identify a person from an image of their face.
- 9 Create a Venn diagram to map out the similarities and differences between the Ames room illusion and the Müller-Lyer illusion.
- 10 Create an Ames room by printing out the template linked in the hotspot and assembling it according to the instructions. Place two identical objects in the two distant corners of the room. Observe any difference and discuss why this occurs.
- 11 Predict the effect of a larger peephole on the Ames room illusion. Justify your prediction.

# 10.2

## The fallibility of gustatory perception

### KEY IDEAS

- Taste perception involves the integration of stimuli from the senses of vision, taste, smell and touch.
- Gustatory perception can be fallible due to supertasters, exposure to miraculin, past experiences, colour intensity and texture.

### Fallibility of gustatory perception

Taste is one of life's greatest pleasures. To perceive food flavours we rely on the complex integration of stimuli from our senses of vision, taste (gustation), smell and touch. When eating a ripe strawberry, the juicy texture of the fruit as we bite on it, the bright red colour, the sweet smell and sweet flavour all combine to create the intensity of flavour that we recognise as the taste of a fresh strawberry (Figure 1). Our

**gustatory cortex** is a specialised area in the cerebral cortex that processes sensory stimuli to create our perception of taste or gustatory perception. In this topic we will look at how our gustatory perception is influenced by several factors, many of which can lead us to form fallible perceptions of taste.

**gustatory cortex**  
the region of the brain where taste information is processed



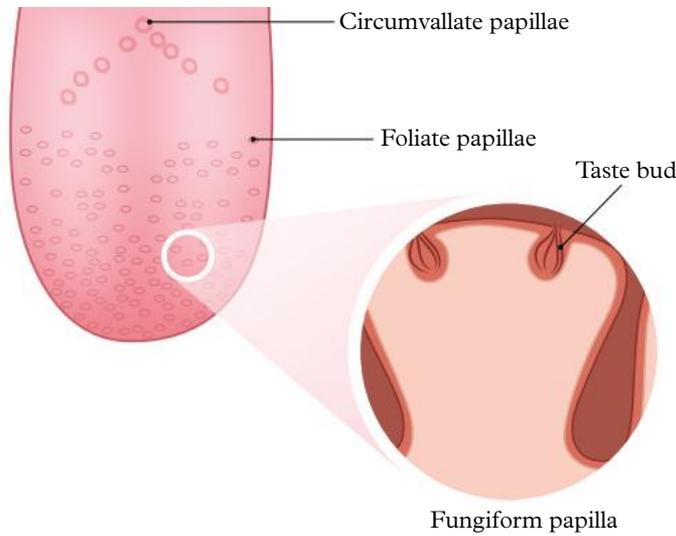
**FIGURE 1** Our perception of what a strawberry tastes like comes from the combination of its colour, texture, smell and flavour.

### Supertasters

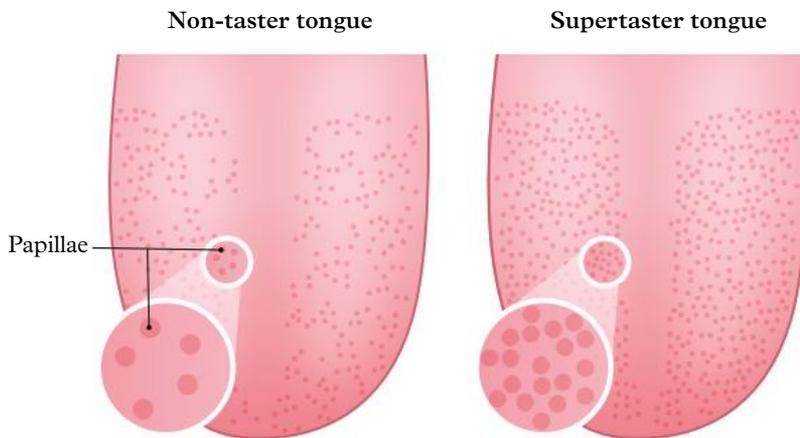
**Papillae** are small, raised structures on the surface of the tongue that play a role in detecting and perceiving information from the food and drinks we consume. There are many different types of papillae that have specific roles in detecting information. These include:

**papillae**  
small round bumps located on the surface of the tongue that play a role in taste and gripping food

- filiform papillae – detect texture and provide friction on the tongue
- fungiform papillae – involved in perceiving sweet, sour, bitter, and umami tastes, and are dispersed across the tongue (generally more concentrated at the tip of the tongue)
- foliate papillae – located along the sides of the tongue that are involved in detecting sour and salty tastes
- circumvallate papillae – large papillae located along the back of the tongue (often in a v-shaped row) primarily responsible for detecting bitter tastes.



**FIGURE 2** Folate, fungiform and circumvallate papillae all contain taste buds.



**FIGURE 3** A supertaster has more papillae on the surface of their tongue than a non-taster.

**medium taster**

a person who falls within the average range of taste sensitivity (without extreme sensitivity or insensitivity to certain flavours)

**non-taster**

an individual who has a decreased sensitivity to tastes

dark chocolate. A person who strongly dislikes eating bitter green leafy vegetables, such as kale and rocket, may in fact be a supertaster. Supertasters often tend to add more salt and sugar to bitter-tasting foods to mask their bitterness.

Of the general population, approximately 25 per cent are supertasters, 50 per cent considered **medium tasters**, and 25 per cent are **non-tasters**. Medium tasters can perceive bitter-tasting foods but are not highly sensitive to their taste. Non-tasters have a lessened ability to perceive flavours. Non-tasters often think food tastes bland and will add condiments to their food, such as hot sauce, to increase the intensity of flavour (Figure 5). Non-tasters also prefer fatty foods, seasonings and sweet-tasting foods.



**FIGURE 4** Rocket is a leafy green that has a sharp, peppery flavour. Many people love it, but to a supertaster, it could taste extremely bitter – a totally different experience.

Fungiform, foliate and circumvallate papillae all contain specialised sensory receptors called taste buds (Figure 2). Taste buds contain gustatory cells, which detect sensory information and transmit signals to the brain. Taste buds respond differently to different tastes such as sweet, bitter, salty, sour and umami.

A supertaster is a person who experiences a heightened sense of taste for certain flavours compared to what is experienced by most people. Supertasters commonly have an increased sensitivity to bitter flavours, leading to strong food preferences and dislikes of specific foods. Supertasters can experience a heightened sense of taste due to the large number of taste buds on their tongue (Figure 3). Most adults have between 2000 and 10,000 taste buds on their tongue, and those who have closer to 10,000 are considered supertasters. Most supertasters have the TAS2R38 gene, which predisposes them to a greater number of papillae and therefore taste buds on their tongue. The large number of taste buds leads to supertasters having extreme sensitivity to the taste of bitter and sweet foods. Because of their sensitivity to certain tastes, it is common for supertasters to dislike bitter foods such as broccoli, spinach, rocket, kale, brussels sprouts, coffee, beer and



**FIGURE 5** Do you know someone who is always adding sriracha or hot sauce onto their food? They may be a non-taster!

## Exposure to miraculin

*Synsepalum dulcificum* or “miracle fruit” is a shrub native to West and Central Africa known for its taste-modifying berries. The berries of the shrub contain a chemical called **miraculin**, which can alter taste to make sour foods taste sweet (Figure 6). While the miracle fruit berry is not sweet-tasting itself, once eaten, the miraculin chemical binds to sweetness receptors on the taste buds of papillae that detect sweetness. This action temporarily sweetens our taste so that sour foods, such as apple cider vinegar or lemons, lose their typical acidic flavours and are instead perceived as sweet. The effect of miraculin is only activated when sour food is introduced; other food flavours (for example, bitter or salty) are unaffected by the chemical. The effects of miraculin typically last for around half an hour, or until the chemical is diluted by our saliva. Miraculin can turn sour worms into sweet lollies and cause sour lemons and limes to taste like sweet oranges. Exposure to miraculin therefore alters our perception of taste.

## Judgment of flavours

Our ability to judge the flavour of food relies on our senses and memory of past experiences with food. Our judgment of flavour can also be fooled by a range of factors which lead us to believe the taste of something differs to what it actually is. Factors such as perceptual set, colour intensity and the texture of our food can all interfere with our judgment of food flavours.

### Perceptual set

As discussed in Chapter 9, our perceptual set is our tendency to perceive specific aspects of available sensory information based on our set expectations. Our perceptual set and expectations of what food will taste like can influence our perception and experience of food flavours. For example, consider the traditional cheese from Sardinia, Italy, called casu marzu that contains live maggots (Figure 7). To those who grew up with the cheese, it is often considered a delicacy and extremely tasty.

However, to people that associate maggots with fly-blown food not fit to eat, just the idea of eating a maggot could trigger a response of disgust and interfere with that person’s gustatory perception of the cheese. If the cheese was served up as a sample in a blind food test, a person disgusted by maggots would be better able to evaluate the true taste of the cheese and may even enjoy it. This is because they would not have their pre-existing ideas about maggots interfering with their perception of the taste of the cheese.

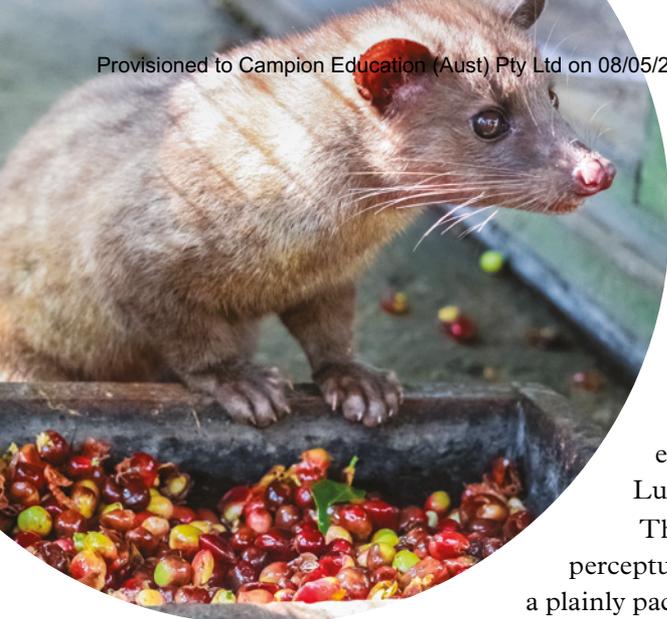


**FIGURE 6** *Synsepalum dulcificum*, or “miracle fruit”, produces berries that contain the taste-modifying chemical miraculin.

**miraculin**  
a chemical extracted from the “miracle fruit” that causes sour foods to taste sweet



**FIGURE 7** Casu marzu is now illegal to eat in Italy and Europe due to health concerns; however, it is sold illegally on the Sardinian black market, showing the lengths people will go to eat the cheese.



**FIGURE 8** An Asian palm civet consuming coffee beans that will later be collected from its faeces to produce Kopi Luwak coffee.

Another example of how perceptual set can influence taste is Indonesia's Kopi Luwak coffee. This coffee is brewed from beans that have been passed through the faeces of an Asian palm civet (Figure 8). Some coffee drinkers expect that the coffee must taste amazing because it is expensive to purchase and therefore must be of high quality. To others, the coffee is completely unpalatable because it has been sourced from animal faeces. Different sets of expectations can lead to different gustatory perceptions of the Kopi Luwak coffee.

The appearance of food and food packaging can also influence our perceptual set and therefore our gustatory perception. If given the choice of a plainly packaged supermarket house-brand chocolate biscuit or a well-known quality brand chocolate biscuit, many people will choose the more expensive brand because the quality of packaging or brand associations are tied to an expectation that the product will taste better.

### Colour intensity

**Colour intensity** refers to how bright or dull the colour of an object or item is. The colour intensity of foods can lead us to taste flavours that are simply not there. As children, we learn to associate intensely coloured foods, such as red icy poles and red cordial, with an intensely sweet taste. The stronger or more vivid the colour, the sweeter the foods are usually perceived to taste. This past experience teaches us that intensely coloured food will have an intense flavour and leads us to expect this in future experiences with food.

Our gustatory perception of a sweet or intense flavour can differ to how much flavour is truly present. This is because the brain can perceive intensity because it has learned to expect it. This association has led to some food brands adding an intensely coloured dye to their food products, a common practice in the production of coloured confectionery and soft drinks. Food manufacturers do this in the hope that the consumer will perceive the product to be full of flavour or sweetness.

Colour can also confuse our flavour perception. For example, it is common to expect intensely coloured red cordial and red icy poles to have a strawberry or raspberry flavour. If we were asked to

identify the flavour of different coloured solutions that are simply water and food dye, we are likely to perceive the flavour that corresponds with the colour. For example, a green solution of water and food dye is likely to be perceived as lime flavoured while a red solution of water and food dye is likely to be perceived as strawberry.

**colour intensity**  
depth of colour



**FIGURE 9** Consider the white cherries and the red cherries shown. Which do you think has the more intense cherry flavour? Most people would say the red cherries due to their colour intensity.



**FIGURE 10** Food and drink manufacturers often add intense dyes to their products so that consumers associate their products with intense flavours.



**FIGURE 11** Did you know that the rainbow and caramel PaddlePops™ are the same flavour? The only difference between the two is the coloured dye used.

## Food texture

**Texture** describes the way food feels in our mouth – it is often described using words such as juicy, crunchy, creamy, tough, grainy, crisp or tender. The texture of foods can also influence our judgment of the flavour of foods. As a marketing tool, companies like to use texture-specific words to describe food products because the sensation described can produce a desirable eating experience. Throughout childhood we learn to associate certain textures with foods – potato chips are crunchy, apples are juicy, ice cream is creamy. When the foods we consume have the texture we expect them to have, we perceive them to taste their best. For example, most people would consider a soggy potato chip less tasty than a crunchy potato chip, or flat soft drink less tasty than fizzy soft drink. We can also change the texture of food to alter flavour perception. For example, grated apple can be thought to taste different to crunching on a whole apple, and pureed apple tastes different to apple juice.

**texture**  
the way food feels in our mouth



**FIGURE 12** Most people expect potato chips to be crispy and would be disappointed with the taste of a soggy potato chip!

## 10.2 SKILL DRILL

### Making predictions about perception investigations

#### **Key science skill: Develop aims and questions, formulate hypotheses and make predictions**

Mr Smith decided to test the influence of colour intensity on the judgment of food flavours with his VCE Psychology class. He asked ten volunteers to taste from each of four glasses of water – each glass was half filled with water and either one, two, three or four drops of red food dye. This food dye influenced the colour intensity but not the flavour. Mr Smith asked each volunteer to rate the sweetness of each glass as they were presented in random order.

#### **Practise your skills**

- 1 Identify the IV and DV for this experiment.
- 2 Identify the type of experiment conducted by Mr Smith – is it a within-subjects or between-subjects design? Justify your answer.
- 3 Predict the likely results of Mr Smith's experiments. Justify your prediction.

Need help identifying variables and making predictions? See Topic 1.2 in your Psychology toolkit.

## 10.2 CHALLENGE

### Applying population statistics to other samples

Mrs Cook decided to give her 20 students coriander to taste test. She gave each student a small sample of fresh coriander and asked them to taste it, then report its flavour as either pleasant or unpleasant.

What percentage of Mrs Cook's class is likely to report the coriander taste as being unpleasant? What would this group of students be called – non-tasters, medium tasters or supertasters?

**FIGURE 13** This investigation involves taste testing coriander.



## 10.2 CHECK YOUR LEARNING



### Describe and explain

- 1 Describe the sensory stimuli that combine to create our perception of food.
- 2 Define a supertaster.
- 3 Describe the effect of miraculin on taste buds.
- 4 Explain how our judgment of flavours can be influenced by colour intensity. Give an example.
- 5 Explain why coriander tastes different for a supertaster as compared to a medium-taster or non-taster.

### Apply, analyse and compare

- 6 Compare the taste of a lemon before and after miraculin.

### Design and discuss

- 7 Discuss how perceptual set could influence our perception of the flavour of kangaroo meat.

- 8 **a** Design a simple experiment to investigate the influence of the texture of corn chips on perception of flavour. You should include the following:
  - an aim
  - a hypothesis
  - the IV and DV
  - your method (including information on the sample, materials used, set-up and how you will collect data).
- b** Discuss your expected results and explain why, with reference to your understanding of the influence of food texture on the judgment of flavour.

# 10.3

## Distortions of perception in healthy individuals

### KEY IDEAS

- ✦ Synaesthesia creates an enhanced sensory experience because of increased neural connectivity between sensory areas of the cortex.
- ✦ Spatial neglect patients lack the ability to perceive and respond to stimuli on one side of their body due to brain injury.

### Perceptual distortions create unique experiences

Neuroscientists learn a great deal about the human brain through studying the brains of healthy individuals. They are also able to add to our understanding of brain function by studying individuals who have unique experiences of processing and perceiving information. In this topic, we will look at two conditions that lead to distortions of perception in healthy individuals: synaesthesia and spatial neglect.



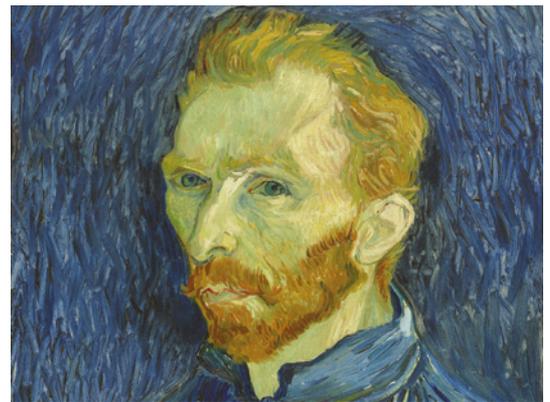
▶ ClickView  
Dorothy Latham's synaesthesia

**synaesthesia**  
a phenomenon where individuals experience an integration of senses when one sense is stimulated

### Synaesthesia

**Synaesthesia** is a neurological condition where stimulation of one sensory pathway leads to the involuntary stimulation of another sensory pathway. The term “synaesthesia” means “to perceive together” and describes the experience of two or more senses being experienced at the same time. Stimulating one sense will involuntarily stimulate the perception of another sense so that the brain thinks they are intricately connected. For example, Kaitlyn Hova, a professional violinist, composer and neuroscientist, grew up assuming it was normal to see flashes of colour as she played the violin. She now recognises that her experience of music is not shared by everyone, and is instead caused by synaesthesia. Kaitlyn’s senses of sound and vision are blended, so that when she plays the C note on her violin, she perceives flashes of red, the D note creates flashes of blue, E a super-yellow, F a light green and G a deep green.

**FIGURE 2** When Kaitlyn Hova plays the violin, each note triggers the flash of a distinct colour.



**FIGURE 1** Some individuals perceive life differently to most. Artist Vincent van Gogh perceived sounds to have certain colours due to a neurological condition called synaesthesia.



**synaesthete**  
an individual with  
synaesthesia

For Kaitlyn, music is an immersive experience where she cannot separate the visual experience from the musical notes – the notes and colours always occur together and in the same way. She believes this experience has enhanced her ability to perceive music as a complete sensory experience. Kaitlyn’s blended sensory experience of sound and colour is unique. The colours she associates with specific notes can differ from other **synaesthetes** who experience a similar type of synaesthesia.

Some synaesthetes “taste” sound, while others might “hear” colours or “taste” shapes. James Wannerton, a synaesthete who learned languages at school, describes French as tasting of “runny egg” while German tastes like “marmalade” (Figure 3).



**FIGURE 3** James Wannerton perceives French language as tasting like runny eggs and German as tasting of marmalade.

**poly-synaesthete**  
an individual who  
experiences more  
than one type of  
synaesthesia

Synaesthetes also consistently experience the same unique sensory associations. For example, when Kaitlyn hears the C note, she always sees a red flash and not another colour. Since synaesthetes grow up accustomed to their integrated senses, it can often be a surprise when a synaesthete realises that not all people have the same sensory experiences. Some synaesthetes can even experience multiple forms of synaesthesia; these individuals are known as **poly-synaesthetes**.

**grapheme-colour  
synaesthesia**

a form of  
synaesthesia where  
letters, digits or  
words are perceived  
as having colours

Varieties of synaesthesia include:

- **grapheme-colour synaesthesia** – when letters, words or numbers are associated with specific colours (Figure 4)
- **chromaesthesia** – when sounds are associated with seeing colours
- **lexical-gustatory synaesthesia** – when letters or words are associated with a particular taste
- **auditory tactile synaesthesia** – when sounds trigger physical sensations, such as tingling, pressure or change in temperature.

**chromaesthesia**

a form of  
synaesthesia where  
sounds are perceived  
to have colours

**lexical-gustatory  
synaesthesia**

a form of  
synaesthesia where  
letters or words are  
perceived to have a  
particular taste

Approximately 3 to 5 per cent of the population experience synaesthesia. The condition is considered neurotypical because the brain can function normally when creating each enhanced perceptual experience. Synaesthesia tends to run in families and is thought to be determined by a genetic trait carried on the X-chromosome. However, the specific type of synaesthesia is not believed to be genetically inherited because sensory associations can vary between family members. For example, a mother might associate words with different tastes, while her son sees shapes when hearing sounds. The condition is more common in women and occurs more frequently in artistic people. Famous synaesthetes include Billie Eilish, Vincent van Gogh, Billy Joel and Pharrell Williams. Artists and musicians with synaesthesia will often describe their experience as being a significant part of their creativity. Synaesthesia is also thought to improve memory recall for some individuals because they can more easily recall things they associate with a specific sense.

**auditory tactile  
synaesthesia**

a form of  
synaesthesia where  
sounds are perceived  
to have a physical  
sensation, such as  
pressure, heat or pain

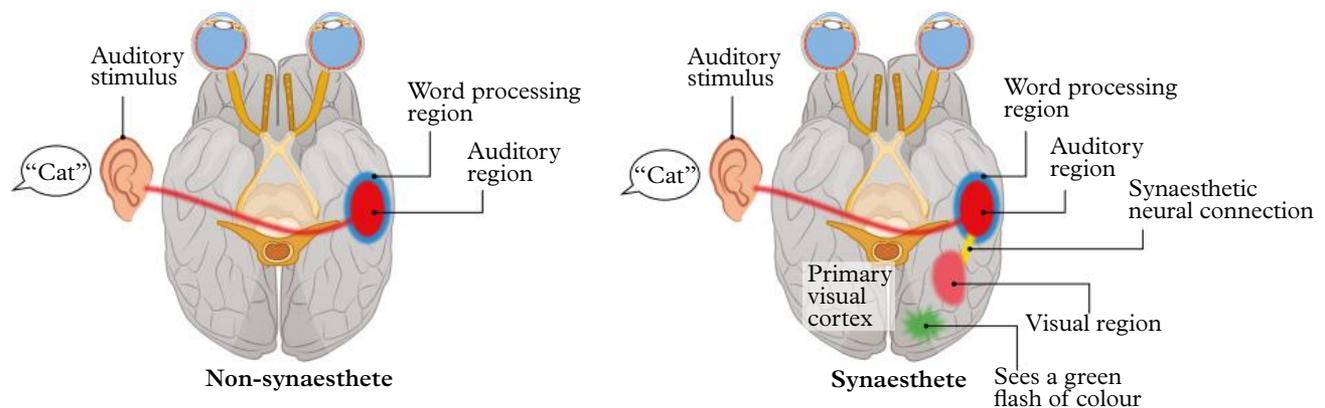
# Synaesthesia

**FIGURE 4** Letters of the alphabet can trigger vivid colours in some synaesthetes.

Synaesthesia is thought to occur because of increased neural connectivity between areas of the brain that link the senses. In a non-synaesthete, a visual stimulus is sent to the visual cortex, but in a synaesthete there are additional connections that will send this message to other sensory areas of the cerebral cortex. As a result, sounds can be seen, and words can be tasted. When Kaitlyn Hova hears a musical note, her auditory cortex processes the sound and at the same time activates her visual cortex, so that she perceives the flashes of colour as being fully integrated into the same experience. It is believed that this experience is created when excess neural pathways are not “pruned back” during brain development as a child grows (Figure 5). A synaesthete brain is therefore a healthy brain with additional connections that create a unique sensory experience.

## Study tip

Remember to make links between key terminology used in chapters. For example, if you know gustatory perception is taste perception – you can infer that lexical–gustatory synaesthesia has something to do with taste perception.



**FIGURE 5** How a synaesthete sees a green flash of colour when they hear the word “cat”, compared to a non-synaesthete

In rare cases, synaesthesia can occur in response to head injury. There have been cases of people who developed the condition following traumatic brain injury. It is thought that the development of synaesthesia occurred due to neural connections forming in response to the brain trying to compensate for injury.

## 10.3 CHALLENGE

### Investigating other forms of synaesthesia

There are more forms of synaesthesia than those mentioned in this topic. Research a form of synaesthesia not mentioned in this topic (such as spatial sequence synaesthesia or mirror–touch synaesthesia) and answer the questions.

- 1 Identify the senses that are blended in this type of synaesthesia.
- 2 Describe how this type of synaesthesia can influence an affected person’s interactions with the world (does it make some tasks difficult or some tasks easier?).
- 3 Use your understanding of the brain to suggest which areas of the brain are activated or connected to create this form of synaesthesia.

## Spatial neglect

### spatial neglect

a disorder created by a damaged parietal lobe where a patient ignores the one side of their world

**Spatial neglect** is a neurological condition where someone is unable to perceive or respond to stimuli on one side of their body. Spatial neglect is typically caused by injury to the right parietal lobe. To understand the effects of spatial neglect, consider Peggy, who experienced a stroke in her early sixties. Peggy recovered from the stroke but afterwards was unable to perceive the left side of her world (left-sided neglect). Peggy's stroke damaged an area at the rear of her right parietal lobe normally involved in processing spatial tasks. Peggy now systematically ignores the left side of her world – her visual sensory system is unaffected, but she does not pay attention to her left field of view. Peggy does not notice food on the left side of her plate, or untidy hair on the left side of her head when she brushes her hair. Peggy also only applies make-up to the right side of her face. When asked to copy a drawing of a flower, Peggy carefully draws petals of the right side of a daisy, and then sits back believing the drawing is finished. When asked to read the word NETBALL, Peggy only sees the word BALL.

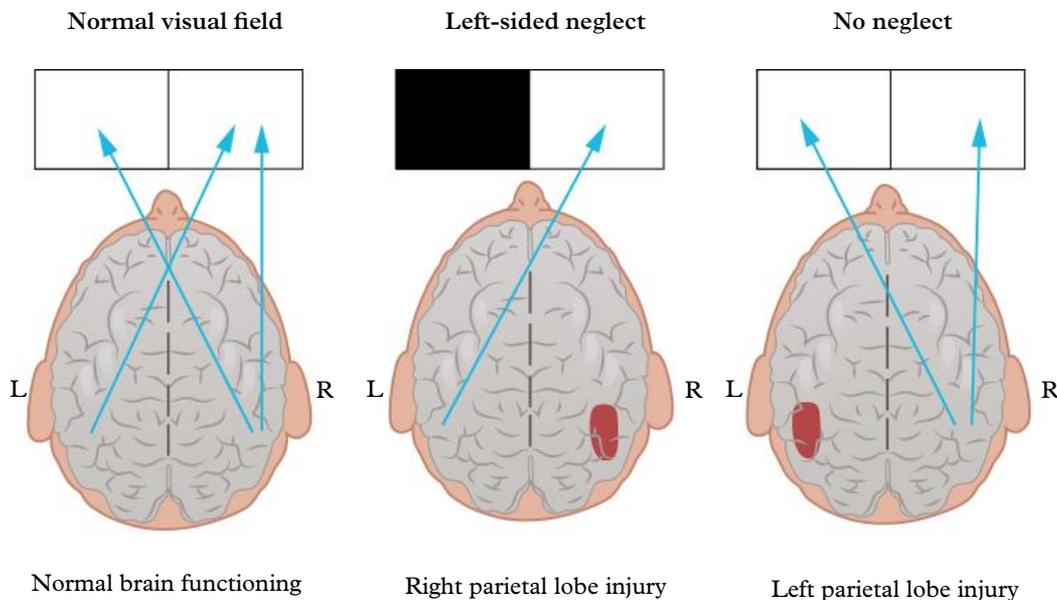
### left-sided neglect

spatial neglect characterised by the inability to perceive and interact with stimuli appearing on the left side of the body due to damage in the right hemisphere

**Left-sided neglect** is more common than **right-sided neglect**. This is because the right hemisphere is largely in control of distributing spatial attention and regulates more attention than the left hemisphere (Figure 6). When the left parietal lobe is injured, the right hemisphere can usually compensate for loss of function, but when the right parietal lobe is injured, the left hemisphere is limited in its ability to compensate for loss of function.

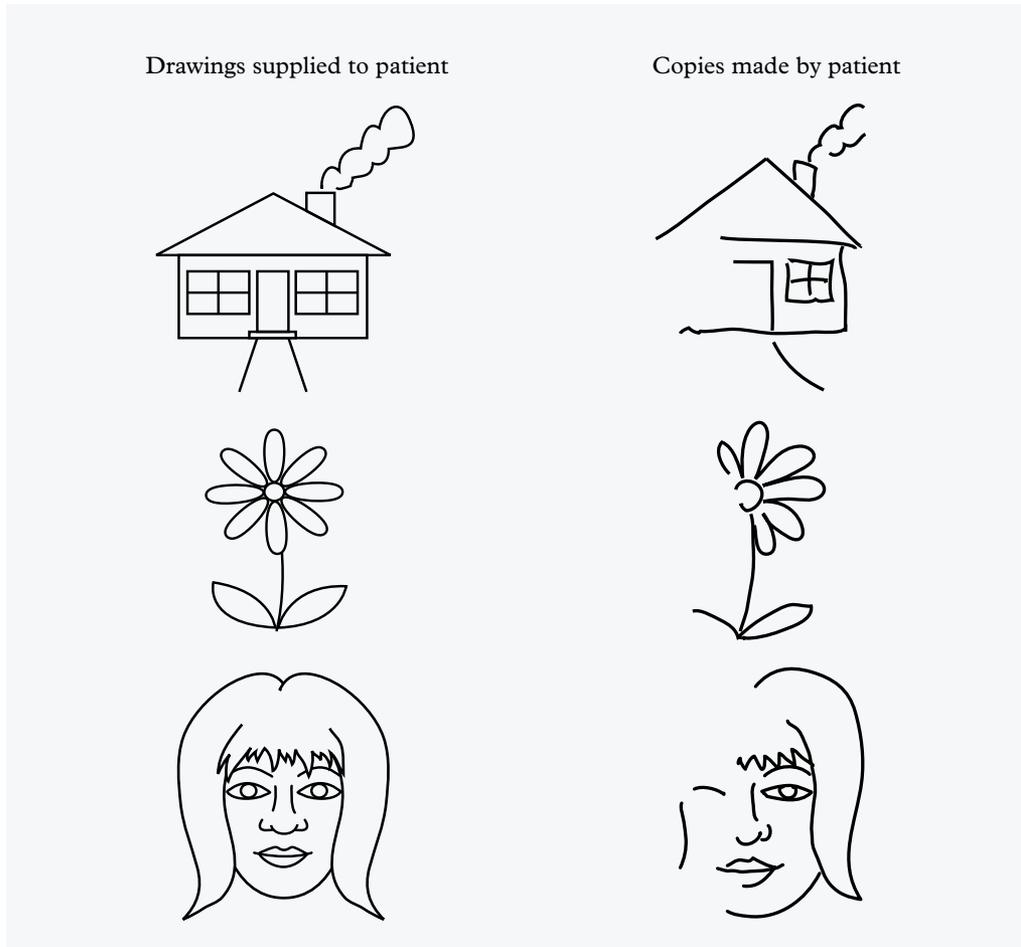
### right-sided neglect

spatial neglect characterised by the inability to perceive and interact with stimuli appearing on the right side of the body due to damage in the left hemisphere



**FIGURE 6** Left-sided neglect is more common than right-sided neglect because damage to the right hemisphere is harder to compensate for.

Curiously, most patients with spatial neglect are unaware of their condition; it is usually first noticed by a caregiver. Spatial neglect can make daily activities difficult for the individual because they are unaware of objects on their left as they navigate their environment. Spatial neglect can also affect memory, as patients with spatial neglect might only describe the right side of a scene they recall and not pay attention to the left side (Figure 7). With the help of caregivers, patients with spatial neglect can develop strategies to help them manage the challenges presented to them in their daily lives.



**FIGURE 7** Drawings copied by a spatial neglect patient

Spatial neglect can be better understood through documented case studies. Oliver Sacks, a well-respected neurologist, wrote extensively about some of his intriguing spatial neglect patients. One such patient was identified as “Mrs S”. “Mrs S” was described as an intelligent woman who had suffered a stroke that had damaged her right hemisphere. The passage below is an extract from Sacks’ observations.

*“She sometimes complains to her nurses that they have not put dessert or coffee on her tray. When they say, “But Mrs S, it is right there, on the left,” she seems not to understand what they say, and does not look to the left. If her head is gently turned, so that the dessert comes into sight, in the preserved right half of her visual field, she says, “Oh, there it is – it wasn’t there before.” She has totally lost the idea of “left”, both with regard to her world and her own body. Sometimes she complains that her portions are too small, but this is because she only eats from the right half of the plate – it does not occur to her that it has a left side as well. Sometimes, she will put on lipstick, and make up the right half of her face, leaving the left half completely neglected: it is almost impossible to treat these things, because her attention cannot be drawn to them and she has no conception that they are wrong. She knows it intellectually, and can understand, and laugh: but it is impossible for her to know it directly.”*

Source: Oliver Sacks (1985)

## 10.3 REAL-WORLD PSYCHOLOGY

### Alan Burgess and spatial neglect

On 5 November 2007, Alan Burgess suffered a stroke that damaged the parietal lobe on the right side of his brain. Burgess, a tool design drafter and driver who was 59 at the time, was left with spatial neglect following the stroke. Due to this damage, Alan was no longer able to work and was forced into an early retirement. When drawing artwork Alan would provide detailed pictures of animals that missed elements and features on their left side. Following his stroke, the severity of Alan's neglect was tested by a neurologist. The neurologist asked Alan to mark the centre point of a 25-centimetre line on a piece of paper. In his first attempt Alan marked the line approximately two centimetres from the right edge, completely ignoring the left side of the line. Alan has responded well to rehabilitation; on later attempts Alan would mark the centre of the line ten centimetres from the right edge.

### Apply your understanding

- 1 Identify which type of spatial neglect Alan is experiencing. Justify your answer.
- 2 Describe how development of spatial neglect has affected Alan's day-to-day life.
- 3 Draw an example of how you would expect Alan to copy the image of the beach chairs.



**FIGURE 8** An image of beach chairs

### 10.3 WORKED EXAMPLE

#### Presenting ideas using visual representations

Create a Venn diagram to showcase the similarities and differences between grapheme–colour synaesthesia and lexical–gustatory synaesthesia. (4 marks)

Think	Do
Step 1: Identify the similarities between the two forms of synaesthesia.	<p>Similarities:</p> <ul style="list-style-type: none"> <li>• Both conditions are forms of synaesthesia.</li> <li>• Both conditions involve an association with words or letters.</li> </ul>
Step 2: Identify what is unique to each form of synaesthesia.	<ul style="list-style-type: none"> <li>• Grapheme–colour synaesthesia involves an association with colour.</li> <li>• Lexical–gustatory synaesthesia involves an association with taste.</li> </ul>
Step 3: Draw your Venn diagram and place the similarities in the intersection, and differences in the ends of the circles. (1 mark each)	

### 10.3 CHECK YOUR LEARNING



#### Describe and explain

- 1 Describe what occurs in a synaesthete brain when one sense is activated.
- 2 Explain why synaesthesia is thought to occur.
- 3 Describe why a spatial neglect patient might experience difficulty when eating a meal.
- 4 Identify which specific type of synaesthesia the following people experience:
  - a Vincent van Gogh
  - b James Wannerton
  - c Kaitlyn Hova.

#### Apply, analyse and compare

- 5 Compare grapheme–colour synaesthesia with chromaesthesia.

#### Design and discuss

- 6 Draw a simple diagram of a house as would be drawn by a left-sided spatial neglect patient.
- 7 Create a Venn diagram to showcase the similarities and differences between synaesthesia and spatial neglect.
- 8 Discuss why damage to the left parietal lobe is less likely to result in spatial neglect than damage to the right parietal lobe.

## Chapter summary

### 10.1

- A visual illusion occurs when we misinterpret real sensory stimuli, creating a mismatch between the real-world stimulus and the perception formed in our brain.
- The Ames room illusion demonstrates how we can ignore depth cues and use our past experience to perceive a trapezoidal-shaped room as rectangular, and therefore perceive a person walking across the room as shrinking or growing in size.
- The Müller-Lyer illusion leads us to view two lines of the same length as different lengths due to the arrowhead and feathertail ends. We consistently view the line with arrowheads as being shorter than the line with feathertails.
- The Spinning Dancer illusion is an ambiguous figure that lacks depth, presenting a figure that can be perceived as spinning in two directions.
- Visual agnosia is an inability to name or describe the use of an object, or to recognise a familiar face.

### 10.2

- A supertaster experiences the sense of taste for certain flavours with a greater intensity than most people in the population.
- Miraculin is a chemical extracted from the berry of the miracle fruit *Synsepalum dulcificum*, which can stimulate taste buds to cause sour foods to taste sweet.
- Judgment of food flavours is influenced by factors such as perceptual set, colour intensity and food texture.

### 10.3

- Synaesthesia is an intriguing phenomenon where the stimulation of one sense will involuntarily stimulate another sense in response to a stimulus.
- Spatial neglect is a disorder most often caused by damage to the right parietal lobe. The condition leaves individuals unable to acknowledge, orient or perceive things that sit within a particular field of view.

## Revision questions

### Multiple choice

- 1 Visual illusions occur when we incorrectly apply \_\_\_\_\_ factors that usually help us to understand our world.
  - A biological
  - B psychological
  - C physiological
  - D fallibility
- 2 The Müller-Lyer illusion leads us to misinterpret two lines of the same length as being different lengths. One explanation to help us understand this illusion is the carpentered world hypothesis. This suggests that we perceive the illusion as a result of:
  - A our experience with rectangular buildings, and therefore our application of depth cues to perceive the feathertails line as being closer and shorter in length.
  - B the misapplication of size constancy where we perceive lines the same size at different distances as being different lengths.
  - C a perceptual compromise where we judge the overall length of the figure to perceive the line with feathertails as the longer line.
  - D our experience with rectangular buildings, and therefore our application of depth cues to perceive the arrowheads line as being closer and shorter in length.
- 3 The Ames room illusion:
  - A occurs when we look through a peephole to perceive a rectangular room as trapezoidal.
  - B enables the viewer to use binocular depth cues when using a peephole to view inside a room.
  - C occurs when we are unable to use normal depth cues to perceive figures as growing or shrinking in size as they walk across a trapezoidal-shaped room.
  - D occurs because a trapezoidal-shaped room uses depth cues to create the illusion of figures changing in size as they walk across the room.
- 4 The inability to name or describe an object or to recognise faces is the result of a disorder known as:
  - A synaesthesia.
  - B prosopagnosia.
  - C visual agnosia.
  - D spatial neglect.
- 5 A supertaster is someone who:
  - A perceives sour foods as tasting sweet.
  - B has an increased sensitivity to the flavours of foods.
  - C combines the senses of vision, taste, smell, and touch to increase the experience of food flavours.
  - D readily identifies intensely coloured foods as having a stronger flavour.
- 6 Our perception of food flavours can be strongly influenced by past experiences. This influence is known as:
  - A perceptual set.
  - B a visual illusion.
  - C spatial neglect.
  - D gustatory perception.
- 7 The texture of foods can influence our perception of flavour. An example of this is when a subject identifies that:
  - A crunchy potato chips taste better than soggy potato chips.
  - B a more intensely coloured red drink tastes sweeter than a diluted red drink.
  - C creamy camembert cheese tastes better than shredded tasty cheese.
  - D crunching on a fresh apple reminds them of happy childhood experiences.



- 8 Synaesthesia is best described as:
- A an abnormal condition that identifies damage to a specific area of the cerebral cortex.
  - B the integration of two or more senses that are perceived as belonging together.
  - C increased connectivity between sensory areas of the cerebral cortex that create an integrated sensory experience when one sense is stimulated.
  - D a unique sensory experience that is experienced as different every time a sense is stimulated.
- 9 Vern has recently had a stroke where his right parietal lobe was damaged. He is unable to notice that he has not eaten the food on the left side of his dinner plate. Vern has a condition known as:
- A visual agnosia.
  - B synaesthesia.
  - C spatial neglect.
  - D blindness.
- 10 Distortions in the perception of visual stimuli and judging the flavours of food can be attributed to all the following factors except:
- A the biological composition of our visual and taste sense organs.
  - B misapplication of psychological factors that we normally use to make sense of sensory stimuli.
  - C past experiences that build our understanding of the world.
  - D an inability to use all information normally available to us for an accurate perception of the world.
- 13 Explain how the Ames room illusion prevents us from using binocular depth cues to perceive the realistic structure of the room.
- 14 Describe how a person with visual agnosia might respond to being asked to name a series of objects.
- 15 Amani dislikes brussels sprouts because they taste extremely bitter. Explain what this could indicate about Amani's perception of taste.
- 16 Identify the food chemical that can temporarily change our perception of a sour taste into a sweet taste.
- 17 Identify which senses are being activated when Isaac perceives the colour blue when he hears the word "tripod". Identify and describe the condition Isaac is experiencing.
- 18 Explain what is occurring in the brain of a synaesthete when they "taste" colours.
- 19 Explain why a person with visual agnosia might be able to identify a pencil if they can touch it, but not when looking at it.
- 20 Describe how a left-sided spatial neglect patient might respond when asked to count the number of meerkats while observing the scene shown. Explain why they would respond this way.



### **Short answer**

#### **Describe and explain**

- 11 Describe the Müller-Lyer illusion.
- 12 Explain how the carpentered world hypothesis can offer an explanation for our inaccurate perception of the two lines in the Müller-Lyer illusion.

### Apply, analyse and compare

- 21 Provide evidence for the carpentered world hypothesis explanation for the Müller-Lyer illusion using a cultural example.
- 22 Create a Venn diagram to display the similarities and differences between the Ames room illusion and the Spinning Dancer illusion.
- 23 Propose why a foreign visitor to Australia may find the flavour of Vegemite disgusting, whereas a person growing up in Australia may enjoy it thickly spread on their toast for breakfast each day.
- 24 Provide two examples not discussed in this chapter to illustrate how both colour intensity and texture can influence our perception of taste.
- 25 Compare how a spatial neglect patient and a patient with visual agnosia might respond when asked to identify the king from a photo and then complete a simple drawing of his face. Justify your responses with reference to characteristics of each disorder.

### Design and discuss

- 26 Discuss the statement, “Perception is fallible”. In your response, refer to the fallibility of both visual and gustatory perceptual systems and use examples to show your understanding.

- 27 The Müller-Lyer, Ames room and Spinning Dancer illusions are all examples of visual illusions. Construct a concept map to compare these illusions as examples of the fallibility of our visual perception.
- 28 Design a simple experiment that could be used to test the idea that miraculin can alter the flavour of sour foods. Identify the IV, DV and hypothesis of your experiment.
- 29 Evie wanted to test the effect of visual cues on the accuracy of taste perception. She conducted an experiment on a group of 20 volunteer Year 7 students from her school. She used a between-subjects: the control group tasted five coloured macarons that visually matched their flavours (such as yellow = banana, blue = blueberry), while the experimental group tasted the same five macarons while blindfolded. Subjects were asked to identify the flavour of each macaron tasted.

Discuss the advantages and disadvantages of using between-subjects design in this experiment, and the predicted results. Justify your prediction with reference to factors influencing taste perception.

- 30 With reference to the experiment in question 29, discuss the ethical guidelines that Evie should have incorporated into her experimental design.

You can find the following resources for this section in your **obook pro**:

#### Quizlet

Compete in teams or against yourself to test your knowledge.



#### Chapter quiz

Test your understanding of key knowledge in this chapter.



#### Chapter checklist

Rate your understanding of key knowledge in this chapter.

# Checkpoint

## Part A – Assessment support for Unit 2 Area of Study 2

In Unit 2 Area of Study 2, you will be required to complete **one** task from the following options:

- analysis and evaluation of an experiment or case study
- a data analysis of generated primary and/or collated secondary data
- reflective annotations of a logbook of practical activities
- media analysis of one or more contemporary media texts
- a literature review
- response to a psychological issue or ethical dilemma
- a modelling or simulation activity
- problem-solving involving psychological concepts, skills and/or issues
- a report of a scientific investigation, including the generation, analysis and evaluation of primary data.

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

The assessment support provided in this section models one way of approaching the following task for Outcome 2:

- a data analysis of generated primary and/or collated secondary data.

### Study tip

If you have access to the *Psychology for VCE Units 1 & 2 Student Workbook*, practise some of the key science skills needed for this assessment by completing the Data drill activities before attempting this practice assessment.

### Important notice to students

Your teacher may select one of the other task options above for you to complete as assessment for this outcome. If so, refer to the table of contents to find the assessment support related to that task.

**The advice, sample assessment and sample response provided should be used as an example only and should not be completed as part of your formal assessment. Instead, your teacher will create a new task for your class to complete.**

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### Overview of Assessment 2 – A data analysis of generated primary and/or collated secondary data

In this sample assessment for Unit 2 Area of Study 2, you will need to read, analyse and evaluate secondary data. This task is designed to assess your understanding of attention and perception, including gustatory and visual perception, as well as the factors that can influence perception. This assessment will require you to carefully read through provided experimental designs and secondary data and extract the necessary information to answer questions.

## **A step-by-step guide to completing Assessment 2**

The information provided in this section is designed to help you prepare and practise for Assessment 2. The tips and advice included are broad and have been designed to help you successfully complete data analysis of collated secondary data, regardless of the specific requirements of the task your teacher or school has created.

### **Step 1: Carefully read the requirements of the task and understand how you will be assessed**

The best way to set yourself up for success on Assessment 2 is to practise completing all the Data drills included in Chapters 9 and 10 in the Student Workbook and read through Topics 1.5 and 1.6 in your Student Book. This will prepare you to be able to analyse and interpret data in a way that links back to the theory covered in Chapters 9 and 10.

### **Step 2: Reference data in your responses**

Remember to specifically reference data, for example, “Was 25 per cent higher than ...” or “showed a strong positive correlation”, when answering a question that asks you to use data to support your response.

### **Step 3: Consider how the experimental design could influence data collected**

When reading through an experimental design, make sure to highlight or note how the methodology, sampling or procedure may have affected results. Note down any limitations or improvements you think could be made to the experimental design to improve the accuracy, precision or validity of results.

### **Step 4: Practise presenting data in different formats**

In a data analysis task, it is highly likely that you will be required to present raw data in an appropriate format. Make sure you understand how different sorts of data can be presented and why certain data is best presented in specific formats (Topic 1.6).

Now that you have learnt about some of the key steps to follow to achieve success on Assessment 2, it is a good time to practise putting this theory into action. In Part A, we will examine:

- a sample assessment
- a high-scoring student response for the assessment (complete with tips and annotations to show you how to maximise your marks)
- the marking criteria for the sample assessment.

## Sample Assessment 2

Read through the experimental design and results provided and use this information to answer all questions.

In 2007, Zampini et al. conducted a study that investigated how colour affects perception. To investigate this, they had 11 participants take part in two experiments. All participants involved in the study:

- were unaware of the purpose of the study
- had normal gustatory and olfactory abilities
- had normal colour vision
- did not report having a cold or respiratory infection in the days leading up to the study
- gave informed consent.

A summary of the experiments and data obtained are given below.

### Experiment 1

The procedure of Experiment 1 was as follows:

- Participants were each seated in an individual testing booth.
- Participants were presented with red, green, orange, yellow, blue, grey and colourless solutions (in random order) to observe without tasting.
- After each presentation of a solution, participants filled out a paper-based response sheet where they marked a tick next to the flavours they thought most closely corresponded to the colour of the solution (out of strawberry, pear, lemon, melon, lime, orange, aniseed, spearmint, liquorice, cherry, lettuce, vanilla, toffee, cream soda, apple, peach, raspberry, pineapple, yoghurt, blackcurrant, flavourless or other). Participants were informed they could choose the same option on more than one occasion and no time limits were given for participants to respond.

The results of Experiment 1 are shown in Table 1.

**TABLE 1** Results from Experiment 1

Colour	<i>p</i>	Associated flavours
Green	<0.001	Lime (69%), Apple (20%), Melon (11%)
Orange	<0.001	Orange (91%), Aniseed (5%), Toffee (4%)
Yellow	<0.001	Lemon (89%), Pear (5%), Apple (4%), Melon (2%)
Blue	<0.001	Spearmint (86%), Raspberry (9%), Cream soda (5%)
Grey	<0.001	Blackcurrant (53%), Liquorice (40%), Cherry (4%), Aniseed (4%)
Red	0.16	Strawberry (46%), Raspberry (27%), Cherry (27%)
Colourless	<0.001	Flavourless (51%), Cream soda (16%), Vanilla (15%), Aniseed (15%), Spearmint (2%), Melon (2%), Pear (2%)

- 1 Present the information from Table 1 in a graphical format of your choice. Justify your selection of format and explain how it improves someone's ability to interpret the data collected. (10 marks)
- 2 Identify which colour had the greatest variety of flavours associated with it. Use data from the table to justify your response. (2 marks)
- 3 Identify which colour-flavour combination had the strongest association among participants. Use data from the table to justify your response. (2 marks)
- 4 The experimenters made sure that all participants had "normal colour vision". Explain why this particular factor was important to control for based on the data that was collected in Experiment 1. (2 marks)
- 5 One of the coloured solutions cannot be associated with the flavours that participants listed against it. Identify which coloured solution this is and explain what aspect of the data provided led you to this conclusion. (2 marks)

## Experiment 2

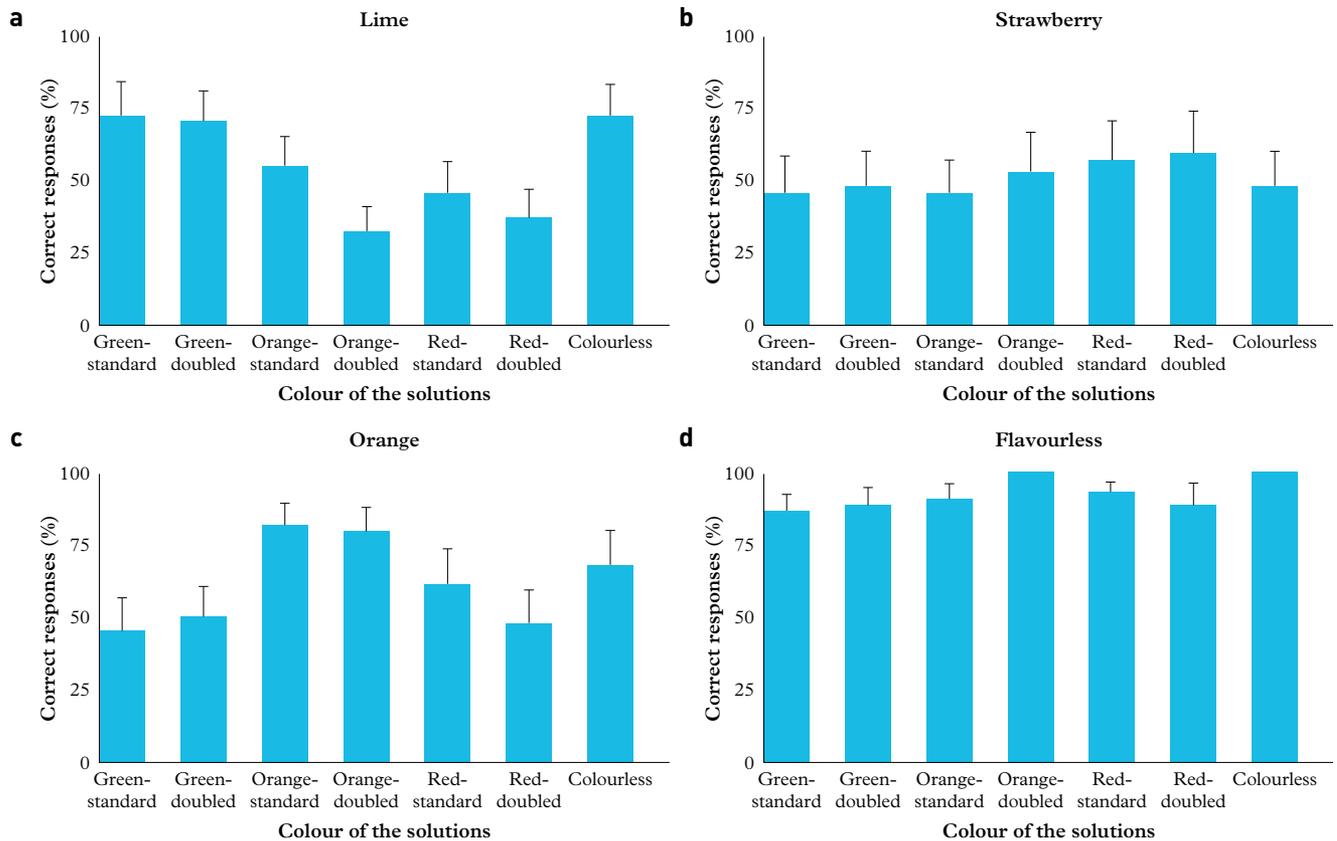
The procedure of Experiment 2 was as follows:

- Participants were told that in this experiment the colour of solutions would often not correspond to the flavours typically associated with that colour.
- Participants were presented with a cup of coloured and flavoured solution on each trial in random order. The colour-flavour combination of solutions were: red-strawberry, red-lime, red-orange, red-flavourless; green-strawberry, green-lime, green-orange, green-flavourless; orange-strawberry, orange-lime, orange-orange, orange-flavourless; colourless-strawberry,

colourless-lime, colourless-orange, colourless-flavourless. In addition to these solutions, a set of each colour-flavour combination with double the amount of food dye was also included for taste testing.

- Participants were asked to view each solution, taste it and then spit out the sample. Participants would then identify which flavour they thought that solution was. Participants were given a palate cleanser between tasting samples. Each of the different conditions (solutions) were tested four times, resulting in 124 randomly ordered trials.

The results of Experiment 2 are shown in Figure 1.



**FIGURE 1** Mean percentage of correct flavour detection responses for the **a** lime, **b** strawberry, **c** orange and **d** flavourless solutions presented in Experiment 2. The error bars represent the between-participants standard errors of the means.

**1** Use the graphs above to identify all the flavour-colour combinations that were guessed correctly by participants 100 per cent of the time.

(1 mark)

**2** Use the graphs above to identify which flavours (excluding flavourless) were able to be correctly identified more than 75 per cent of the time when the colour of the solution matched the flavour profile of the solution.

(1 mark)

- 3 a Which condition of the lime flavour led to the lowest percentage of correct identification? (1 mark)
- b Which condition of the orange flavour led to the lowest percentage of correct identification? (1 mark)
- 4 What do your responses to Questions 2 and 3 suggest about the relationship between colour and taste perception? (3 marks)
- 5 a Define the term “gustatory perception”. (1 mark)
- b The expectation that food of a certain colour will taste a certain way is an example of what psychological influence on gustatory perception? (1 mark)
- c Do the results from Experiment 2 support or refute that the factor identified in question 5b has an influence on gustatory perception? Justify your response. (2 marks)
- d Discuss two other factors that can distort gustatory perception and describe how these factors were controlled for in the experimental design. (4 marks)
- 6 Provide one suggestion to improve the accuracy of results in Experiment 2. (1 mark)
- 7 This experiment did not include any participants who were “supertasters” or “non-tasters”. Discuss why the results of the experiment would probably vary if the experiment had been conducted on a sample that included supertasters and non-tasters. (4 marks)
- 8 Comment on what the results from Experiments 1 and 2 suggest about the fallibility of gustatory perception. (2 marks)

You can find the following resources for this section in your [obook pro](#):

pro



**Annotated response and marking criteria**

Once you've completed the practice SAC use this resource to assess your response.

## Part B – Checkpoint questions

### Multiple choice

#### Question 1

The Spinning Dancer illusion is caused by:

- A misapplication of size constancy.
- B a lack of depth cues and the ambiguity of the figure.
- C the carpentered world hypothesis.
- D perceptual compromise theory.

#### Question 2

Which of the following is true for visual illusions?

- A They occur when our perception aligns to what is visually real.
- B They are caused solely by biological factors.
- C They occur due to sense organs misinterpreting stimuli.
- D They occur when our perception differs to what is visually real.

### Question 3

Hassan looks at the photo in Figure 2 and perceives that the photo was taken of a tree-lined street that has cars and safety cones on it. Hassan was able to form this perception due to:

- A divided attention.
- B bottom-up processing.
- C selective attention.
- D top-down processing.



FIGURE 2 A blurry photo

### Question 4

Which of the following is the correct order of the visual pathway?

- A Transmission, transduction, reception
- B Reception, transduction, transmission
- C Transduction, transmission, reception
- D Reception, transmission, transduction

### Question 5

Camouflage makes use of which Gestalt principle?

- A Proximity
- B Closure
- C Similarity
- D Figure-ground organisation



FIGURE 3 A green huntsman spider camouflaging

Use the following information to answer questions 6 to 10.

A researcher investigated the effect of colour on gustatory perception. Sixteen adults aged between 20 and 30 years took part in the study. Each participant was given two samples of lime-flavoured cordial to taste (Figure 4) and was required to rate the flavour on a scale of 1 (weak) to 5 (strong). Both Sample A and Sample B were the same recipe formula; the only difference between the two samples was the food colouring used. The results showed that 14 out of the 16 participants stated that Sample B had a stronger lime flavour than Sample A.



Sample A Sample B

FIGURE 4 Lime cordial samples

### Question 6

Identify the experimental design employed in the study.

- A Within-subjects design
- B Between-subjects design
- C Mixed design
- D Twin study

### Question 7

The flavour of the drink, as reported by participants on a scale of 1 to 5, was:

- A the independent variable.
- B the dependent variable.
- C a controlled variable.
- D an extraneous variable.

**Question 8**

Which of the following is an advantage of the experimental design used in the study?

- A It is cost-efficient.
- B It can be used to investigate the effects of more than one independent variable on the dependent variable.
- C It is time-efficient.
- D It requires fewer participants than other designs.

**Question 9**

Which of the following is a disadvantage of the experimental design used in this study?

- A Findings can be hard to interpret.
- B Individual participants may differ in characteristics.
- C The order of conditions affects results.
- D Researchers have limited control over participant variables.

**Question 10**

The study consisted of:

- A one control and one experimental condition.
- B two experimental conditions.
- C two control conditions.
- D one control and two experimental conditions.

**Short answer**

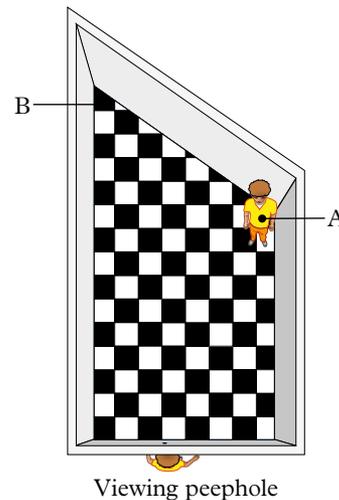
**Question 1** (4 marks)

Identify the specific type of synaesthesia experienced in each of the following examples.

- a When learning the alphabet in school, Rudi finds that each letter has a sour, sweet or bitter taste. (1 mark)
- b When playing guitar, Leilani sees a different colour for each chord she plays. (1 mark)
- c Billy sees odd numbers as red and even numbers as blue. (1 mark)
- d Abhik feels his skin tingle when he hears rain falling on his roof and feels cold each time he hears his myki card beep. (1 mark)

**Question 2** (9 marks)

Use Figure 5 to answer the questions.



**FIGURE 5** A person viewing a visual illusion

- a Name the visual illusion shown in Figure 5. (1 mark)
- b Describe what the viewer would see if the person standing in position A moved to position B. Explain each factor that causes the viewer to perceive this. (4 marks)
- c After experiencing the illusion, the viewer is informed of how the visual illusion works. The viewer decides to try looking again to see whether their perception will change. Assess whether the viewer would perceive the illusion the same way or perceive it differently after understanding how the illusion works. Explain your answer. (2 marks)
- d Identify one change that could be made (to the room, viewer or person) that would prevent the visual illusion from occurring. Explain how the change would prevent the illusion from occurring. (2 marks)

**Question 3** (14 marks)

Fernando is revising for a VCE Psychology assessment at home. Just before starting their study session, Fernando puts on some lo-fi music softly in the background. They then begin writing notes and completing practice questions.

- a Define controlled and automatic processes. Identify whether the task of listening to music and the task of completing homework are controlled or automatic processes. (4 marks)
- b Fernando being able to listen to music while they revise is an example of which type of attention. Justify your response. (2 marks)

**c** When their playlist finishes, Fernando’s phone starts playing a true crime podcast they enjoy. When the podcast comes on, Fernando finds it difficult to focus on studying and they change it back to music. With reference to divided attention, explain why Fernando finds it difficult to focus on studying when a podcast is playing. (2 marks)

**d** When Fernando returned to school, they discussed with their friends how they believe listening to lo-fi music in the background enhances concentration levels. Fernando’s teacher overheard the conversation and suggested Fernando devise an experiment to test their hypothesis. Provide an explanation of how Fernando could conduct the study to assess whether listening to lo-fi music in the background enhances concentration levels. Include an aim, hypothesis, proposed sampling technique, investigation design and methods of data collection. (6 marks)

**Question 4** (5 marks)

James notices that his partner, who has Alzheimer’s disease, can no longer recognise people by looking at their face.

- a** Name the condition that describes what James’ partner is experiencing. (1 mark)
- b** Explain what has happened in the brain to cause this condition. (2 marks)
- c** When James picks up his partner from the train station, his partner can recognise him because James calls out. Explain why James’ partner is still able to recognise James, despite being unable to identify James when looking at his face. (2 marks)

**Question 5** (7 marks)

An artist has used several pictorial cues in the painting of the Parisian scene in Figure 6.



**FIGURE 6** An oil painting of a street in Paris

- a** Define the term “pictorial cue”. (1 mark)
- b** Describe linear perspective and explain how the artist has used it in the painting in Figure 6. (2 marks)
- c** Describe relative size and explain how the artist has used it in the painting in Figure 6. (2 marks)
- d** Describe interposition and explain how the artist has used it in the painting in Figure 6. (2 marks)

**Question 6** (5 marks)

- a** Use an example to explain how colour intensity can affect perceptual set, in relation to gustatory perception. (2 marks)
- b** A researcher wants to study whether including the word “crunchy” on a packet of potato chips will influence a person’s judgment of the flavour of the chips. Evaluate whether a within-subjects design or between-subjects design would be most appropriate for this study. (3 marks)

**Question 7** (6 marks)

Lydia wanted to test whether perceptual set (through cost or luxurious branding) affects people’s perception of the taste of chocolate. She purchased 50 of the same milk chocolate bars, then wrapped 25 in plain packaging and the remaining 25 in extravagant gold wrapping. Lydia recruited 25 participants and asked them to taste one of each kind of wrapped chocolate, then rate how tasty the chocolate was.

- a** Write a hypothesis for this experiment. (3 marks)
- b** On the drive home after purchasing the 50 chocolate bars, some of the chocolate bars melted in the sun without Lydia realising. Explain how this factor affects the validity of Lydia’s research. (2 marks)
- c** Explain whether the chocolate bars melting is an example of an extraneous or confounding variable. (1 mark)

# Student-designed investigation

This chapter will guide you through your student-designed investigation. Each topic will focus on the essentials of investigation design, from planning and conducting to communicating your results. To-do lists for part of your investigation are also included to help you.

Before you get started, make sure you have the details of this assessment task from your teacher. You should always check the assessment criteria, as well as for any tips your teacher might provide to help you succeed!

## KEY KNOWLEDGE

### Investigation design

- the role of scientific investigations in reducing uncertainty
- psychological science concepts specific to the selected scientific investigation and their significance, including the definition of key terms
- scientific methodology relevant to the selected scientific investigation, selected from classification and identification; controlled experiment; correlational study; fieldwork; modelling; or simulation
- techniques of primary qualitative and quantitative data generation relevant to the investigation
- accuracy, precision, repeatability, reproducibility and validity of measurements in relation to the investigation
- health, safety and ethical guidelines relevant to the selected scientific investigation

### Scientific evidence

- the distinction between an aim, a hypothesis, a model and a theory
- observations and investigations that are consistent with, or challenge, current scientific models or theories
- the characteristics of primary data
- ways of organising, analysing and evaluating generated primary data to identify patterns and relationships, including sources of error and remaining uncertainty
- use of a logbook to authenticate generated primary data
- the limitations of investigation methodologies and methods, and of data generation and/or analysis

### Science communication

- the conventions of scientific report writing, including scientific terminology and representations, standard abbreviations and units of measurement
- ways of presenting key findings and implications of the selected scientific investigation

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**FIGURE 1** Unit 2 Area of Study 3 gives you the opportunity to explore a psychological concept by either designing your own investigation from scratch or by adapting an existing investigation.

## GROUNDWORK

This chapter will build on concepts you may have come across in Chapter 1 and Chapter 6. Before starting the chapter, check how well you know the basics by completing this groundwork quiz.



Groundwork quiz  
Chapter 11



# 11.1

## Investigation design

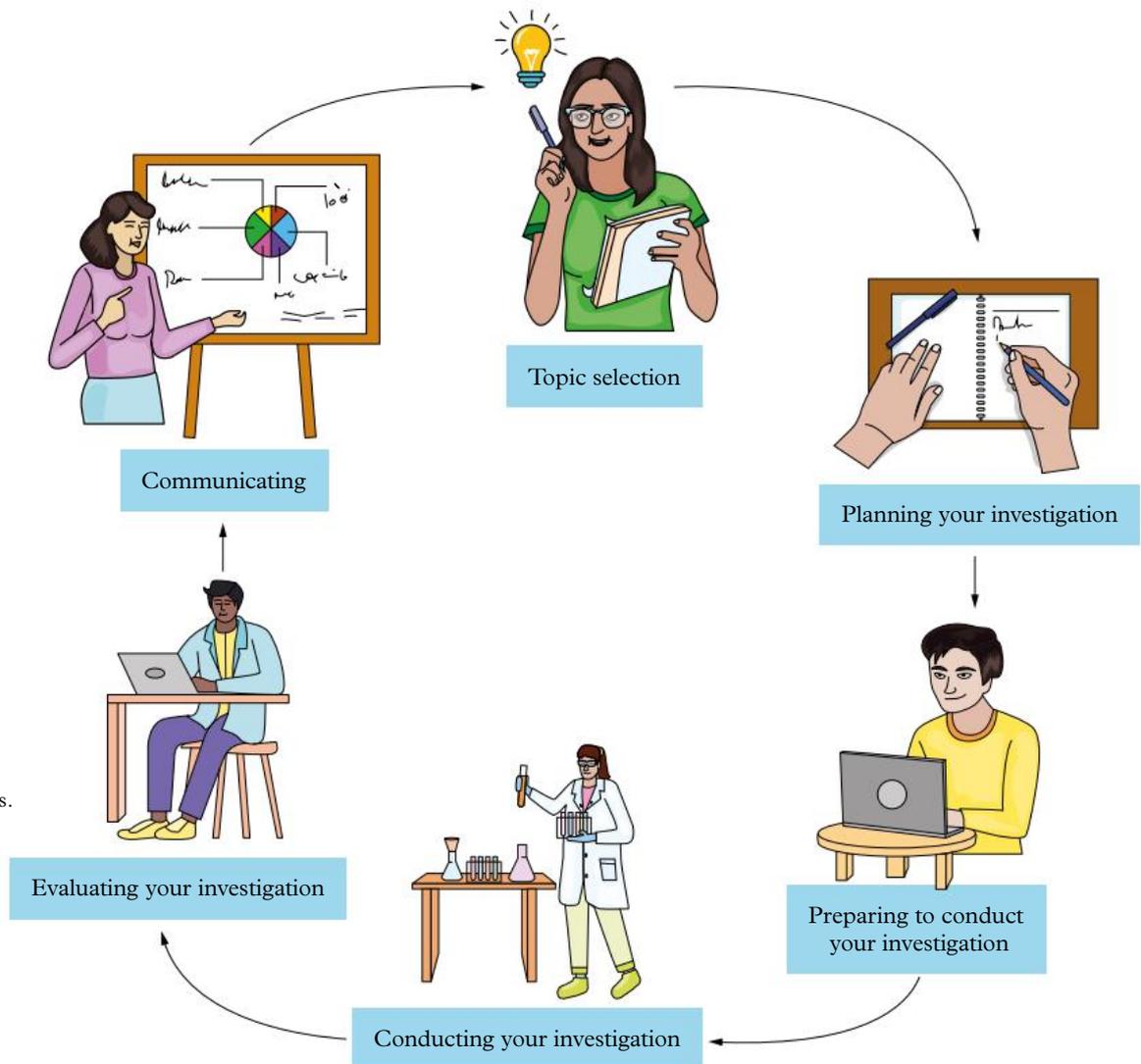
### KEY IDEAS

In this topic, you will:

- + write a scientific question
- + select an experiment to design or adapt
- + conduct research and define key theories
- + understand how to analyse the assessment criteria
- + define your variables
- + write a suitable hypothesis for your experiment
- + construct a method for your experiment
- + complete a risk assessment
- + consider the ethics around your experiment.



A scientific investigation is a multistep process. In Figure 1 you can see that the process can cycle, specifically when the final steps of your first investigation prompt a second investigation. Following the scientific process is essential to the success of the investigation.



**FIGURE 1** The scientific investigation process consists of different stages.

This chapter will go through each phase of the process so that you can complete your own scientific investigation for Unit 2 Area of Study 3 – How do scientific investigations develop understanding of influences on perception and behaviour?

The start of your investigation begins with the topic selection phase. This phase includes:

- deciding on your topic
- deciding to design or adapt an experiment
- choosing and writing an investigation question
- conducting research and defining key theories
- analysing the assessment criteria.

## Topic selection

Your teacher may have already assigned you a specific topic or set of topics to select from; however, if you are choosing your own topic, then you must select one that relates to internal and external influences on perception and/or behaviour. Revising relevant chapters can help refresh your memory of these topics.

Topic selection can be inspired by many areas. Table 1 presents some potential sources for your topic selection and a thinking prompt you can use to help you assess your interest in a topic.

**TABLE 1** Sources and ideas to help inspire your topic selection

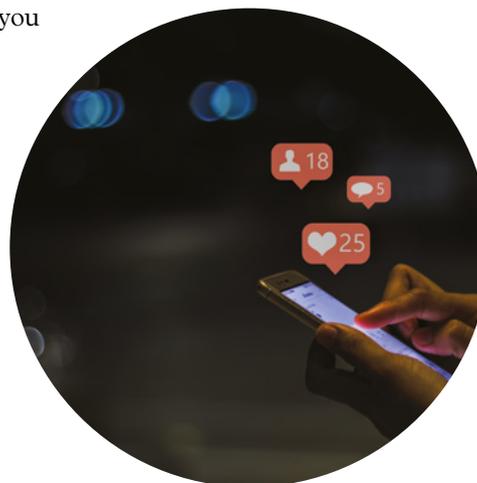
Potential source	Thinking prompt
Direct observation of, and curiosity about, an object, event, phenomenon, practical problem or technological development	Have any science concepts, real-world psychology extracts or scientific articles sparked your interest?
Anomalous or surprising investigation results from analysis of qualitative and/or quantitative data	Throughout investigations you have completed, has anything occurred to pique your interest or intrigue you?
Extension of a previous inquiry	Have any inquiry tasks in investigations led you to ask further questions?
Research involving secondary data	Have you come across something that others have investigated that you might like to expand on or look further into?

Whatever the source of inspiration for your topic, you should aim to select a topic that interests you because this will make the process more enjoyable and allow you to engage more. Topic selection can also happen while choosing and writing a question and/or designing or adapting an experiment.



Topic selection

**FIGURE 2** The first stage of your scientific investigation is topic selection.



**FIGURE 3** Your investigation topic must relate back to concepts covered in Unit 2 Area of Study 1 or Area of Study 2.

## Deciding to design or adapt an investigation

For Unit 2 Area of Study 3 you will have to design or adapt a scientific investigation. To help decide which you will do, consider the following:

- Has your teacher outlined a specific investigation/s you must use for your assessment?
- Did you complete a practical investigation during Unit 2 that left you asking more questions, or collect any data that did not align with your hypothesis?

If either of these are the case, then reusing or adapting an investigation that you have completed during Unit 2 may be a good choice (or compulsory!).

If you would like to investigate a particular topic but have not previously completed a related practical activity, you can look online for an investigation to use or adapt. You may also consider designing your own investigation.

If you are designing your own experiment or reusing/adapting one, make sure to consider:

- whether you can complete the experiment in the time that you have been given
- the equipment you have access to
- whether the investigation allows you to collect primary data.

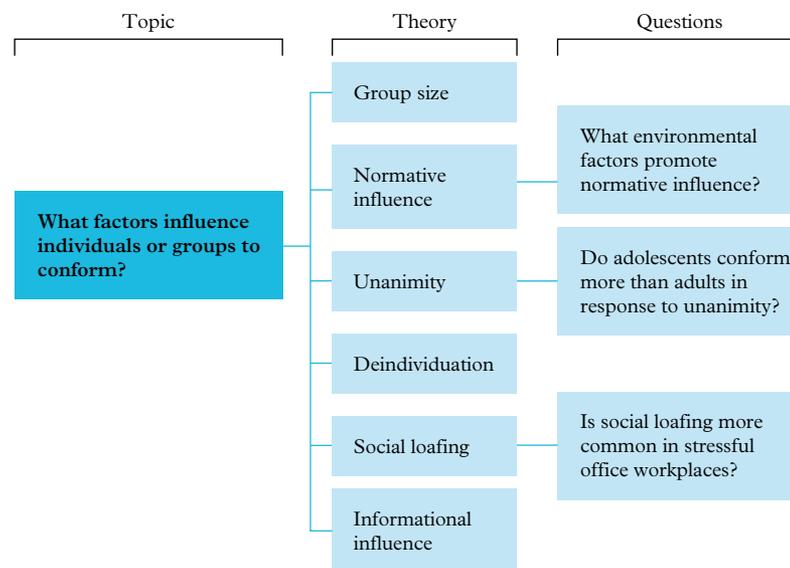
## Choosing and writing an investigation question

A scientific investigation involves asking or responding to an investigation question and then performing experiments and reporting on your findings. Your investigation and report should always respond to your investigation question.

Once you have a topic or experiment in mind, consider questions that you have about the topic. You could also start with a general question that has arisen during your Unit 2 studies and then narrow it down into a research question. How you refine your question can vary depending on whether you start off with a topic/idea or start off with an experiment in mind.

### Starting with a topic or idea

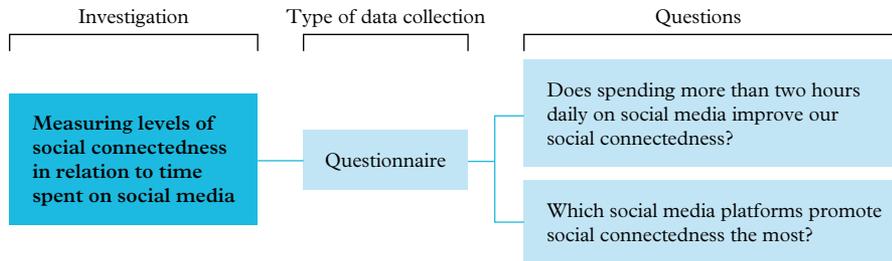
Figure 4 shows a process that you could use to help you write an investigation question starting with a topic or idea. This process starts with the topic, considers the theory involved and then structures questions around the relevant theory.



**FIGURE 4** Example of the process involved in developing a research question from a topic or idea

## Starting with an investigation

If your teacher has given you an investigation to complete or you completed an investigation and it left you with questions, you may consider using the process in Figure 5 to help build your question.



**FIGURE 5** Example of how to develop a research question from an existing investigation

## Finalising your research question

After completing the processes in Figures 4 or 5, you might have several research questions to choose from. You may also need to go back a step and look at designing or adapting an experiment and what will fit with your question and the time allocated. Whatever investigation question you decide on, it should have the following key features:

- be clear and focused
- have an appropriate scope (not too vague or too narrow)
- not be too easy/difficult to answer
- be researchable.

### Research tip

Read your proposed question to a friend or teacher and ask them whether they think it delivers on all four of the key features of an investigation question.

## Conducting research and defining key theories

Once you have decided on your topic or experiment and have written a good investigation question, you should conduct some research into the theories surrounding your topic.

Research will help you to:

- understand the key theories or psychological concepts surrounding your topic
- write your introduction
- determine whether better experiments or methods exist for conducting your investigation
- write your hypothesis and understand the reasoning behind your prediction
- better understand the data that you might need to collect
- fill any current gaps in your knowledge.

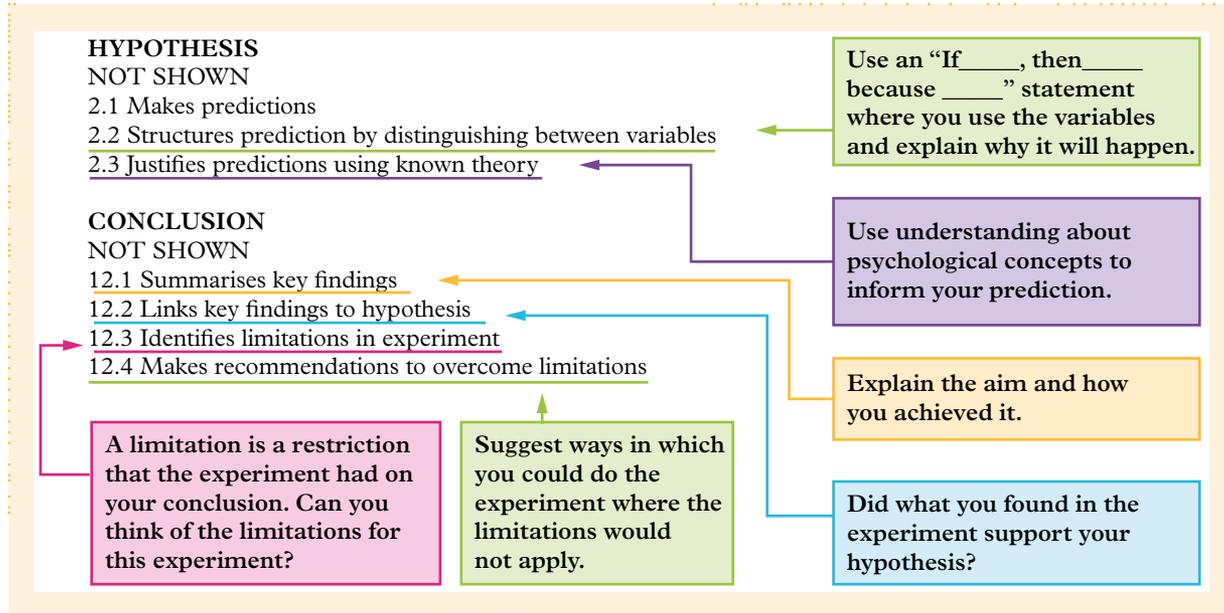
Before researching and compiling your key theories, read the information on sourcing information and analysing your chosen secondary sources using the CRAAP method discussed in Topic 6.1.



**FIGURE 6** You will need to conduct some research and learn the background information relevant to your topic.

## Analysing the assessment criteria

When given the assessment criteria for your Unit 2 Area of Study 3 investigation, check to see what is required to achieve the highest marks. Annotate the rubric or criteria with specific actions you can take to achieve the highest marks (Figures 7 and 8).



**FIGURE 7** An example of a developmental rubric for a hypothesis and a conclusion with annotations stating what the student should do to get each mark

Very low	Low	Medium	High	Very high
Some attempt at formulation of an investigable question with very limited outline of investigation design	Mostly appropriate formulation of an investigable question with limited outline of investigation design	Appropriate formulation of an investigable question with sound investigation design	Accurate formulation of an investigable question with well-constructed investigation design	Highly proficient formulation of an investigable question with sophisticated investigation design

Investigation question should be formulated and be:

- testable
- clear and focused
- have appropriate scope.

This rubric descriptor also includes the overall investigation design, which should link to the:

- question
- topic
- or
- the investigation your teacher set.

**FIGURE 8** An example of a performance descriptor rubric for investigation question and investigation design with annotations of the breakdown of the top marks

You can also turn the assessment criteria into a checklist to ensure that you include everything required for achieving high marks (Figure 9).

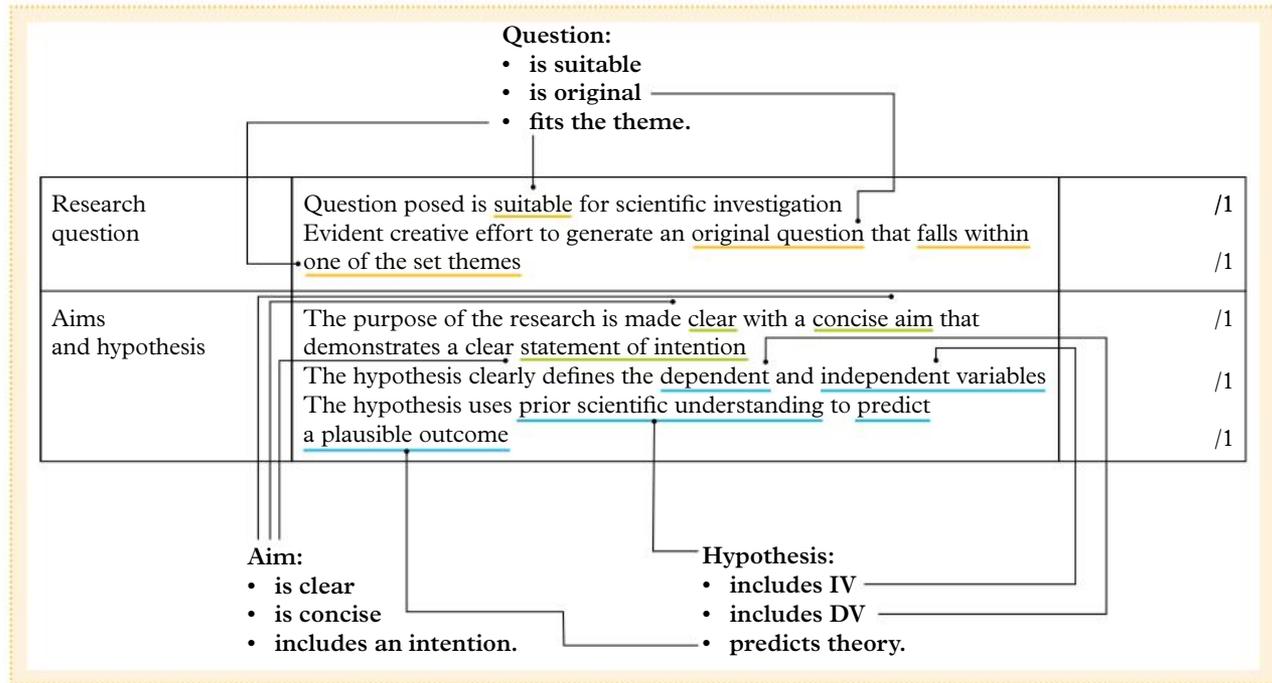


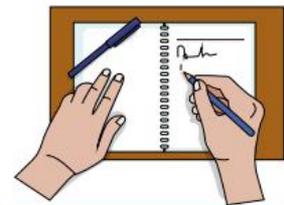
FIGURE 9 An example of labelling assessment criteria to create a checklist for the investigation

Whatever the assessment criteria you are given, remember to check through it at the start of your investigation to help you determine what you must do and include. You should also go through the criteria again at the end and double check that you have included everything.

## Planning your investigation

After you have selected your topic, the next phase involves planning your scientific investigation. This will include:

- defining the variables
- writing a hypothesis
- designing a method (including participants, materials and procedure).



Planning your investigation

FIGURE 10 The second stage of your scientific investigation is planning your investigation.

## Defining the variables

Before you can write a hypothesis and method for your investigation, you must first define your variables. If you are conducting a controlled experiment the three types of variables to consider are:

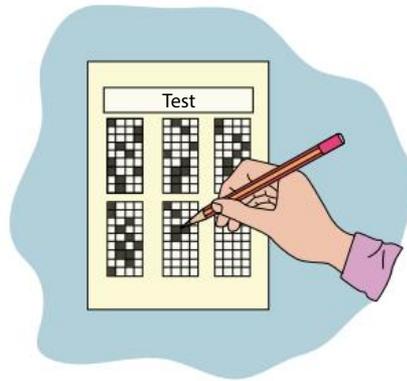
- independent variable (IV) – what you change or manipulate
- dependent variable (DV) – what you measure
- controlled variable(s) – what you “control” or keep constant to ensure that any change in the DV is due to the IV and not other factors.

### Research tip

To remember the IV and DV roles and how you would graph them you can use:  
**DRY** – Dependent (Responding) **y**-axis  
**MIX** – (Manipulated) Independent **x**-axis.



**Independent variable**  
What you change (e.g. hours of sleep participants have before test)



**Dependent variable**  
What you measure (e.g. test scores of participants)



**Control variables**  
What you keep constant (e.g. quiet test environment, participants of similar age and academic ability)

**FIGURE 11** Define your variables before writing your hypothesis.

## Writing a testable hypothesis

Topic 1.2 in your Psychology toolkit showed you how to write a hypothesis. Now it is time to put this skill into practice. To write a testable hypothesis, you can use an if/then/because statement to make sure you include all the required elements.

**TABLE 2** Summary of how to write a testable hypothesis

If	Then	Because
If the <b>independent variable</b> is <i>[changed]</i>	then the <b>dependent variable</b> will <i>[change]</i>	because of <b>scientific reasoning</b> .
E.g. increased, decreased	E.g. increase/decrease the amount/rate/height/weight/number	A possible explanation for the relationship between the IV and DV

A useful hypothesis is a testable statement that often includes a prediction. In some instances, a research question may not lend itself to having an accompanying hypothesis. In such cases you should work directly with your research question. If this applies to your research question, check in with your teacher before moving on, as some criteria might have marks allocated for a testable hypothesis and you may need to change your experiment.

### 11.1 WORKED EXAMPLE

#### Writing a testable hypothesis for a research question

Write a testable hypothesis for the following research question: “Do adolescents conform more than adults in response to unanimity?”

Think	Do
Step 1: Define your variables.	IV: Age DV: Rate of conformity in response to unanimity Controlled variables: Number of participants in each group, script used to instruct participants, number of lollies in jar
Step 2: Write your hypothesis.	Hypothesis: <b>If</b> adolescents and adults are exposed to unanimity, <b>then</b> the rate of conformity will be higher in adolescents than adults <b>because</b> adolescents are more susceptible to social influence.

## Choosing a methodology

There are many ways you can approach your scientific question. How you choose to approach your investigation is called your methodology. Different scientific methodologies include:

- controlled experiments
- fieldwork
- modelling
- simulations
- classification and identification
- correlational study.

Information on each of these methodologies is provided in Topic 1.3 in your Psychology toolkit. The flow chart shown in Figure 12 can help you select the methodology best suited for your scientific investigation:

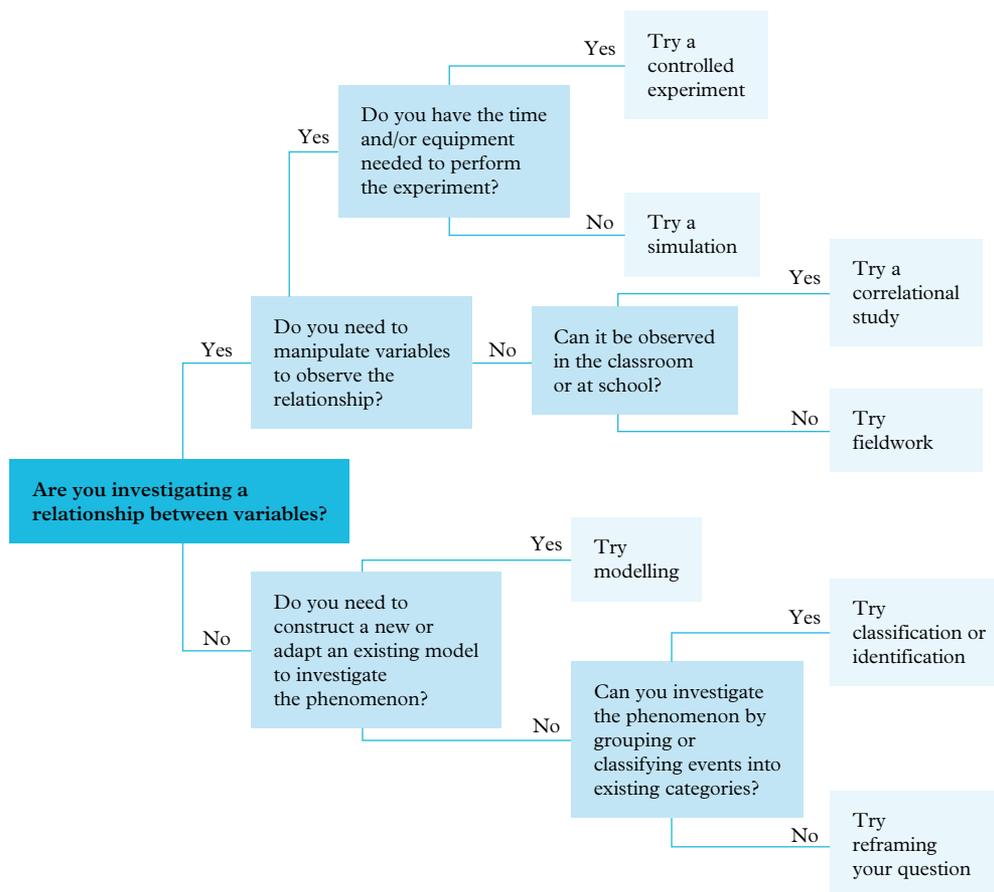


FIGURE 12 Flow chart to assist with scientific methodology selection

## Generating primary data

For this investigation you will need to generate your own primary data. There are two types of primary data that you can collect:

- **Quantitative data** – numbers, things that are counted or measured and given a numerical value (for example, scores on a test, number of times a behaviour occurs). This sort of data can be collected using surveys, scored tests, observations and interviews.

- **Qualitative data** – descriptive rather than numerical, using observations, it is more categorical (for example, case studies, smell, taste). This sort of data can be collected using focus groups, observations, case studies and interviews.

## Writing your method

The method of your investigation is intended to allow other people to understand your methodology and replicate the study. The method is split into three sections:

- 1 **participants** – the details of any relevant characteristics of the participants in your sample (for example, age, sex, education level)
- 2 **materials** – a detailed description or list of all equipment and settings needed to conduct your investigation
- 3 **procedure** – a detailed description of the testing procedures, from the selection of participants to how you will conduct the study. The descriptions should be specific enough that another researcher could accurately replicate your study.

Key things to remember when writing your method:

- ensure the steps are in the correct order
- number each of your steps
- ensure your controlled and independent variables are appropriately manipulated (the independent variable is the thing you change, so that change should be in the method correctly; the controlled variables are the things you need to control during the experiment; providing detail about this is important for replication)
- include appropriate measurements and concentrations with accurate use of units.

## Preparing to conduct your investigation

This section details how you can prepare to conduct your scientific investigation. This process includes conducting a risk assessment and considering the ethics of your investigation.

### Conducting a risk assessment

When conducting an experiment, there are many health and safety measures that need to be taken to protect yourself and those around you. Before you conduct an experiment, you must consider any risks involved. **Risk assessments** help you identify any potential risks associated with your investigation procedure, equipment and health and safety. These risks could include:

- health and safety risks – anything that could cause physical or psychological harm or injury to participants or the experimenter (for example, location hazards, equipment, testing set-up, chemicals, stressful activities, physical exhaustion)
- social risks – anything that could affect participants' social relationships (for example, their friendships, family, work life)
- safeguarding risks – any risks that could result in the abuse or exploitation of young or vulnerable people.

#### **risk assessment**

a system or document that evaluates any potential risks involved with a particular activity



Preparing to conduct your investigation

**FIGURE 13** The third stage of your scientific investigation is preparing to conduct your investigation.

As part of VCE Psychology you need to submit risk assessments for any experimental procedures you design yourself. Risk assessments can be written in a variety of formats and some schools may use external programs to generate them. An example risk assessment with annotations is available in your obook pro. A blank risk assessment template is also provided.



**FIGURE 14** If your investigation involved testing physical activity, you would need to consider risks such as potential physical exhaustion of participants.

## Ethical considerations

For your scientific investigation, you will need to generate primary data. When writing and planning your investigation you will need to consider any potential ethical issues.

This includes considering the impact of your research on:

- participants
- the greater community
- living organisms and non-living things.

For example, it is important that participants have their rights explained to them before starting. If you were investigating conformity, you might have to use deception to prevent participant knowledge confounding results. In this case you would need to debrief participants following the procedure, or the study would invalidate participant rights. The details of ethical concepts and considerations you need to account for in your research are described in Topic 1.4 in your Psychology toolkit.

## TO-DO LIST

### Topic selection

- Write a scientific question that you would like to investigate.
- Make sure your question is posed as a question and is not a statement.
- Select an experiment to adapt or design for your investigation.
- Define the key psychological theories and terms that are relevant to your investigation topic.
- Analyse the criteria you will be marked on for this assessment.

### Planning your investigation

- Choose a methodology for your investigation and justify why you have chosen this as the best way to answer your scientific question.
- Identify the independent and dependent variables that you will be investigating.
- Identify which variables you will control for your investigation.
- Write a testable hypothesis for your investigation.
- Write a succinct and detailed method for your investigation. (Remember to include enough detail so someone else could conduct your investigation – repeatability and reproducibility.)

### Preparing to conduct your investigation

- Conduct a risk assessment for your investigation.
- Evaluate the ethics of your investigation.

**FIGURE 15** When planning your investigation you need to consider ethical concepts.



## 11.2

# Scientific evidence



## KEY IDEAS

In this topic, you will:

- + create a data table to collect and record your data
- + be prepared to conduct your experiment
- + display your results
- + evaluate your results
- + identify and discuss any errors
- + write a discussion about your investigation.

In your investigation you will need to understand how to use scientific evidence to support or assess your findings. This includes being able to collect and produce valid data when conducting your investigation and evaluating your data as well as data from secondary sources.

## Conducting your investigation

When conducting your experiment, you should remember the following:

- be safe at all times
- consider the safety of those around you
- follow your method, or make annotations in your logbook when you change anything
- record all results at the time of taking them
- record any errors or things that seem out of place
- record observations and comparisons between tests
- check before disposing of experiment equipment, chemicals and materials.

If you have any questions or concerns, always talk to your teacher.



Conducting your investigation

**FIGURE 1** The fourth stage of your scientific investigation is conducting your investigation.

## Recording results, data and observations

Establishing data-recording habits will help greatly when it comes to writing your discussion and evaluating your errors. Data collection does not just include recording numbers and data, but also recording your observations. Figure 2 shows an annotated data table for recording the results of Group 1 in the investigation “Do adolescents conform more than adults in response to unanimity?”

Rate of conformity results: Group 1 (Adolescents)				
Participant	Original estimate (prior to group discussion)	Estimate provided after group consensus (210 lollies)	Observations	Conformed
A	230	215	Moved closer to group estimate	Y
B	146	210	Moved closer to group estimate	Y
C	178	210	Moved closer to group estimate	Y
D	378	230	Moved closer to group estimate	Y
E	201	212	Moved closer to group estimate	Y
F	170	200	Moved closer to group estimate	Y
G	280	Did not change	N/A	N
H	232	215	Moved closer to group estimate	Y
I	250	210	Moved closer to group estimate	Y
J	140	206	Moved closer to group estimate	Y
K	287	Did not change	N/A	N
L	401	250	Moved closer to group estimate	Y
M	386	217	Moved closer to group estimate	Y
O	277	300	Moved answer further away from group estimate	N
P	192	208	Moved closer to group estimate	Y

Total no. participants (Group 1): 15  
 Number of participants that conformed: 12  
 Number of participants that did not conform: 3  
 Rate of conformity:  $12/15 \times 100 = 80\%$

Participants deidentified

Well-labelled headings

Table format makes estimates easy to compare

Observations used to determine whether participants conformed or did not conform

Calculation of rate of conformity included

**FIGURE 2** Annotated and completed table for recording results, data and observations when investigating how age affects the rate of conformity

A considerable amount of time can sit between when you first conduct the experiment and when you write it up. Good data, results and observation collection will be extremely helpful when you need to write, because it refreshes your memory of the details of the experiment. Results should be recorded into your logbook as these will need to be verified for authenticity by your teacher.

## Evaluating your investigation

### Research tip

When conducting an experiment, scientists constantly take notes and annotate changes made to the method. This ensures the method can be reproduced by others in the future.

This stage will look at evaluating your scientific investigation. This includes:

- displaying your data
- discussion
  - analysing your results
  - evaluating your errors
  - modifications to the method
  - writing a conclusion.



Evaluating your investigation

**FIGURE 3** The fifth stage of your scientific investigation is evaluating your investigation.

## Displaying your data

After conducting your experiment and recording your data and observations, you will need to select an appropriate way to display your data so that others can get a quick snapshot of your results. Your data presentation should also show any trends that may exist between your variables.

The way in which you choose to display your data is important; some graphs cannot be used for a particular purpose. The flow chart in Figure 4 summarises different methods of displaying data based on how you wish to use that information.

Remember, what you are trying to show the people reading or assessing your report is the relationship between variables, or the trend or pattern from your results.

### Research tip

Play around with different graph styles if you are having trouble deciding. There are graphing programs that will give you many types of graphs, and if in doubt, ask someone to tell you what your graph says to them.

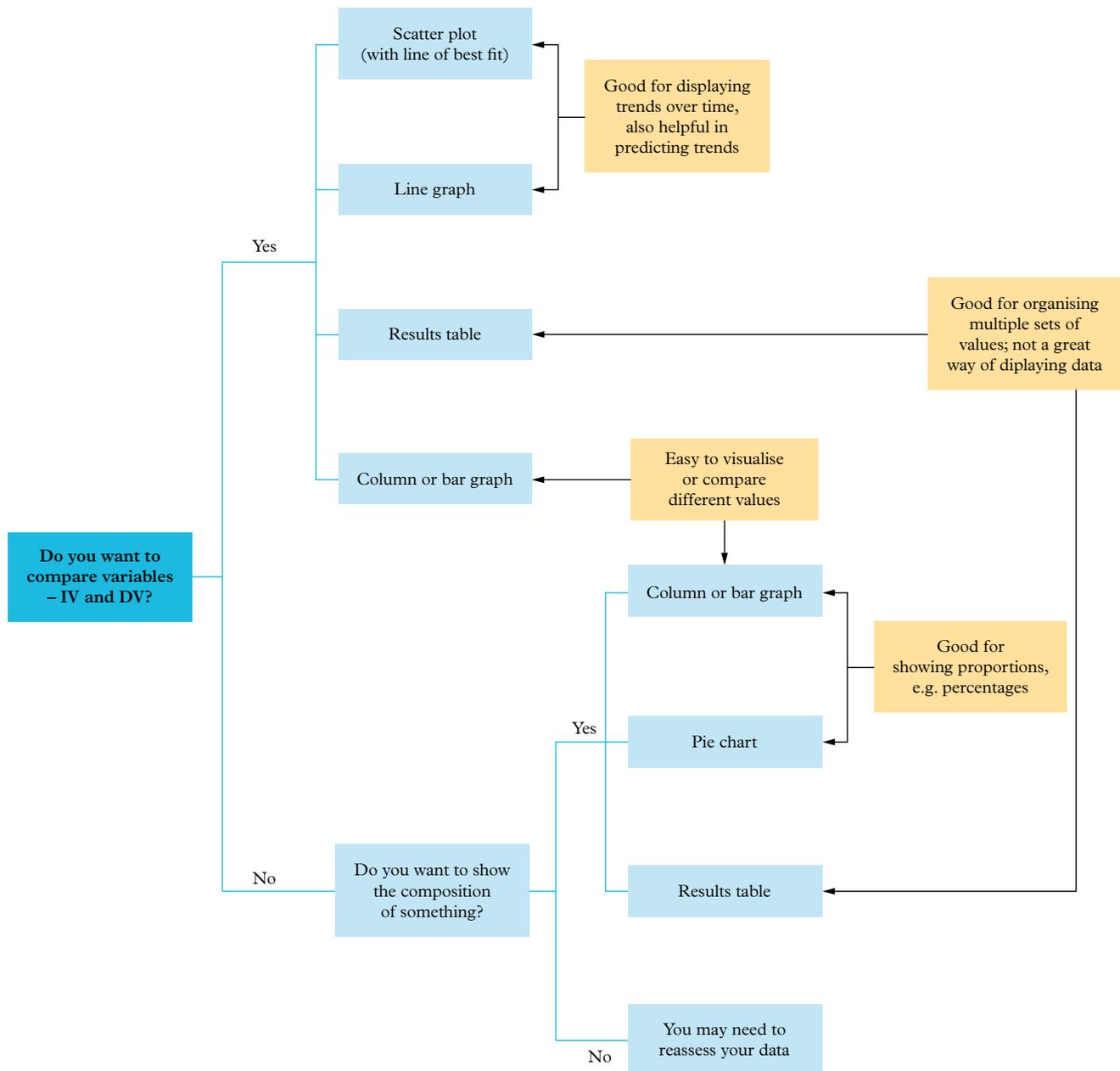


FIGURE 4 Flow chart to help you decide how to display your data

## 11.2 WORKED EXAMPLE

### Displaying data

The data in Table 1 was collected in an investigation exploring the research question: “Do adolescents conform more than adults in response to unanimity?”

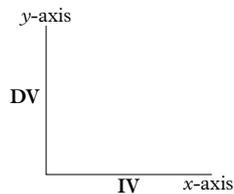
**TABLE 1** Results table from the investigation “Do adolescents conform more than adults in response to unanimity?”

Group	Number of participants who conformed	Number of participants who did not conform	Percentage of group who conformed
Adolescents	12	3	80%
Adults	7	8	47%

Select and display the results from the table on the most appropriate graph.

### Research tip

If you are drawing graphs that have an x- and y-axis, the IV is on the x-axis and the DV is on the y-axis.



**FIGURE 5** How to graph your IV and DV

Think	Do
<p>Step 1: Use the data display flow chart (Figure 4) to determine which graph type best suits the data.</p> <p>Step 2: Format your data into a table or pie chart using a program (such as Microsoft Excel). An example of the data for Group 1 represented as a pie chart is shown.</p>	<p>The data has multiple sets (percentage of group who conformed for Group 1 and Group 2), so we can either use a results table or construct two pie charts to show composition for each group.</p> <div style="text-align: center;"> <p>Percentage of participants that conformed in the adolescent group</p> <p>20% did not conform</p> <p>80% conformed</p> </div>

## Writing a discussion

The information you need to provide in your discussion will depend on what the assessment criteria for your investigation has said to include.

For the most part, it will include:

- analysis of your results
- evaluation of errors and limitations
- modifications of the method.



**FIGURE 6** Remember to include your observations, data and analysis of results in your logbook.

## Analysis of your results

Once you have displayed your data to show your results and trends, it is time to analyse and evaluate your results. To do this there are two questions you need to ask and answer:

- What trend(s) can you see from the data?
- How does the trend relate to psychological theories or concepts?

One approach to addressing these questions is to simply answer them. Another approach if you need more guidance is to use Table 2. The information in Table 2 can help you understand how to unpack each question and format your responses so they can be included in your discussion.

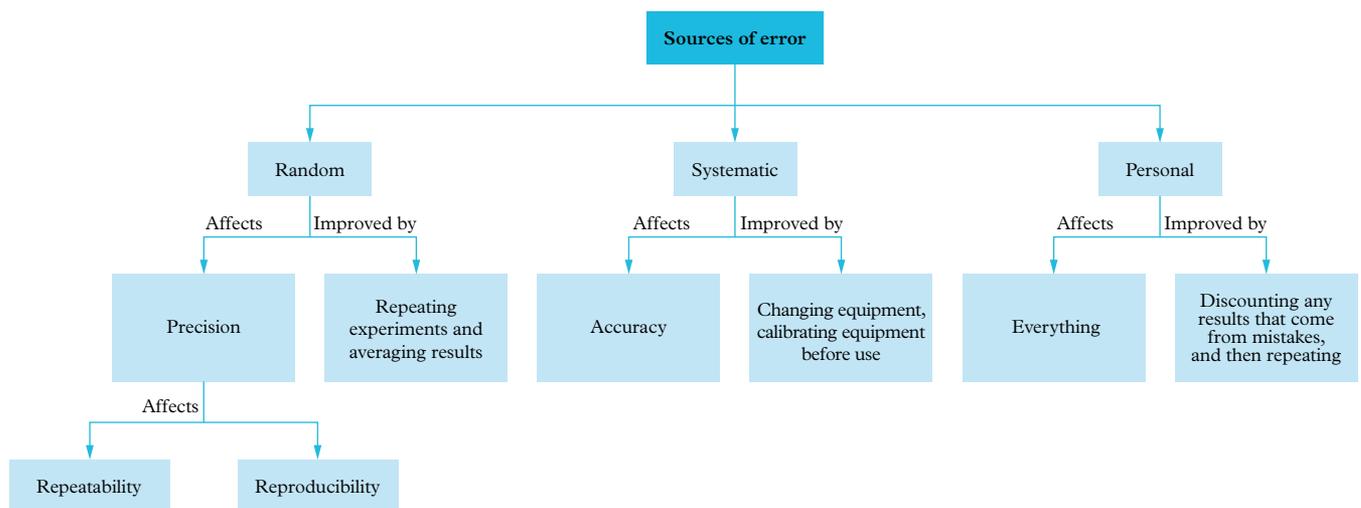
You will need to use research and your understanding to link and support your findings from your experiment. You may use information you have already gathered from the topic selection phase, or conduct more research to inform and support your data and trends. You may also need to gather more information if you find that your data or trend is not supported by the theory, or if your hypothesis is not supported.

**TABLE 2** Analysing results for discussion flow chart

Analysis of results		
<b>Step 1:</b> Identify key findings	<b>Observation 1:</b>  <b>Result 1:</b>	<b>Observation 2:</b>  <b>Result 2:</b>
<b>Step 2:</b> Matches/supports key findings using theory	<b>Theory that explains result 1:</b>	<b>Theory that explains result 2:</b>
<b>Step 3:</b> Uses theory to link/bring together key findings	What does each of the above support in the wider context of the theory? Also identify any outliers and explain why they can be excluded from the analysis.	

## Evaluating errors

Topic 1.7 in your Psychology toolkit explains types of errors, accuracy, precision and repeatability and reproducibility. It is important that you evaluate errors in your discussion. Figure 7 shows how different errors can affect results in an investigation.



**FIGURE 7** Errors, their impacts and how they can be improved during an experiment

## Evaluating limitations

In your discussion you need to consider the limitations in your experiment. Check your assessment criteria to confirm whether this consideration will be assessed in your conclusion or in your discussion. Limitations are things that affect the overall research and conclusion that you are making. For example, if you were testing the conformity of adolescents and adults in response to unanimity and you only selected participants from the school community, then you cannot conclude that your study is externally valid.

**TABLE 3** Evaluating limitations using the discussion flow chart

Evaluating limitations	
<b>Step 1:</b> Identify limitation	<b>Limitation:</b> Small sample size
<b>Step 2:</b> Explain limitation	<b>How did it come about/get introduced?</b> Investigation was confined by selecting participants only from the school community. Could not find more than 15 adults and 15 adolescents within the school.
Discuss effect of error on quality of experiment/data	<b>How did it affect the result?</b> Reduces the power of the study and increases margin for error. May prevent data from being externally valid.
<b>Step 3:</b> Propose ways to reduce or remove the limitations	<b>How could you prevent this from happening again?</b> Increase the sample size by sourcing participants from the broader community (sporting teams, work, family).

## Modifying the method

Errors that occur during your investigation and limitations in your methods can affect the repeatability and reproducibility of your experiment. They are often related to your controlled variables or extraneous variables that you have failed to control. This means that you need to consider these variables both during your experiment and when you are evaluating your errors. Modifying the method can resolve errors or limitations related to the variables. Table 4 can help you determine appropriate modifications you can make to your method and incorporate these ideas into your discussion.

**TABLE 4** Incorporating modifications to the method in your discussion

Modifying the method	
<b>Step 1: Propose modification</b> For example, something that will improve the repeatability, reproducibility or validity of the experiment	<b>What needs to be controlled?</b> Friendships between group participants
	<b>Propose modification/change to a specific step</b> Screen potential participants to ensure that members within the group do not have any pre-existing social/personal relationships.
<b>Step 2: Explain how modification will improve design</b> Note: Be specific about increase/decrease and the effect on repeatability/reproducibility of the experiment and validity of results.	<b>How will this make the investigation results better?</b> Reasons for conforming become more reliable as they are no longer affected by potential existing relationships.
<b>Step 3: Predict effects of modification on quality of data</b> For example, increased accuracy/validity, with example of how	<b>What will you get for these “improved” data/results?</b> Internal validity of results will be improved with the removal of an extraneous variable (friendship between participants).

## Conclusion

A conclusion is the end to your report, a wrap-up of everything you did. You should check the assessment criteria for your investigation to write your conclusion, but they often involve answering the following questions:

- What were your key findings?
- Was your hypothesis supported or refuted?
- To what extent has your analysis answered the research question?

### Addressing your hypothesis

It is important to link all aspects of your report to the key idea – the question or hypothesis throughout the investigation. In your conclusion, the first thing you should do is summarise the key findings, then link them straight to the hypothesis and explain whether results supported your hypothesis or refuted it.

#### TO-DO LIST

##### Conducting your investigation

- Set up a logbook so that you can record all results and observations as you conduct the investigation.
- Check in with your teacher to make sure you are ready to begin generating data.

##### Evaluating your investigation

- Find the best way to display your data in order to best represent your results.
- Analyse your results.
  - Identify key findings.
  - Match/support key findings using theory.
  - Link key findings and theory.
- Evaluate your errors.
  - Identify errors.
  - Explain the reason(s) for errors.
  - Discuss the effect of error(s) on quality of data.
  - Propose way(s) to remove or reduce the errors.
- Modifying the method.
  - Propose modifications to the method.
  - Explain how modification(s) will improve experiment.
  - Predict effect of modification(s) on quality of data.
- Identify whether your hypothesis was supported.
- Identify the limitations of your investigation design.
- Propose recommendations to overcome limitations.

# 11.3

## Scientific communication

### KEY IDEAS

In this topic, you will:

- + select a format for presentation of your investigation
- + create a reference list and acknowledgments.



## Communicating your findings

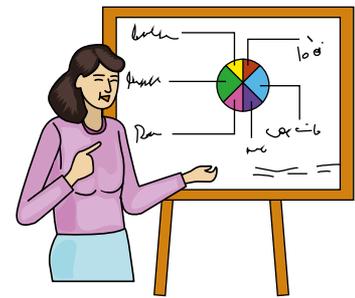
This topic will look at the reporting phase of your scientific investigation, which includes:

- communicating your findings
- using scientific terminology
- referencing
- acknowledgments.

### Selecting a form to communicate

There are many different formats you can use to present your investigation, including:

- an oral presentation
- a report
- an infographic
- a video or animation
- a multimodal presentation
- a scientific poster.



Communicating

**FIGURE 1** The sixth stage of your scientific investigation is communicating your findings.



**FIGURE 2** Scientific posters on display at a scientific conference

When you get to Unit 4 Area of Study 3, you are only allowed to report your findings as a scientific poster in the format that the study design specifies, so you may wish to select this format for Unit 2 Area of Study 3 to practise presenting in this way. The poster format outlined in the VCE Psychology Study Design is shown in Figure 3; this image includes VCAA’s requirements for what should be under each heading. The poster may be produced electronically or in hard-copy format and must not exceed 600 words. The 600-word limit does not include supporting text, such as:

- tables
- graphs
- flowcharts
- image captions
- references
- acknowledgments.

Title Student name		
<p><b>Introduction</b></p> <ul style="list-style-type: none"> <li>Brief explanation or reason for undertaking the investigation, including a clear aim, a hypothesis and/or prediction and relevant background psychological concepts</li> </ul> <p><b>Methodology and methods</b></p> <ul style="list-style-type: none"> <li>Brief outline of the selected methodology used to address the investigation question</li> <li>Summary of data generation method(s) and data analysis method(s)</li> </ul> <p><b>Results</b></p> <ul style="list-style-type: none"> <li>Presentation of generated data/evidence in appropriate format to illustrate trends, patterns and/or relationships</li> </ul>	<p><b>Communication statement reporting the key finding of the investigation as a one-sentence summary</b></p>	<p><b>Discussion</b></p> <ul style="list-style-type: none"> <li>Interpretation and evaluation of analysed primary data</li> <li>Identification of limitations in data and methods, and suggested improvements</li> <li>Cross-referencing of results to relevant psychological concepts and previous research</li> <li>Linking of results to investigation question and the aim, to explain whether the investigation data and findings support the hypothesis</li> <li>Implications of the investigation and/or suggestions as to further investigations that may be undertaken</li> </ul> <p><b>Conclusion</b></p> <ul style="list-style-type: none"> <li>Conclusion that provides a response to the investigation question</li> <li>Identification of the extent to which the analysis has answered the investigation question, with no new information being introduced</li> </ul>
<p><b>References and acknowledgements</b></p> <ul style="list-style-type: none"> <li>Referencing and acknowledgement of all quotations and sourced content relevant to the investigation</li> </ul>		

Source: *VCE Psychology Study Design (2023–2027)* reproduced by permission © VCAA

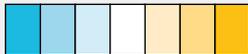
**FIGURE 3** The VCAA scientific poster format

You need to summarise everything that you have done throughout your investigation within the 600-word limit. This means it is important to be careful with how many words you designate to each section.

The following tips can help you generate your scientific poster or report:

- **Choose your content wisely.** Do not include fluff or things that do not relate to your question; find one or two key points and stick with those throughout the poster.
- **Do not waste the word count where there are only a small number of marks allocated.** Use the assessment criteria to help with this – if there is only one mark for something, do not waste 200 words trying to explain it.

- **Edit and proofread your work.** Edit your poster to make sure there is nothing irrelevant included. Proofread it to make sure there are no spelling or grammatical errors. After editing and proofreading once, do it again! Having a friend proofread it for you is also valuable.
- **Make your poster visually appealing.** Figure 4 shows the dos and don'ts of formatting your poster.

Do	Don't
<ul style="list-style-type: none"> <li>• Do use one colour scheme throughout your poster, e.g.</li> </ul>  <ul style="list-style-type: none"> <li>• Do replace or break up large sections of text with figures, e.g.</li> </ul>  <ul style="list-style-type: none"> <li>• Do leave some blank space so that your poster is not too text-heavy.</li> </ul>	<ul style="list-style-type: none"> <li>• Don't use more than two font types, because "MULTIPLE FONTS can <b>make your</b> poster <i>look messy</i>."</li> <li>• Don't use clashing or garish colours, e.g.</li> </ul>  <ul style="list-style-type: none"> <li>• Don't use all capital letters, e.g. "THE HYPOTHESIS WAS REFUTED"</li> </ul>

**FIGURE 4** A summary of what to do and what not to do to make your poster visually appealing

## The communication statement

The centre of the poster will occupy between 20 and 25 per cent of the poster space and will be a one-sentence summary of the major finding of the investigation that answers the investigation question. Because the communication statement is such a large area of your poster, when writing your statement you should:

- keep it succinct, one sentence only
- avoid using large confusing words
- avoid phrasing it as a question
- make sure it relates to the question.

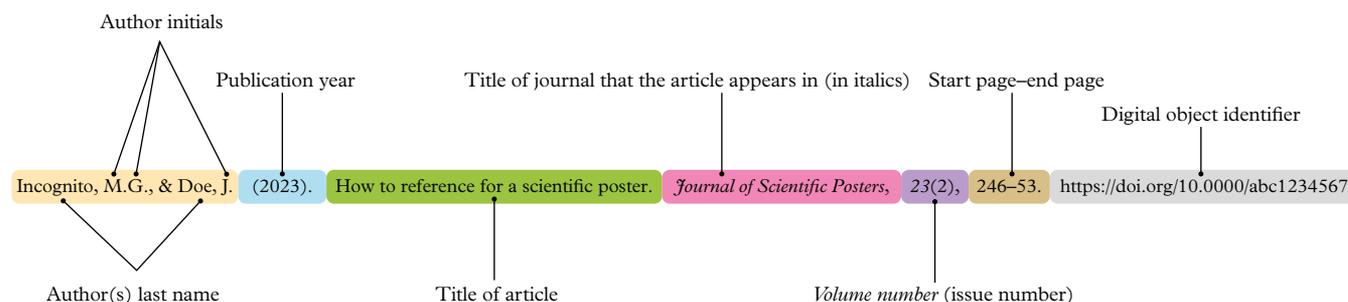
For example, a communication statement based on the sample investigation relating to the relationship between age and rate of conformity is: "Teenagers conform more than adults in response to unanimity."

## Using scientific terminology

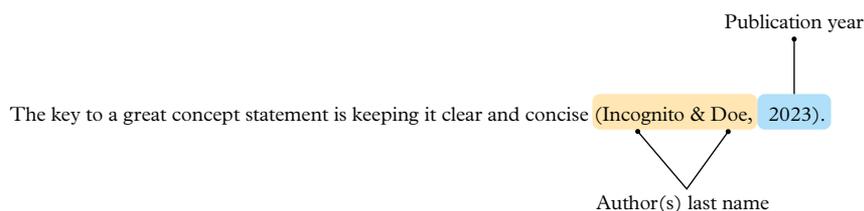
Every scientific discipline will use different terminology and present their ideas in slightly different ways. In psychology, you need to convey your ideas using the correct scientific terminology and align them with the way psychological ideas are represented. Make sure you are using correct terms and definitions. Personal language is not used when presenting scientific research. So do not include words such as I, we or us. Aim to write your poster in third-person past tense.

## Referencing

There are many styles of scientific referencing that can be used. You should refer to your assessment criteria to see whether a particular type is required. A common referencing style is APA (American Psychological Association) – see Figures 5 and 6 for an example. If you present your investigation as a poster, your reference list will appear in the bottom section.



**FIGURE 5** Example of how to include a journal article in your reference list using APA referencing



**FIGURE 6** Example of how to reference a journal article in the body text of your report

## Acknowledgments

Your acknowledgments section is where you, the author of the report, will acknowledge and list the people who contributed or supported your research investigation. People who directly contributed, such as your group members, should appear at the top of the poster as group members and not in the acknowledgments.

People you may wish to acknowledge include:

- the lab assistant who prepared all your equipment and materials
- your teacher for contributing ideas
- class members who helped with ideas
- people who helped proofread your poster.

### TO-DO LIST

- Select an appropriate communication format.
- Format your list of references.
- Include an acknowledgment for everyone who helped you – do not forget your teacher!

### Chapter summary

11.1

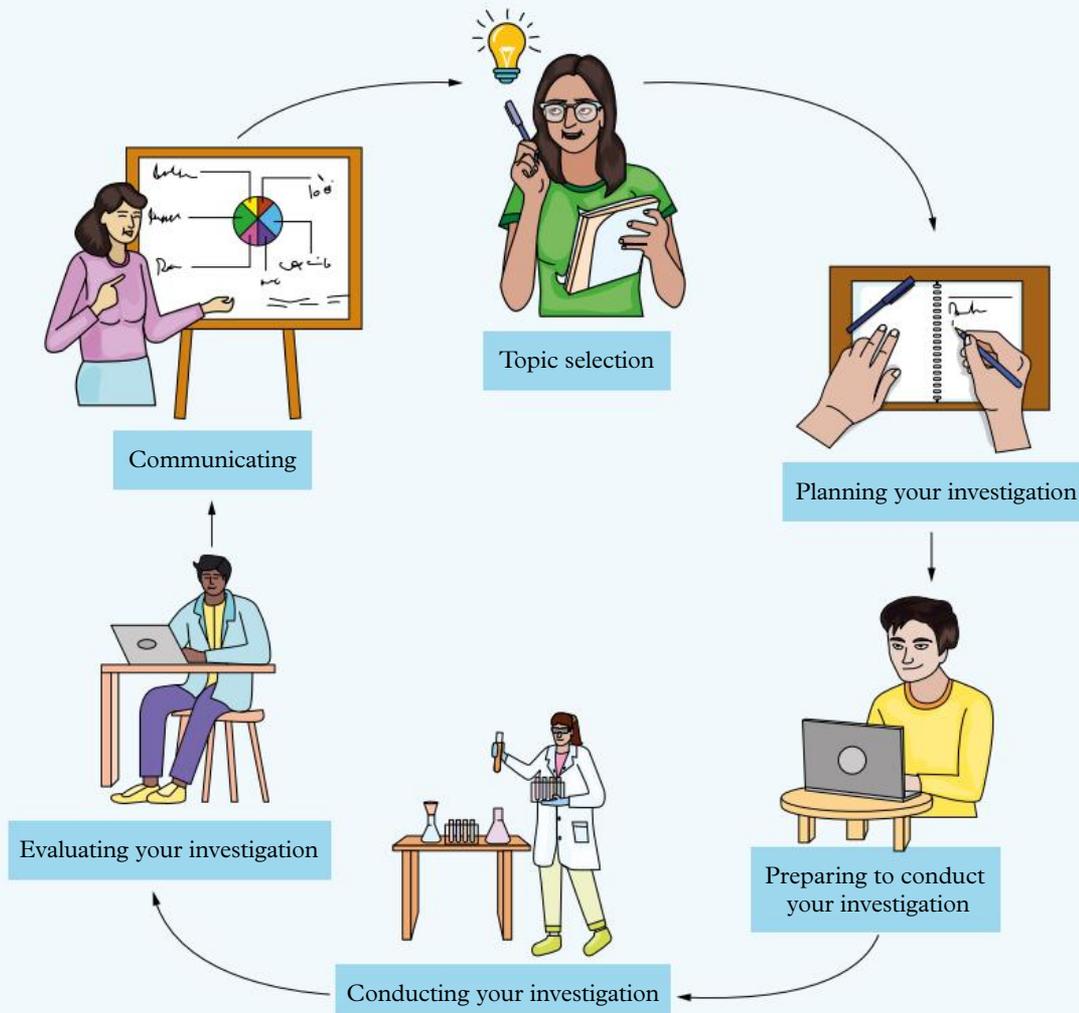
- As part of Unit 2 Area of Study 3, you will conduct a research investigation related to psychological concepts explored in Unit 2.
- For your research investigation you will need to collect and analyse primary data; that is, data that has been generated from your own experimentation.
- To answer your investigation question, you can break down the question into smaller parts and generate expanding questions to guide your research.
- Planning your investigation using a research outline is helpful to keep you on track.

11.2

- Annotating your results with detailed notes when collecting data for your investigation can make the research investigation process easier.

11.3

- Information can be organised in different ways to communicate your findings.
- You must acknowledge your sources by referencing them in-text and in a reference list or bibliography.



## Research investigation checklist

Use the following checklist to make sure you have completed the research investigation.

“I have ...”

- Written or decided on a scientific question to investigate.
- Defined the key scientific theories and terms that are relevant to my investigation topic.
- Analysed the criteria I will be marked on for this assessment.
- Chosen a methodology for my investigation that will best answer my research question.
- Identified the independent and dependent variables that I will be investigating and identified the variables that I will control for my investigation.
- Written a testable hypothesis.
- Written a succinct and detailed method for my investigation.
- Conducted a risk assessment.
- Evaluated the ethics of my investigation.
- Set up a logbook to record all results and observations as I conduct my investigation.
- Determined the best way to display my data to best represent my results.
- Analysed my results by identifying key findings and linking key findings to theory.
- Evaluated my errors.
- Modified the method where needed.
- Identified whether my hypothesis was supported.
- Identified the limitations of my investigation design and proposed recommendations to overcome limitations.
- Used an appropriate presentation format to communicate my findings.
- Formatted my list of references.
- Included acknowledgments.

## AREA OF STUDY 3

UNIT

# 2

# Sample poster

## Are adolescents more likely to conform in

Student

1 Relevant background psychological concepts outlined and defined in logical manner.

2 Clear aim that incorporates IV and DV.

3 Hypothesis accurately defines IV and DV and predicts a directional outcome.

4 Method includes all necessary information (participants, materials and procedure).

### Introduction

- Conformity is defined as “the act of changing one’s behaviour to match the responses of others in a group” (Jessulat et al., 2024). Three factors shown to influence conformity include normative influence (the desire to gain the approval or acceptance of others), informational influence (the desire to respond appropriately) (Campbell & Fairly, 1989), and unanimity (the degree to which the majority are in consensus) (Levitan & Verhulst, 2016). Studies have shown that as age increases, rate of conformity decreases (Costanzo & Shaw, 1966) (Pasupathi, 1999). Explanations of this include that during adolescence the desire to belong or feel accepted by peers is greater than in adulthood, causing higher rates of conformity in young people in response to normative influence and unanimity (Allen & Newton, 1972). Self-belief also tends to increase over adulthood, which may reduce the impact of informational influence (Pasupathi, 1999).
- The investigation aims to investigate whether the rate of conformity differs between adolescents and adults in response to unanimity. The independent variable is age, and the dependent variable is percentage of the group that conforms.
- It is hypothesised that percentage of conformity in response to unanimity will be higher among adolescents than adults.

### Method

#### Participants

Fifteen Year 9 students between the ages of 15 and 16, and 15 teachers between the ages of 31 and 62 were selected from OUP Secondary College.

#### Materials

- a jar of assorted sweets (containing 272 sweets)
- pen
- table to record results
- debriefing sheet with follow-up questions

#### Procedure

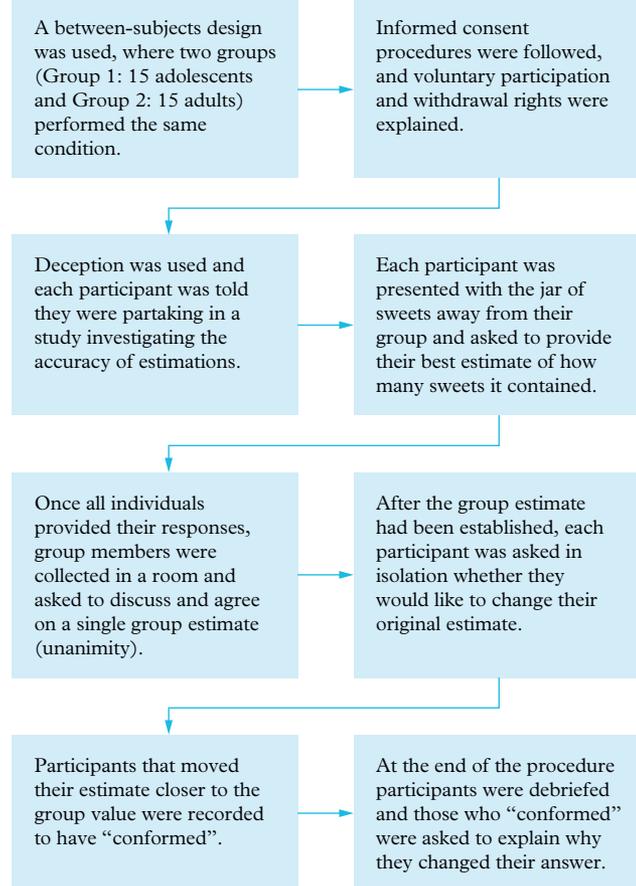


FIGURE 1 Outline of the experimental design used

### References

Allen, V. L., & Newton, D. (1972). Development of conformity and independence. *Journal of Personality and Social Psychology*, 22(1), 18. Campbell, J. D., & Fairly, P. J. (1989). Informational and normative routes to conformity: The effect of faction size as a function of norm extremity and attention to the stimulus. *Journal of Personality and Social Psychology*, 57(3), 457–468. Costanzo, P. R., & Shaw, M. E. (1966). Conformity as a function of age level. *Child development*, 967–975. Jessulat, P., Hong, L., Allen, J., Blaher-Lucas, E., Rock, M., Morey, K. & Edwards, R. (2024). *Psychology for*

Adolescents more conform in response

# response to unanimity than adults?

name

are likely to conform more than adults to unanimity.

## Results

**5** TABLE 1 Percentage of participants that conformed in each group.

Group	Number of participants that conformed	Number of participants that did not conform	Percentage of group that conformed
Adolescents	12	3	80%
Adults	7	8	47%

TABLE 2 Reasons why participants conformed in each group

	Reasons for conforming	
	Wanted their estimate to fit in with the group estimate. (normative influence)	Believed that other members of the group were able to provide a better estimate than their own. (informational influence)
Adolescents	75%	25%
Adults	28%	72%

**6** The percentage of participants that conformed was higher in the adolescent group (80 per cent) than in the adult group (47 per cent), with variance in the reasons why participants conformed between the two groups.

- Seventy-five per cent of adolescent participants who conformed did so due to normative influence, compared to 28 per cent of adult participants.
- Twenty-five per cent of adolescent participants who conformed did so due to informational influence compared to 72 per cent of adult participants.

## Discussion

**7** Results showed the percentage of participants that conformed was higher in the adolescent group (80 per cent) compared to the adult group (47 per cent). **8** This supports the hypothesis that the rate of conformity in response to unanimity will be higher among adolescents than adults. **9** This is consistent with Pasupathi's (1999) research that showed higher rates of conformity in teenagers compared to adults. Research suggests this could be due to adolescents generally having less self-assurance (Moutoussis, Dolan, & Dayan, 2016) and more concern about what others think of them compared to adults (Chierchia, Pi-Sunyer, & Blakemore, 2020). This is also consistent with the responses provided by participants who conformed, where most adolescents conformed due to normative influence over informational influence. In contrast, adults who conformed mostly did so due to informational influence, suggesting that adults were not as influenced by wanting to belong but rather by wanting to respond correctly.

**10** A potential extraneous variable is existing friendships between group participants. Existing friendships between group members could have influenced their likelihood of conforming following discussions. This could be controlled for using random sampling rather than convenience sampling. A limitation is that the effect of group size was not considered. The investigation could have included three sizes of groups (for example, 5, 15, 30) for each condition.

## Conclusion

**11** In response to unanimity, adolescent participants conformed more than adult participants. Therefore, the hypothesis was supported. However, the group size, small sample size and potential relationships between participants may have rendered results internally and externally invalid. **12** Despite this, the findings provide valuable insight on how age can influence conformity and the reasons that different age groups conform. This information could benefit adolescents and adults by improving their autonomous decision-making in group settings.

**5** Presentation of collected data/evidence is appropriately formatted (as either a table or graph) to illustrate patterns, trends or relationships.

**6** Results are clear and accurate.

**7** Analysis of primary data is accurate.

**8** Statement of whether hypothesis was supported or refuted.

**9** Results are effectively linked with relevant psychological concepts.

**10** Any outliers, extraneous variables or limitations in data and/or method are discussed and suggested improvements are provided.

**11** Conclusion reflects an appropriate response to the question and shows evidence of correct interpretation of data and hypothesis.

**12** Suggested possible implications/applications of the findings.

VCE Units 1&2. Oxford University Press. Levitan, L. C., & Verhulst, B. (2016). Conformity in groups: The effects of others' views on expressed attitudes and attitude change. *Political Behavior*, 38(2), 277–315. Moutoussis, M., Dolan, R. J., & Dayan, P. (2016). How people use social information to find out what to want in the paradigmatic case of inter-temporal preferences. *PLoS computational biology*, 12(7), e1004965. Pasupathi, M. (1999). Age differences in response to conformity pressure for emotional and nonemotional material. *Psychology and aging*, 14(1), 170.

UNIT

# 2

# Review

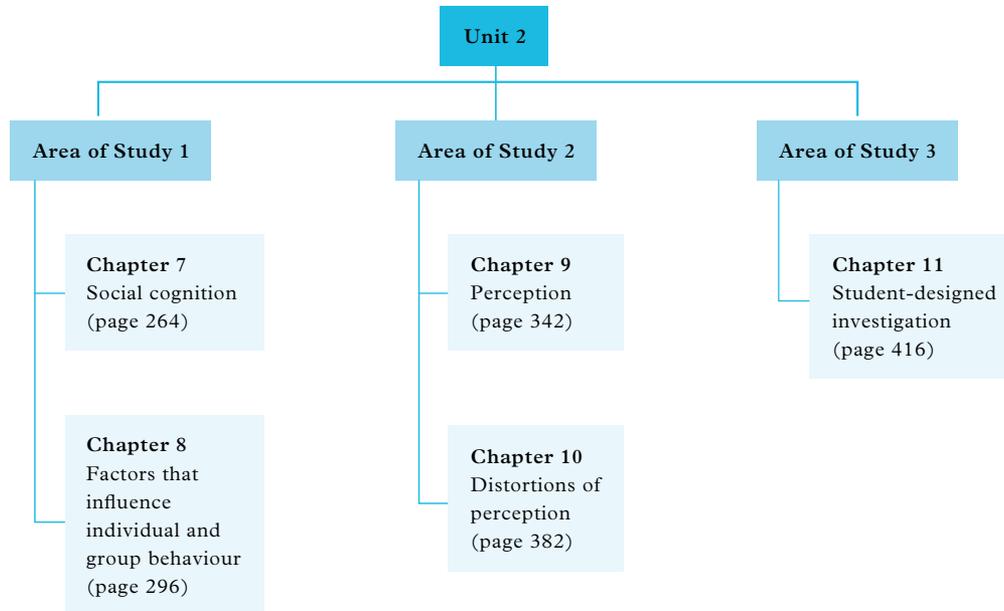
This unit review is designed to help you revise your understanding of key concepts for all the content covered in Unit 2, learn some expert tips for answering exam questions, and practise your skills on a range of exam-style questions.

## Part A - Revisit and revise

Part A of the Unit review will help you revisit and revise all key concepts from Unit 2 and test your understanding so that you can identify strengths and weaknesses in your understanding.

## Unit 2 Overview

The chart below shows all the Areas of Study for Unit 2 and the relevant chapters in your Student Book. Go to the pages shown to review the key concepts for each chapter.



## Test your understanding

Use Table 1 to guide your revision.

Step 1 – Read the key knowledge for this unit.

Step 2 – Test your understanding of the key knowledge by answering the question(s).

Step 3 – Rate your understanding of each key knowledge point from low to high.

Step 4 – Use the topic and page numbers to revise the concepts you have identified that you need to practise.

**TABLE 1** Test your understanding of Unit 2

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>the role of person perception, attributions, attitudes and stereotypes in interpreting, analysing, remembering and using information about the social world, including decision-making and interpersonal interactions</li> </ul>	1 Compare attitudes and attributions.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 7.1 Pages 266–273
<ul style="list-style-type: none"> <li>the avoidance of cognitive dissonance using cognitive biases</li> </ul>	2 Explain what anchoring bias is and provide your own example.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 7.2 Pages 274–278
<ul style="list-style-type: none"> <li>the positive and negative influences of heuristics as mechanisms for decision-making and problem-solving</li> </ul>	3 Using an example, explain how heuristics can benefit us in solving a problem.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 7.3 Pages 279–282
<ul style="list-style-type: none"> <li>the influence of prejudice, discrimination and stigma within society on a person’s and/or group’s mental wellbeing and ways to reduce it</li> </ul>	4 Distinguish between the terms prejudice and discrimination.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 7.4 Pages 283–291
<ul style="list-style-type: none"> <li>the influence of social groups and culture on individual behaviour</li> </ul>	5 Compare the terms status and power in relation to social groups.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 8.1 Pages 298–308
<ul style="list-style-type: none"> <li>the concepts of obedience and conformity and their relative influence on individual behaviour</li> </ul>	6 Describe two factors that influence: a conformity b obedience.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topics 8.2 and 8.3 Pages 309–315 and 316–321
<ul style="list-style-type: none"> <li>the positive and negative influences of different media sources on individual and group behaviour, such as changing nature of social connections, social comparison, addictive behaviours and information access</li> </ul>	7 Outline how social comparisons can lead to either positive or negative outcomes.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 8.4 Pages 322–327

(continued)

TABLE 1 continued

Key knowledge	Test yourself	Rate yourself	Target your revision
<ul style="list-style-type: none"> <li>the development of independence and anti-conformity to empower individual decision-making when in groups</li> </ul>	8 Distinguish between the terms independence and anticonformity.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 8.5 Pages 328–331
<ul style="list-style-type: none"> <li>the role of attention (sustained, divided, selective) in making sense of the world around us</li> </ul>	9 Provide two examples of controlled processes and two examples of automatic processes.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 9.1 Pages 344–348
<ul style="list-style-type: none"> <li>the role of perception in the processing and interpretation of sensory information, as demonstrated through top-down and bottom-up processing</li> </ul>	10 Provide an example of bottom-up processing.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 9.2 Pages 349–355
<ul style="list-style-type: none"> <li>the influence of biological, psychological and social factors on visual perception and gustatory perception</li> </ul>	11 Identify two psychological factors that influence: a visual perception b gustatory perception	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topics 9.3 and 9.4 Pages 356– 358 and 369–377
<ul style="list-style-type: none"> <li>the fallibility of visual perceptual systems, for example, visual illusions and agnosia</li> </ul>	12 Explain how a person with prosopagnosia has different perception from what is considered “normal” perception.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 10.1 Pages 384–390
<ul style="list-style-type: none"> <li>the fallibility of gustatory perception, for example, supertasters, exposure to miraculin and the judgment of flavours</li> </ul>	13 Describe how miraculin can alter a person’s perception of sour-tasting food.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 10.2 Pages 391–396
<ul style="list-style-type: none"> <li>distortions of perception of taste and vision in healthy individuals, such as synaesthesia and spatial neglect</li> </ul>	14 Identify which area of the brain is most likely to result in left-sided spatial neglect when injured.	<input type="checkbox"/> <b>High</b> – I’ve got this! <input type="checkbox"/> <b>Medium</b> – I could use a bit more practice. <input type="checkbox"/> <b>Low</b> – I have some work to do!	Topic 10.3 Pages 397–403

## Part B – Exam essentials

Now that you have completed Part A, it is time to learn and practise some of the skills you will 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 any end-of-unit examinations.

### Exam tip 1 - Use the mark allocation as a guide

- Every exam question is allocated a certain number of marks. You can use these marks to work out how much information you need to provide in your response.
- Do not just write down everything you know about a topic to answer a question; sometimes even a single word or few words is enough to answer a question. For example, a one-mark “State the name of ...” question would require you to write less information than a four-mark “Discuss the value of ...” question.
- A good rule of thumb to follow is one mark = one piece of information. Using the mark allocation as a guide can help you structure your responses and even save you time.

## See it in action

Read the exam question below and see how the tip has made a difference in the high-scoring and low-scoring responses.

### QUESTION 1

(2 marks)

Name the pictorial cue principle that describes how objects that are closer overlap objects that are further away and explain how this pictorial cue is used in Figure 1.



FIGURE 1 Which pictorial cue would you use to explain why closer objects overlap objects that are further away?

#### Response 1 (high-scoring)



One mark awarded for one piece of information; clearly and succinctly addresses first part of question.

Interposition/overlap. This pictorial cue is used in the image to show us that the blue ball is closer to us than the dog because the blue ball overlaps the dog.

One mark awarded for correct explanation of how interposition/overlap is used in image.

#### Response 2 (low-scoring)



One mark awarded for correct pictorial cue but excess detail was not required. Student could have saved time if they just stated the name of the pictorial cue.

The pictorial cue principle described is interposition/overlap. Interposition/overlap can help determine if objects are closer to us or further away. You can observe the pictorial cue of interposition in the photo of the dog on the lawn with the ball.

Student has written two lines of information but has not been awarded the second mark. This is because the student has not correctly explained how interposition/overlap is used in the photo.

## Think like an examiner

To maximise your marks on an exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

### Mark the response

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guide below to mark the response.

#### QUESTION 2

(6 marks)

Summarise the three main stages of perception.

- 1 Selection - picking the stimuli that are important to us and that we should pay attention to
- 2 Organisation - sorting stimuli
- 3 Interpretation.

### Marking guide

#### Question 2

1 mark – for each correctly identified stage of perception.

1 mark – for a succinct summary of each stage.

### Fix the response

Consider where you did and did not award marks in the above response. How could the response be improved? Write your own response to the question to receive full marks from an examiner.

### Exam tip 2 - Justify answers using evidence

- Sometimes a question will ask you to “justify your answer/response/decision”. Seeing the word **justify** is an indication that you need to provide evidence or reasoning that supports your response or claim.
- The source of evidence to justify your response could be information you have learnt about the topic, stimulus material, scientific studies, or data presented in the stem of the question.

## See it in action

Read the exam question below and see how the tip has made a difference in the high-scoring and low-scoring responses.

#### QUESTION 3

(4 marks)

- A teacher confiscates a student’s phone after catching the student using it during class time. Which two types of power is the teacher exercising in this scenario? Justify your response.

#### Response 1 (high-scoring)



Two marks given for correctly identifying each type of power exercised.

Two marks given for appropriate justification. Student has used evidence from their knowledge and tied this into the scenario to support their response.

One type of power the teacher is exercising is coercive power. Coercive power is the ability to give or threaten punishment. In this case the teacher is punishing the student by confiscating their phone. The second type of power exercised by the teacher is legitimate power. Legitimate power is the belief that an individual is authorised by a recognised power structure to command and make decisions. In this case the teacher is authorised by the school to make decisions regarding the students in their class.

## Response 2 (low-scoring)



*The teacher is exercising coercive power and legitimate power.*

Student has lost marks for not justifying their responses.

## Think like an examiner

To maximise your marks on the exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

### Mark the response

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guide below to mark the response.

### QUESTION 4

(2 marks)

Rafael has become obsessed with video games over the last two months. He experiences extreme sadness when he cannot play video games and is disengaged with the hobbies he previously enjoyed. Rafael has also been unable to reduce the amount of time playing games each time he has attempted to do so.

Based on the information given, make an assessment of whether Rafael has internet gaming disorder (IGD). Justify your assessment.

*Rafael meets the criteria needed for a positive diagnosis of IGD as he is showing preoccupation with video games, loss of interest in previous hobbies and/or entertainment (excluding video games) and unsuccessful attempts to control participation in video games.*

### Marking guide

Question 4	1 mark – for correct assessment of IGD
	1 mark – for justification of assessment based on the nine criteria and conditions outlined in DSM-5-TR regarding IGD diagnosis.

### Fix the response

Consider where you did and did not award marks in the above response. How could the response be improved?

Write your own response to the question to receive full marks from an examiner.

### Exam tip 3 - Link causes to effects

- Some exam questions might expect you to link the cause of a disorder, condition or symptom to the effects that occur. Identifying the cause and effect without providing a linking statement can result in missing out on marks.
- To ensure you link your cause and effect you can structure your answers using the following approach.

Cause: \_\_\_\_\_

Therefore: \_\_\_\_\_

Effect: \_\_\_\_\_

## See it in action

Read the exam question below and see how the tip has made a difference in the high-scoring and low-scoring responses.

### QUESTION 5

(3 marks)

- Explain how inheritance of the TAS2R38 gene could result in a person's gustatory perception varying from what most would consider normal.

#### Response 1 (high-scoring)



Identifies what the TAS2R38 gene does.

Cause: The TAS2R38 gene predisposes a person to having a greater number of tastebuds and higher sensitivity to bitter flavours.

If a person inherits this gene and develops a large number of tastebuds and high sensitivity to tasting flavours, they would be considered a "supertaster" and have a heightened ability to perceive particular flavours (such as bitterness). This could result in the supertaster's gustatory perception of bitter tasting foods differing from what most people would consider normal (such as finding coriander tasting like soap).

Provides a linking statement explaining how the TAS2R38 gene can alter the perception of taste.

Provides the link to gustatory perception using an example.

#### Response 2 (low-scoring)



Student has identified a cause but has not provided enough detail about how that cause results in a person perceiving things differently to most.

The TAS2R38 gene can cause a person to have more tastebuds and higher sensitivity to bitter-tasting flavours, which affects their gustatory perception.

## Think like an examiner

To maximise your marks on the exam, it can help to think like an examiner. Consider how many marks each question is worth and what information the examiner is looking for.

### Mark the response

A student has given the following response in a practice exam. Imagine you are an examiner and use the marking guide below to mark the response.

#### QUESTION 6

(3 marks)

Explain how variation of neural pruning during development could result in a person experiencing a perceptual disorder.

*A lack of pruning of neural connections during development can result in a person developing synaesthesia, where a stimulus can trigger the experience of more than one sense at the same time.*

### Marking guide

Question 6	1 mark – for correct explanation of how altered neural pruning can result in unique connections between sensory pathways in the brain.
	1 mark – for a statement that links brain structure cause to the condition of synaesthesia
	1 mark – for an explanation of how synaesthesia alters a person's perception.

### Fix the response

Consider where you did and did not award marks in the above response. How could the response be improved? Write your own response to the question to receive full marks from an examiner.

## Part C – Exam practice

Now it's time to put the tips and advice you have learnt into practice as you complete these exam-style questions!

### Multiple choice

#### Question 1

Which of the following statements best describes the difference between attitudes and attribution?

- A Attributions are inferences, whereas attitudes are ideas.
- B Attributions help us make sense of our social world, whereas attitudes help us evaluate our actions.
- C There is no difference – both attitudes and attributions help us identify the cause of events in our social world.
- D Attitudes are inferences, whereas attributions are ideas.

#### Question 2

Which of the following are considered binocular depth cues?

- A Linear perspective and convergence
- B Relative size and linear perspective
- C Retinal disparity and accommodation
- D Convergence and retinal disparity

Use the following information to answer questions 3 to 8.

Mr Nguyen, a primary school teacher, wanted to investigate whether branding affected children's taste perception. He selected two cans of identical size. One can displayed Pepsi™ branding and the other can displayed no branding. Using a measuring cup, an equal amount of Pepsi was poured into both cans. Mr Nguyen selected eight students from his Grade 5 class to act as participants. Each participant was called into the classroom and asked to taste the contents of each can. The participants rated the taste of each can on a scale of 1 (no taste) to 5 (strong taste).

#### Question 3

What was the independent variable in the investigation?

- A Whether or not the cans were branded
- B Taste perception
- C Tasting the contents of both cans
- D The equal amount of Pepsi in both cans

#### Question 4

Identify the population of interest in Mr Nguyen's research.

- A Grade 5 students
- B Eight students from Grade 5
- C Children
- D Eight children

#### Question 5

Based on theory relating to taste perception, results obtained from the study would most likely show:

- A no difference in the mean score between both cans.
- B a higher mean score for the branded can compared to the non-branded can.
- C a higher mean score for the non-branded can compared to the branded can.
- D the sample size is too small to calculate a mean score.

#### Question 6

Which of the following best describes the type of data collected in the study?

- A Primary, quantitative data
- B Primary, qualitative data
- C Secondary, quantitative data
- D Secondary, qualitative data

#### Question 7

Which of the following would be the most appropriate way to graph the mean score obtained for each can type?

- A A line graph
- B A bar chart
- C A scatterplot
- D A pie chart

**Question 8**

At the end of the experiment, Mr Nguyen noticed that the measuring cup he used was off calibration by 1.5 mL. What type of error would this have introduced into the experiment?

- A Random error
- B Personal error
- C Uncertainty
- D Systematic error

**Question 9**

When looking at Figure 1, Lani groups the letters in A as rows of “X” and “O”, and groups the letters in B as columns of “X” and “O”.

A	B
X X X X X	X O X O X
O O O O O	X O X O X
X X X X X	X O X O X
O O O O O	X O X O X

**FIGURE 1** Sample of two groups of letters

Identify the Gestalt principle Lani uses to organise and interpret the information in Figure 2.

- A Proximity
- B Camouflage
- C Similarity
- D Figure-ground organisation

**Question 10**

A surgeon’s authority in an operating room is an example of:

- A expert power.
- B coercive power.
- C referent power.
- D legitimate power.

**Question 11**

Which of the following is a similarity between Milgram’s and Asch’s experiments?

- A Both experiments used deception.
- B Both experiments required the presence of an authority figure.
- C Both samples were culturally diverse.
- D Withdrawal rights were breached.

**Question 12**

Nullah looks at the pixelated image in Figure 2 and identifies that the image is of a purple flower and its leaves. Which of the following best describe how Nullah has perceived the image?



**FIGURE 2** A pixelated photograph

- A Bottom-up processing: the stimulus has shaped Nullah’s perception without the influence of any preconceived ideas.
- B Bottom-up processing: missing information about the stimulus has been filled in with existing schemata for Nullah to perceive how the flower looks.
- C Top-down processing: missing information about the stimulus has been filled in with existing schemata for Nullah to perceive how the flower looks.
- D Top-down processing: the stimulus has shaped Nullah’s perception without the influence of any preconceived ideas.

### Question 13

Which of the following best explains bias?

- A A positive or negative action against someone in a minority group
- B How attitudes form and can result in negative actions towards a group, object or person
- C An opinion or belief about an object, group or person that could be positive or negative in nature
- D A shortcut in decision-making based on prior knowledge of a concept

Use the following information to answer questions 14 and 15.

Year 11 student, Leonardo, was campaigning for his local high school to include more vegan options at the canteen. To obtain support for the proposal, he emailed a self-report survey to all students. The self-report survey consisted of five open-ended questions relating to attitudes towards the consumption of meat-based and dairy-based products.

### Question 14

Which of the following is a limitation of collating data through self-reports?

- A Data obtained is subjective.
- B It is time-consuming to construct a line graph based on the data collated.
- C Data can only be collated from a small group of individuals.
- D The data obtained is objective.

### Question 15

Based on the responses obtained from the students, Leonardo decided to create another self-report survey, but this time he focused on collecting quantitative data. What could Leonardo include in his survey to achieve this?

- A A ratio-scale
- B A nominal-scale
- C An ordinal-scale
- D A Likert-type scale

### Question 16

Which of the following best describes mental shortcuts that allow us to quickly make decisions or solve problems?

- A Attitudes
- B Biases
- C Heuristics
- D Attributions

### Question 17

Petra always puts a high level of effort into classwork that they are assigned to complete individually. However, Petra puts considerably less effort into completing tasks that are assigned as group work. Petra's tendency to put less effort into group work is best described as:

- A deindividuation.
- B unanimity.
- C social loafing.
- D informational influence.

### Question 18

Anthony works in aged care and his friend Naomi works as a mouse breeder for a pharmaceutical lab. When shown Figure 3, Anthony sees an elderly man's face, while Naomi sees a mouse.

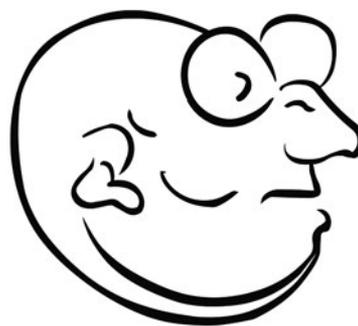


FIGURE 3 Anthony sees an older man, but Naomi sees a mouse.

The variation between Anthony and Naomi's perception of the image is due to:

- A camouflage.
- B perceptual set.
- C shape constancy.
- D figure-ground organisation.

### Question 19

Which of the following ethical guidelines did Stanley Milgram breach in his study on obedience?

- A Willing participation from participants
- B Informed consent
- C The do-no-harm principle
- D Participant confidentiality

### Question 20

The main purpose of ethical guidelines in psychological research is to:

- A ensure that participants are not deliberately misled about the intent of research.
- B safeguard the wellbeing of participants.
- C make sure participants are not exposed to any harm during research.
- D dissuade the use of children in psychological research.

### Short answer

#### Question 1 (8 marks)

Classify the following examples as either sustained, divided or selective attention. Justify your classification.

- a Rodney listens to a true crime podcast while he drives to work. (2 marks)
- b Abeeku reads a best-selling novel for an hour before bed. (2 marks)
- c Jezabel has a conversation with her friend at a noisy house party. (2 marks)
- d Javier cooks dinner while talking to his partner on the phone. (2 marks)

#### Question 2 (8 marks)

Amelia was visiting a relative when she woke in the middle of the night and went to get a glass of water. Unfamiliar with the layout of the house, she tripped and fell down the stairs. She shattered her cheekbone and glass lacerated her eye. The injury resulted in the loss of her right eye. Amelia is now experiencing difficulties with depth perception.

- a Distinguish between the terms “monocular depth cue” and “binocular depth cue”. (2 marks)
- b Identify and explain one task that Amelia will have trouble with because of her injury. (2 marks)
- c Explain how texture gradient and linear perspective will allow Amelia to perceive depth when she looks at a photo of herself and her dog Rusty at the beach. (4 marks)

#### Question 3 (8 marks)

- a Contrast the differences between the two lines in the Müller-Lyer illusion. (2 marks)
- b With reference to perceptual compromise theory, explain why people often see the two lines in the Müller-Lyer illusion as different lengths. (2 marks)
- c Discuss how culture can influence visual perception with reference to the carpentered world hypothesis and the Müller-Lyer illusion. (4 marks)

#### Question 4 (10 marks)

Research conducted by Stanley Milgram, Philip Zimbardo and Solomon Asch has been extensively reviewed to determine whether it complied with ethical and safety requirements. Evaluate each of the experiments performed with reference to the ethical concepts of beneficence, integrity, justice, non-maleficence and respect.

#### Question 5 (12 marks)

Mia is overseas travelling in France and is offered the chance to order a local delicacy of garlic butter escargot (snails) at dinner. Mia recently completed a research project on snail physiology and behaviours in her biology class. Mia feels uncomfortable ordering the dish as through her research she grew fond of snails and gained a new appreciation for the creatures. Mia decides not to order the escargot and orders something else instead.

- a With reference to the tri-component model of attitudes, discuss Mia’s attitude towards eating snails. (6 marks)
- b Explain whether Mia’s attitude is considered implicit or explicit. (2 marks)
- c Discuss how Mia’s attitude towards snails and perceptual set could influence her gustatory perception of escargot if she were to taste it. (4 marks)



FIGURE 4 Snails are eaten as a delicacy in France.

**Question 6** (10 marks)

Alan, a 65-year-old male, was recently made redundant. After losing his job as a financial advisor, he began applying for roles via a job-seeking website. After he had submitted numerous applications, he attended an interview. During the interview, Alan was asked several questions by a panel of three interviewers. When asked about his experience, Alan told the panel that he had been a financial advisor for the past 41 years. Following this response, the interview ended abruptly and Alan was informed he was not the right fit for the role. Alan believed that he had been discriminated against, based on his age. Alan is now doubting his ability to find a new job and feels like his interview skills are insufficient.

- a Explain whether the interview panel meet the criteria of a “group”. (2 marks)
- b Identify and describe two influences that contribute to the formation of prejudice. (4 marks)
- c Identify which type of power dynamic the interview panel possessed. Justify your response. (2 marks)
- d Explain whether Alan doubting his ability to find a new job is an example of an internal or external attribution. (2 marks)

**Question 7** (12 marks)

Kalani works as a “nose”, an expert at identifying and creating fragrances for a perfume company. She is currently trying to detect which notes (scents) a perfume competitor has used in their best-selling fragrance.

- a Identify what type of stimulus energy and sense organ enable Kalani to smell the different notes in the perfume. (2 marks)
- b Explain how transduction and transmission allow Kalani to interpret and understand what she is smelling. (2 marks)
- c Kalani smells the perfume and picks up strong top notes of jasmine. From this she suspects the perfume might also include bergamot, as the combination of the two is popular in “romantic” scents. On her second whiff she detects that bergamot is present. Discuss whether Kalani’s first perception of the scent being a combination of jasmine and bergamot is an example of top-down or bottom-up processing. (4 marks)
- d After recovering from a stroke, Kalani’s perception of smell changes. She associates each specific scent with an irregular shape. Identify the condition Kalani is experiencing. (1 mark)
- e Explain how a brain injury could have led Kalani to develop the condition identified in part **d** and how the structural organisation of Kalani’s brain has resulted in her being able to simultaneously perceive two senses in response to a stimulus. (3 marks)



**FIGURE 5** A “nose” is an expert at identifying and creating fragrances.

**Question 8** (12 marks)

American social psychologist Stanley Milgram investigated whether individuals would obey an authority figure that instructed them to inflict pain on another person. Participants in his study were led to believe they would be involved in a study on “memory” and “learning”.

Participants were selected from a pool of respondents who replied to an advertisement Milgram put in the local paper. Forty males of various occupations, aged 20 to 50 years, took part in the study. A confederate was also used in the experiment and was introduced to the participants. The random allocation process was rigged by Milgram to ensure that the real participant was always allocated as the “teacher” and the confederate was always allocated as the “learner”.

Teachers were told their task was to teach learners how to remember word pairs by administering an electric shock each time the learner made a mistake. Teachers were also told that, although the shocks could be painful, they would not cause permanent tissue damage. The shock generator consisted of 30 levers spanning from 15 to 450 volts, increasing in 15-volt increments. Each lever was also marked with descriptions of the severity of the shock, ranging from “slight shock” to “danger/severe shock”. Teachers were instructed to raise the shock administered to the learner by 15 volts each time the learner made a mistake.

The table below shows the results from Milgram’s obedience experiment.

**TABLE 1** The impact of shock level on the percentage of obedient participants

Shock level (volts)	Percentage of obedient participants (%)
300	100
315	87.5
330	77.5
345	72.5
360	70
375	67.5

Source: Milgram (1963)

- Explain why confederates were used in Milgram’s obedience experiment. (2 marks)
- Use the data provided in Table 1 to produce a line graph of the results obtained. Ensure that you label the axis correctly and give the graph an appropriate title. (4 marks)
- Explain why a line graph is the best choice for representing the data in Table 1. (2 marks)
- Milgram told participants that they were taking part in a study on “memory and learning”. Evaluate whether this action violated participant rights or whether it was necessary for the research. (2 marks)
- Parallels exist between Stanley Milgram’s obedience experiment and Philip Zimbardo’s Stanford prison experiment. Describe the relationship between the perceived status of the authority figure and the obedience level of an individual. (2 marks)

## 1 &amp; 2

## Practice exam

This practice exam is designed to help you revise your understanding of all the key concepts covered in Units 1 and 2 and practise your skills on a range of exam-style questions. You can download a printable version of the exam using the hotspot below.

## Practice examination

Section	Number of questions	Number of questions to be answered	Number of marks
A	40	40	40
B	9	9	80
<b>Total</b>	49	49	120

## Section A – Multiple choice



Use the following information to answer questions 1 and 2.

Kurt has been employed as an accountant at a large firm for the past three years. A promotion became available in the firm and Kurt applied for it. Kurt's boss awarded the promotion to Sabina, who, unknown to Kurt, had more qualifications and relevant experience.

**Question 1**

Which of the following attributions to explain Kurt's interpretation of his boss' decision to promote Sabina is plausible?

- A Kurt holds the external attribution that his boss' decision is due to his boss' poor decision-making.
- B Kurt holds the external attribution that he is a better-suited candidate for the promotion as he feels he works harder than Sabina.
- C Kurt holds the internal attribution that his boss' decision is out of the ordinary and probably due to something adverse that his boss recently experienced.
- D Kurt holds the internal attribution that during the interview, his boss was distracted and was not paying enough attention to Kurt's responses.

**Question 2**

Prior to Sabina's promotion, Kurt perceived that Sabina and he were very similar. Kurt originally thought that both he and Sabina shared many of the same skills and abilities and produced a similar quality of work. Kurt's person perception of Sabina prior to her promotion can be explained through:

- A Kurt's evaluation of physical cues surrounding Sabina.
- B Kurt's reference to self-schema in his evaluation of Sabina.
- C Kurt's attention to saliency detection surrounding Sabina's skills, abilities and knowledge.
- D Kurt's social categorisation of Sabina.

**Question 3**

Stereotyping can best be explained as an:

- A oversimplified collection of beliefs and situational attributions towards a certain person, group, culture or subculture.
- B oversimplified collection of beliefs and personal attributions towards a certain person, group, culture or subculture.
- C oversimplified collection of attitudes towards a certain person, group, culture or subculture.
- D oversimplified collection of cognitions towards a certain person, group, culture or subculture.

#### Question 4

Veronika is invited by her friend to go to a cocktail party. When Veronika's friend explains that the party is celebrating the end of financial year for a successful and wealthy business firm, Veronika immediately feels unsure about attending as she thinks she might be judged by others at the party for not being wealthy. Due to this, Veronika tells her friend that she cannot attend.

Which heuristic is Veronika basing her decision-making upon?

- A The self-serving heuristic
- B The representative heuristic
- C The availability heuristic
- D The affect heuristic

#### Question 5

Hank, 19, is part of a friendship group where some members occasionally binge drink alcohol, a behaviour that never really appealed to Hank. At a party one evening, Hank is encouraged to quickly drink many shots of a strong spirit. Hank considers consuming the shots as most of his friends have done so and appear to be having fun. Instead, Hank declines and leaves the party.

Hank's decision-making and actions can best be described as:

- A a position of dissent against the friendship group.
- B a position of anticonformity against the friendship group.
- C a position of independence without regard to the majority of the group.
- D a position of counter conformity against the majority of the group.

#### Question 6

Angie is getting ready for a costume party at her house with some friends. Angie originally planned to go dressed as Shrek. When she sees all her friends dressing as superheroes, Angie raids her closet for an outfit and cape that resembles Wonder Woman so she can fit in with her friends. Which of the following best

describes the factor that has influenced Angie to conform?

- A Normative influence
- B Informational influence
- C Group size
- D Deindividuation

Use the following information to answer questions 7 to 11.

A research psychologist investigated the effect of sleep deprivation on attention levels. As part of the study, participants were required to complete a reaction time test, with a stopwatch used to time each participant. After analysing the results, the psychologist reported that the standard deviation for the sleep-deprived condition was higher than the standard deviation for the not sleep-deprived condition.

#### Question 7

Which of the following is a possible hypothesis for this experiment?

- A Participants who are sleep deprived will experience changes in their attention levels compared to those who are not sleep deprived.
- B Participants who are sleep deprived will display lower attention levels compared to those who are not sleep deprived.
- C Sleep deprivation will have no impact on attention levels.
- D Attention levels will be higher for individuals who are not sleep deprived.

#### Question 8

During the data collection phase of the research, the psychologist noticed that it was difficult to determine the reaction time of each participant as there was variation in the speed in which the stop and start buttons were pressed.

Which type of error is this an example of?

- A Random error
- B Systematic error
- C Personal error
- D Bias

### Question 9

Which of the following will be reduced by the error identified in question 8?

- A Precision
- B Accuracy
- C True value
- D Reproducibility

### Question 10

Which of the following best describes “standard deviation”?

- A How much a data set is spread around the mean in a data set
- B The most common score in the data set
- C Variation within the scores in the data set
- D The middle score in the data set

### Question 11

When the research was being peer-reviewed, it was noted that the research psychologist must have miscalculated the standard deviation for the sleep-deprived condition. This type of error is best described as:

- A random error.
- B systematic error.
- C personal error.
- D bias.

### Question 12

Which of the following treatments for mental health disorders involves a mental health professional providing information on a patient’s condition to family and/or friends so they can better understand and support the patient?

- A Cognitive behavioural therapy
- B Medications
- C Psychoeducation
- D Psychotherapy

### Question 13

Dr Hana is a psychiatrist interested in the factors that can influence social and emotional wellbeing. She decides to work with an Elder to set up an informal speaking and listening space in a local Aboriginal

community where individuals can share, discuss and question the domains of social and emotional wellbeing. What is the name of this practice?

- A Focus group
- B Clinical interview
- C Case study
- D Yarning circle

### Question 14

When Kara drives, she can hold conversations with passengers, check her GPS and listen to the traffic report. Kara’s ability to perform these tasks simultaneously is due to:

- A selective attention.
- B divided attention.
- C concentrated attention.
- D focused attention.

*Use the following information to answer questions 15 and 16.*

A researcher was interested in the findings of Milgram’s study and decided to replicate Milgram’s original 1963 experiment. The researcher was aware that participants may potentially experience psychological harm while taking part in the experiment. Prior to conducting the study, the researcher was required to prove that the benefits of undertaking the research outweighed the resulting psychological harm.

### Question 15

Which ethical concept does this apply to?

- A Respect
- B Integrity
- C Non-maleficence
- D Justice

### Question 16

At the conclusion of the experiment, the researcher compared their results to Milgram’s and noticed they were similar. This demonstrates:

- A reproducibility.
- B repeatability.
- C accuracy.
- D validity of the measurement.

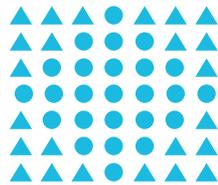
**Question 17**

To which of the following areas of the brain do the cranial nerves initially transmit received and transduced gustatory information?

- A Primary gustatory cortex, between the frontal and temporal lobes
- B Primary olfactory cortex, within the parietal lobe
- C Primary gustatory cortex, between the frontal and parietal lobes
- D Primary gustatory cortex, between the temporal and parietal lobes

**Question 18**

Which Gestalt principles are being used in Figure 1?



**FIGURE 1** An example of a Gestalt principle

- A Proximity and closure
- B Figure-ground and similarity
- C Proximity and similarity
- D Figure-ground, proximity and closure

**Question 19**

Kevin was involved in a physical confrontation where, after being struck in the head, he was rendered unconscious and in need of medical attention. When Kevin regained consciousness in hospital, his partner Nigella came to visit but Kevin was unable to recognise her. He was, however, able to recognise her when she started speaking to him.

One possible reason for this is because:

- A Kevin may be displaying symptoms indicative of spatial neglect.
- B Kevin may be displaying symptoms indicative of anterograde amnesia.
- C Kevin may be displaying symptoms of prosopagnosia.
- D Kevin may be displaying symptoms of aphasia.

Use the following information to answer questions 20 to 23.

Dr Saveen is investigating the impact of caffeine consumption on the behavioural and cognitive functioning of young adults. She conducts a literature review on this topic. Based on the review, she separates 40 willing participants into two groups. Group 1 will consume 400 mg of caffeine daily for a period of two weeks. Group 2 will consume no caffeine for a period of two weeks. At the end of the two-week period, all participants will complete a behavioural test using a driving simulator. They will also complete a recall task to determine their level of cognitive functioning.

**Question 20**

Which of the following best describes the purpose of a literature review?

- A To collect and analyse primary data
- B To ensure that the proposed research has not been completed in the past
- C To collect and analyse secondary data
- D To gain approval from an ethics committee

**Question 21**

Which type of experimental design is used by Dr Saveen?

- A Within-subjects
- B Between-subjects
- C Mixed design
- D Twin studies

**Question 22**

Dr Saveen's investigation contains:

- A one independent variable and one dependent variable.
- B one independent variable and two dependent variables.
- C two independent variables and one dependent variable.
- D two independent variables and two dependent variables.

### Question 23

Participants' results from the recall test are collated. After reviewing the data, Dr Saveen decides to calculate the median score for each group rather than the mean. An explanation for this is:

- A that a wide spread of data existed.
- B that data was clustered around a central point.
- C that it is less time-consuming.
- D that there was the presence of extreme or irregular scores in the data set.

### Question 24

Henry has been studying hard for his end-of-semester examination on Australian history. Which brain structure is primarily involved when he is learning the information?

- A The cerebrum
- B The reticular formation
- C The hypothalamus
- D The cerebellum

Use the following information to answer questions 25 to 27.

Joel was injured in a parachuting accident, after which he could no longer formulate meaningful sentences. Although Joel could pronounce words clearly, his sentences lacked clarity and cohesion and were nonsensical.

### Question 25

Which cortical lobe has Joel sustained damage to?

- A Left parietal lobe
- B Right temporal lobe
- C Left frontal lobe
- D Right frontal lobe

### Question 26

Damage to which brain structure is most likely to have influenced Joel's speech problems?

- A Primary motor cortex
- B Wernicke's area
- C Auditory cortex
- D Broca's area

### Question 27

Which of the following could be a biological symptom of Joel's acquired brain injury?

- A Aggression towards his friends
- B Reduced attention
- C Nerve damage
- D Communication issues

### Question 28

Based on Ainsworth's research, an infant who has developed secure attachment during the first year of their life will most likely:

- A become emotionally insecure during childhood.
- B develop an anxiety disorder in their second year of life.
- C have low self-esteem as an adult.
- D be able to form long-lasting positive relationships in the future.

Use the following information to answer questions 29 and 30.

A high school Psychology teacher, who was interested in Piaget's studies on cognitive development, arranged for their students to visit a local primary school to observe various stages of cognitive development. During the visit, students were required to report data in their logbook.

### Question 29

Which scientific investigation methodology describes this scenario?

- A Fieldwork
- B Case study
- C Correlational study
- D Controlled experiment

### Question 30

Which of the following is a limitation of the scientific investigation methodology identified in question 29?

- A It does not confirm if a variable causes a change in another variable.
- B There is limited control over extraneous variables.
- C Due to the small sample size the results may be externally invalid.
- D Controlled conditions may be difficult to maintain.

Use the following information to answer questions 31 and 32.

Gerrard, a four-year-old child, has strict parents who hold strong beliefs about how a child should behave. Believing respect and maturity should be shown as early as possible, Gerrard's parents monitor his behaviour constantly and punish him for actions they view as undesirable. Gerrard, being an energetic child, is reprimanded numerous times throughout the day.

**Question 31**

According to Erikson, Gerrard is in the stage of development where the crisis to overcome is:

- A initiative versus guilt.
- B identity versus isolation.
- C intimacy versus isolation.
- D integrity versus despair.

**Question 32**

Due to the way his parents are raising him, Gerrard is likely to:

- A be shy or introverted, possibly hostile or rebellious.
- B have clear respect for authority figures.
- C be creative and a diligent worker.
- D suffer from stunted growth.

**Question 33**

Which of the following terms best describes people who have psychological or cognitive attributes that are not common to most people in society?

- A Neurotypical
- B Neurodivergent
- C Abnormal
- D Maladaptive

**Question 34**

ADHD symptoms are classified into two groups: inattentive or hyperactive-impulsive symptoms. Which symptom is a hyperactive-impulsive symptom?

- A Forgetfulness
- B Paying sustained attention
- C Excessive talking
- D Becoming distracted

Use the following information to answer questions 35 to 40.

Professor Abenaki was investigating the effect a new vitamin D tablet has on blood cholesterol levels in Psychology students in Victoria. The student numbers of all Psychology students enrolled in Victoria were placed in a computer generator and 47 individuals were selected to take part in the research.

Before the research commenced, all participants were administered a blood test, and their cholesterol levels were recorded.

Professor Abenaki then divided the participants into two groups and administered the following medications.

- Group 1 took a capsule containing 25 mcg of colecalciferol (vitamin D3) once per day for six weeks.
- Group 2 took a capsule containing 25 mcg of an inactive substance once per day for six weeks.

Participants were not told which capsule they received. At the end of the six-week period, participants were administered another blood test, and their cholesterol levels were recorded.

**Question 35**

Which of the following would be a suitable independent and dependent variable for this study?

	Independent variable		Dependent variable
	Experimental group	Control group	
A	25 mcg inactive capsule	25 mcg colecalciferol capsule	Difference in pre- and post-test cholesterol levels
B	25 mcg colecalciferol capsule	25 mcg inactive capsule	Cholesterol levels
C	25 mcg colecalciferol capsule	25 mcg inactive capsule	Difference in pre- and post-test cholesterol levels
D	25 mcg colecalciferol capsule	25 mcg colecalciferol capsule	Cholesterol levels

**Question 36**

Which of the following represents the population and sample, respectively, in Professor Abenaki's study?

- A Psychology students, 47 Psychology students
- B 47 Psychology students, Psychology students
- C Victorian Psychology students, 47 Psychology students
- D Victorian Psychology students, 47 Victorian Psychology students

**Question 37**

Which type of sampling method was used in Professor Abenaki's study?

- A Convenience
- B Random
- C Stratified
- D Random stratified

**Question 38**

Which of the following could be an extraneous variable in the study?

- A The uneven distribution of students between groups
- B The small sample size
- C Only using individuals from Victoria
- D Whether participants were already taking cholesterol medication

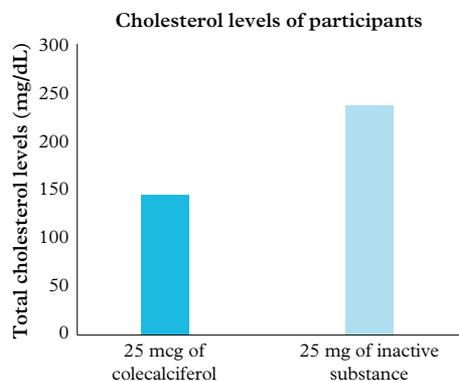
**Question 39**

Which of the following best describes the data collected by Professor Abenaki?

- A Primary, quantitative data
- B Primary, qualitative data
- C Secondary, quantitative data
- D Secondary, qualitative data

**Question 40**

Which of the following statements represents an appropriate conclusion for the results of the controlled experiment shown in Figure 2?



**FIGURE 2** Cholesterol levels of participants after taking colestiferol or an inactive substance

- A The total cholesterol level was lower for those who were administered 25 mcg of colestiferol than those who were administered 25 mcg of inactive substance.
- B The total cholesterol level was lower for those who were administered 25 mcg of the inactive substance compared to those who were administered 25 mcg of colestiferol.
- C People with a higher total cholesterol level were administered 25 mcg of colestiferol.
- D People with a lower total cholesterol level were administered 25 mcg of inactive substance.

**TOTAL SECTION A**

\_\_\_/40 MARKS

## Section B – Short answer

### Question 1 (9 marks)

Mary manages the local supermarket. As part of a government initiative to assist refugees, Mary has employed an Iraqi refugee named Sidar. Sidar is still learning English and sometimes struggles to communicate with others. Being a devout Muslim, Sidar also needs to pray at certain times of the day.

Sidar's employment was not received well by the other supermarket workers, nor by the local community, who protested the initiative, saying jobs should go to locals. The workers at the supermarket often make racist remarks to Sidar, thinking that he does not understand what is being said to him. Workers often refuse to work with or assist Sidar. Mary has noticed the increasing tension and racism at work and has decided to take measures to reduce racism in her workplace.

- a Distinguish between prejudice and discrimination and provide examples of each from the scenario above. (4 marks)
- b Apply the tri-component model of attitudes to the racist attitude held by the supermarket workers and identify the affect, cognition and behaviour. (3 marks)
- c Describe an action Mary could take to reduce racism in her workplace. (2 marks)

### Question 2 (6 marks)

Penelope is treating herself to a shopping spree on her lunch break in the city. On the way back to work, an animal charity fundraiser calls out to Penelope and asks her for a donation. Annoyed, because she is trying to rush back to work on time, Penelope deliberately ignores the fundraiser and pretends she did not hear them. Penelope believes the charity only targeted her because she was carrying a tote bag with a picture of a kitten on it.

- a Identify and explain the type of attribution that Penelope has used in interpreting why the fundraiser called out to her. (2 marks)
- b After walking away, Penelope feels guilty for not giving the charity money as she does love animals and had the money to donate. The sense of guilt that Penelope experiences is due to cognitive dissonance. Describe two examples of cognitive bias that Penelope could use to resolve or reduce her cognitive dissonance. (4 marks)

**Question 3** (6 marks)

Both hereditary and environmental factors are viewed as equally important in influencing our psychological development. These factors also influence each other. Regular physical activity is an example of an environmental factor that has been extensively studied. Its benefits include prevention and management of health conditions such as high blood pressure, stroke and heart disease. The 2020–21 National Health Survey assessed, among other things, physical activity levels. Table 1 represents data for individuals aged 18 to 64 years.

*Note: The 2014 physical activity guidelines recommend that people aged 18 to 64 years should be active on most days of the week (interpreted as five active days in this survey). The guidelines recommend that people aged 18 to 64 years undertake either 150 to 300 minutes of moderate intensity physical activity, or 75 to 150 minutes of vigorous intensity physical activity, or an equivalent combination of both, per week. The guidelines also recommend that people aged 18 to 64 years include strength or toning on at least 2 days per week.*

- a Compare the data for individuals aged 25 to 34 and 45 to 54 across all factors analysed. (2 marks)
- b Using an appropriate graph type, represent the data for all age groups in relation to undertaking strength or toning activities. (4 marks)

**TABLE 1** Met physical activity guidelines and recommendations, proportion of people aged 18 to 64, 2020–21

Age	Met guidelines	Undertook 150 minutes or more of physical activity in the week prior to the survey (%)	Undertook physical activity on five or more days of the week prior to the survey (%)	Undertook strength or toning activities on two or more days of the week prior to the survey (%)
18–24	34.3	80.6	72.8	38.1
25–34	27.2	73.3	70.5	31.2
35–44	24	71.8	70.8	27.1
45–54	20.6	71	65.7	24.1
55–64	19	72.4	69.4	22.1

Source: Australian Bureau of Statistics

**Question 4** (4 marks)

A student at a local high school was interested in the data obtained for individuals aged 18 to 24 (in question 3) and decided to conduct their own survey investigating whether high levels of physical activity improved teenagers’ quality of sleep. The student selected 14 peers from their high school who engaged in high levels of physical activity and asked them to complete a survey about their sleep quality. Raw data from the survey is shown in Table 2.

**TABLE 2** Sleep survey raw data

Participant	Sleep quality	Participant	Sleep quality
1	High	8	Moderate
2	High	9	High
3	Moderate	10	Moderate
4	High	11	Low
5	Low	12	High
6	Low	13	High
7	Moderate	14	Moderate

- a Construct another table to present these raw data in an organised way. Be sure to include a title. (3 marks)
- b State one limitation of the data type collected. (1 mark)

**Question 5** (13 marks)

A cross-sectional study was conducted on adolescents between 12 and 17 years old that investigated the effects of social media on individual and group behaviours. The study consisted of a survey where respondents provided both qualitative and quantitative responses to questions on how social media use has affected their social connections and social comparison. It was found that viewing social media influencers and making social comparisons both negatively and positively affected the social interactions of individuals and individuals' self-esteem.

- a** Assess whether the finding of the study aligns to what is currently scientifically accepted about social media and social comparisons. (1 mark)
- b** Using examples, explain how making upward comparisons on social media can result in both positive and negative effects on a person's self-esteem. (4 marks)
- c** Using examples, explain how connecting and engaging with influencers on social media can both positively and negatively affect a person's sense of social connectedness. (4 marks)
- d** Identify the type of investigation methodology used in the study. Justify your response. (2 marks)
- e** Evaluate the use of the investigation methodology identified in part d as a means of investigating social cognition. (2 marks)

**Question 6** (11 marks)

Egaz Moniz performed lobotomies on violent and overly emotional patients.

- a** Define the term "lobotomy". (1 mark)
- b** Identify the area of the brain that lobotomies focused on. (1 mark)
- c** Identify a symptom a lobotomised patient may experience after the procedure and explain how this symptom is linked to damage to the area of the brain identified in part b. (2 marks)
- d** Identify and explain an ethical principle that Moniz's lobotomies would violate. (2 marks)
- e** Describe how one type of mental health professional could assist an overly violent patient or a patient experiencing persistent emotional difficulties. In your description include:
  - the type of mental health professional
  - the role of the chosen mental health professional
  - justification of why that mental health professional would be appropriate for this patient
  - an explanation of one treatment the mental health professional could employ and how this treatment could benefit the patient.(5 marks)

**Question 7** (11 marks)

Dr Klaus is interested in examining whether a relationship between how we see food and how we taste food exists. To examine this, Dr Klaus conducted an experiment where 60 participants were split into two groups, Group A and Group B. Each participant from Group A was presented with five different cups of clear fluid. Each cup had one specific taste: salty, sweet, sour, bitter or umami. Participants in Group A consumed each cup, one at a time, with a five-minute interval between each tasting. Participants in Group A were required to rate the intensity of the flavour on a 10-point scale (where 0 = no intensity and 10 = high intensity).

Each participant from Group B was presented with five different cups of fluid that had red food dye added to them. Each of the cups had one specific taste: salty, sweet, sour, bitter or umami. Participants in Group B consumed each cup, one at a time, with five-minute intervals between each cup. Participants in Group B were required to rate the intensity of the flavour on a 10-point scale (where 0 = no intensity and 10 = high intensity).

Both Groups A and B were required to attend the second part of the experiment the following day. Group B completed the same method that Group A completed the previous day, and Group A completed the same method that Group B had completed the previous day.

The results were as follows:

**Clear fluid average taste intensities**

Sweet	Sour	Bitter	Salty	Umami
6	7	5	6	8

**Red fluid average taste intensities**

Sweet	Sour	Bitter	Salty	Umami
9	6	6	6	8

- Identify the independent and dependent variables for the experiment. (2 marks)
- Identify the experimental design used in the experiment and explain one advantage and one disadvantage of this experimental design. (3 marks)
- With direct reference to the results, outline one inference that can be made from the results in relation to your understanding of visual and gustatory perception. (3 marks)
- Propose how and why the results of the experiment might have changed if all participants were exposed to miraculin prior to the second part of the experiment. (3 marks)

**Question 8** (10 marks)

Psychologist Solomon Asch conducted a series of experiments to assess the strength of a person's independence under different conditions. These experiments helped shed light on why people conform and how common the occurrence of conformity is. In one experiment, male college students ranging in age from 17 to 25 years took part in a study where participants were allocated into a group that contained between seven and nine confederates. The group was then shown two cards and asked, "Which line on Card B is closest in length to Line X on Card A?". Members of the group had to respond in order of how they were seated, a position which was manipulated to ensure the participant would always be the second-last to answer. The percentage of errors, as a measure of the level of conformity, was recorded for each of the 12 trials.

The results are presented in Table 3.

**TABLE 3** Percentage of errors for each trial amongst experimental groups

Trial	Percentage of errors (%)
1	17
2	36
3	24
4	54
5	37
6	43
7	35
8	37
9	36
10	51
11	29
12	41

Source: Asch (1956)

The mean percentage of errors was calculated to be 37 per cent.

- Represent the results of the investigation using a correctly labelled graph. (4 marks)
- With specific reference to the data obtained, explain why the mean was an appropriate measure of central tendency to report. (2 marks)
- Explain why Asch's experiment is considered to have low external validity. (2 marks)
- Explain how Asch's experimental design could be altered to ensure participant rights are met. (2 marks)

**Question 9** (10 marks)

Jody Miller was three years old when she started to experience seizures. After a series of investigations, she was diagnosed with Rasmussen's encephalitis. The seizures Jody experienced all originated from the right side of her brain. Consequently, Jody experienced paralysis on the left side of her body. Despite trying all known options to treat the condition, Jody's seizures persisted. The only option remaining was for surgeons to perform a hemispherectomy, a procedure where half of the brain is removed. After undergoing extensive surgery, the right hemisphere of Jody's brain was removed. The surgery was successful. Jody no longer experienced seizures. Despite experiencing some slight paralysis on the left side of her body, Jody's left hemisphere was able to compensate and take over many of the functions of the right hemisphere.

Discuss how Jody's hemispherectomy led to her leading a normal life. In your response, consider how the brain changes in response to experience and trauma and the contribution of contemporary research to the understanding of neurological disorders.

**TOTAL SECTION B**

\_\_\_/80 MARKS

CHAPTER

# 12

## Investigations

To complete VCE Psychology, you will need to complete at least 10 hours of practical work for each of Units 1 and 2. Practical work can cover a range of scientific investigation methodologies, such as controlled experiments, modelling, case studies, classification and identification, literature reviews, fieldwork, simulations, correlational studies and product, process or system development. All investigations that are undertaken as part of your course, as well as internal assessments, should be written in a logbook that will be monitored and submitted to teachers. Before undertaking an investigation for the first time, ethical concerns should be considered, including the importance of sociocultural, economic, political and legal factors that may arise from science-related decision-making.



### SAFETY IN THE LABORATORY

This chapter will highlight key safety concerns for each investigation, though there are some general safety concerns to be considered before completing all practical work.

- Do not eat or drink in the lab.
- Always be aware of your peers and act in a way that will not cause harm.
- Wear a lab coat, safety glasses, close-toed shoes and gloves when appropriate.
- Review the school's safety procedures and location of the eyewash, shower, spill kits and first-aid kits.
- Handle all materials with care and consult your teacher and risk assessments for all hazards involved with each particular material used.
- Always check that electrical equipment is not damaged and that there are no exposed wires before use.
- Fieldwork should be completed in groups, with a full risk assessment completed before any excursion.

It is the responsibility of the teacher and school to conduct a risk assessment before any investigation covered in this book.

**FIGURE 1** Modelling is one type of scientific investigation methodology that you will come across throughout VCE Psychology. In the 4.4A Modelling investigation you will use materials such as plasticine to build a model of the brain.

## UNIT 1 INVESTIGATIONS

2.2	PRODUCT, PROCESS OR SYSTEM DEVELOPMENT	How can we promote mental wellbeing with mobile apps?	Page 472
2.4	CONTROLLED EXPERIMENT	How can we assess conservation as part of cognitive development?	Page 474
3.1A	CLASSIFICATION AND IDENTIFICATION	How can we categorise typical and atypical behaviour?	Page 476
3.1B	CORRELATIONAL STUDY	Is there a relationship between the number of atypical behaviours exhibited daily and perceived mental wellbeing?	Page 478
4.4A	MODELLING	How can we model the structure of the brain?	Page 479
4.4B	CASE STUDY	How can damage to the frontal lobe impact our experience of emotion?	Page 480
5.1	LITERATURE REVIEW	What strategies are effective in maximising brain plasticity and function?	Page 482
5.6	PRODUCT, PROCESS OR SYSTEM DEVELOPMENT	How can we minimise head injuries in contact sports?	Page 483

## UNIT 2 INVESTIGATIONS

7.1	CONTROLLED EXPERIMENT	How does age affect person perception?	Page 484
8.4A	CORRELATIONAL STUDY	Is there a relationship between time spent on social media and perceived social connectedness?	Page 486
8.4B	CASE STUDY	How can advertising affect our individual behaviour?	Page 487
9.1	FIELDWORK	Have you been paying attention?	Page 488
9.2	CONTROLLED EXPERIMENT	How does perceptual set affect your perception of rat-man?	Page 489
9.3	SIMULATION	What does the world look like with red–green colour vision deficiency?	Page 491
10.2	CONTROLLED EXPERIMENT	Does perceptual set influence our judgment of flavours?	Page 494
10.3	LITERATURE REVIEW	How can a non-synaesthete acquire synaesthesia?	Page 496

## 2.2

INVESTIGATION:  
PRODUCT, PROCESS OR  
SYSTEM DEVELOPMENT

# How can we promote mental wellbeing with mobile apps?



### Investigation worksheet

2.2 How can we promote mental wellbeing with mobile apps?

## Context

Mobile applications can provide valuable tools and resources to help support psychological development and wellbeing. There are many apps available to help promote wellbeing, but not all these apps apply the biopsychosocial approach to understanding wellbeing. In this investigation you will design an application that uses an understanding of the biopsychosocial model to help promote mental wellbeing.

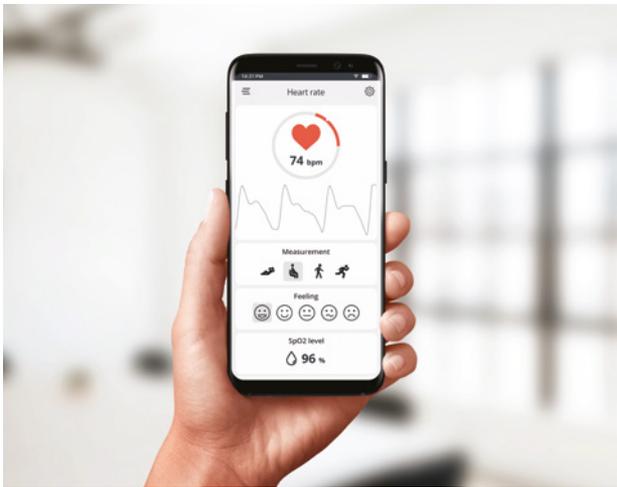


FIGURE 1 A mobile health application

## Aim

To design an application that uses understanding of the biopsychosocial model to promote mental wellbeing.

## Materials

- Computers or tablets with internet access
- Drawing/design software or poster paper, markers and other art supplies

## Method

- 1 Identify the target market for your application. You may wish to choose a specific demographic (such as children, adolescents, parents or senior citizens) or a broader demographic (for example, all adults over the age of 18).
- 2 Research three to five popular mental wellbeing apps for your demographic. For each application you research, take note of:
  - the highlights of the app (what features are most engaging, informative, easy to use and help promote wellbeing)
  - the shortcomings of the app (what features are missing, hard to use, behind a paywall or could be improved on).
- 3 Use your research from step 2 to brainstorm app features you could include that address biopsychosocial factors. These features should aim to improve and promote mental wellbeing by considering physical health, psychological wellbeing, and social support. Remember to keep features and information relevant to your demographic.
- 4 Select which ideas you will incorporate into your application and use these features to define the application's primary purpose. Outline how the app will contribute to improving the user's mental wellbeing by addressing biopsychosocial factors.
- 5 Use design software or art supplies to create digital or hand-drawn mock-ups of your app interfaces. Annotate your interfaces with the reasoning behind your selection of information, features, functionality and design choices.

- 6 Share your interfaces with three students and ask them to each provide three points of feedback on your app.

### **Discussion**

- 1 Which components of your application incorporated the biopsychosocial model to promote wellbeing? Describe how they worked.
- 2 Based on the feedback you received from your peers, describe what you would change about your app interface if you had to redesign it.

- 3 Discuss whether you believe a well-designed mental wellbeing app is sufficient to replace intervention from a mental health professional.

### **Conclusion**

Discuss the importance of the biopsychosocial model for considering mental wellbeing and psychological development.

## 2.4

INVESTIGATION:  
CONTROLLED  
EXPERIMENT

# How can we assess conservation as part of cognitive development?



### Investigation worksheet

2.4 How can we assess conservation as part of cognitive development?



### Risk assessment

2.4 How can we assess conservation as part of cognitive development?

## Context

Piaget's theory of cognitive development proposed that while in the pre-operational stage, children aged 2 to 7 years are unable to grasp the concept of conservation (that an object can remain the same despite changing appearance). However, Piaget proposed that by the time children reach the concrete operational stage (between 7 and 12 years) they can begin to understand conservation and that they should have mastered it by the formal operational stage (12+ years).

This investigation will allow you to assess whether children that fall into the age groups associated with Piaget's stages of cognitive development above have mastered the skill of conservation or not.

## Aim

To investigate whether children within the age brackets of 2 to 7 years, 7 to 12 years and 12 years and over have the cognitive skill of conservation or not.

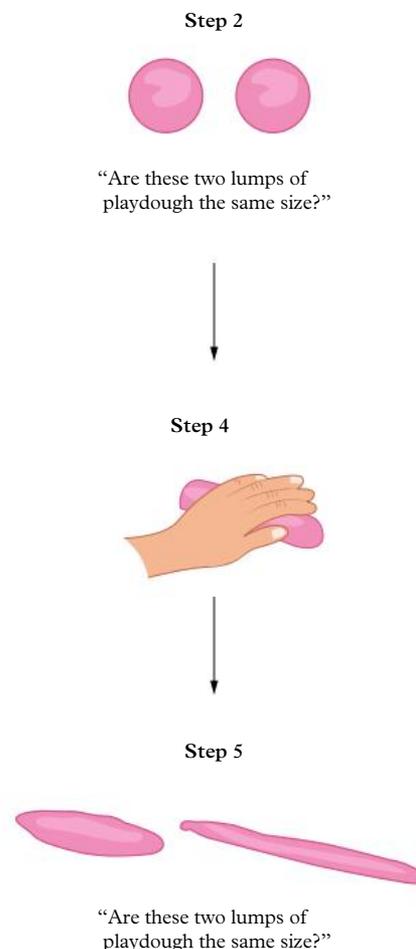
## Materials

- Playdough – two lumps of the same size and colour
- A pen or pencil to record responses
- At least one participant from each of the following age groups: 2 to 7 years, 7 to 12 years, 12 years and over

## Method

- 1 Place the two lumps of playdough of the same size and colour in front of your first participant.
- 2 Ask the participant, "Are these lumps of playdough the same size?"
- 3 If the participant replies "yes", go on to Step 4. If they reply "no", have them make the two balls the same size to their satisfaction.

- 4 Roll one lump of playdough into a long sausage and one lump into a shorter sausage.
- 5 Ask the participant, "Are these lumps of playdough the same size?"



**FIGURE 1** Participants will be shown the same two lumps of playdough in different forms to assess conservation.

- 6 If the participant replies "yes", record their response to the question in the results table column "Did the child show an understanding of conservation?" as "yes". If the participant

replies “no”, ask which lump of playdough is bigger and get them to point out which one. Record their response as “no” in the same column.

- 7 Based on the participant’s response, state which of Piaget’s four stages they are likely to be in, using the fourth column of the table.
- 8 Repeat steps 1 to 7 with the other two participants.

### Results

	Age of participant	Did the child show an understanding of conservation?	What stage of Piaget’s theory of cognitive development is the child likely to be in?
Participant 1	(age 2 to 7)		
Participant 2	(age 7 to 12)		
Participant 3	(age 12+)		

### Discussion

- 1 Identify the operationalised IV and operationalised DV from this experiment.
- 2 Did your results support Piaget’s theory of cognitive development? Justify your response with reference to your collected data.
- 3 Identify one limitation of this experiment and explain the impact of this limitation on the generalisability of your results.

### Conclusion

Formulate a conclusion for the experiment you conducted.

### What if?

- 1 What if we added another age group comprising children aged between 0 and 2 to the experiment?
- 2 What if the participants were blindfolded and could only touch the playdough, not see it?

# 3.1A

INVESTIGATION:  
CLASSIFICATION AND  
IDENTIFICATION

## How can we categorise typical and atypical behaviour?



### Investigation worksheet

3.1A How can we categorise typical and atypical behaviour?



### Resource

Observation checklist

### Context

This investigation is designed to contextualise the occurrence of typical and atypical behaviours.

### Aim

To identify and categorise typical and atypical behaviours according to psychological criteria, through observation.

### Materials

- Clipboard
- Pen
- Observation checklist (available in your obook pro)

### Method

- 1 Select a location in your school where you can observe the behaviours of other students without disturbing them.
- 2 Using the checklist in your obook pro, note down the first five specific behaviours that you observe from one or more students in your school.
- 3 In the appropriate row of the table, classify each observed behaviour as either typical or atypical. Justify your response with reference to relevant psychological criteria.

### Results

- 1 What percentage of the behaviours that you observed were classified as typical or atypical?
- 2 Calculate the class mean percentage of typical and atypical behaviours observed and record this in Table 1.

TABLE 1 Mean percentage of observed behaviours

	Typical behaviours	Atypical behaviours
Mean percentage of observed behaviours		

- 3 As a class, record in Table 2 the number of times that each of the psychological criteria was used by class members to classify behaviours as typical or atypical. Calculate this as a percentage.

TABLE 2 Number of times psychological criteria was used

Psychological criteria	Number of times used by class	Percentage
Cultural perspectives		
Social norms		
Maladaptive behaviours		
Statistical rarity		
Personal distress		

### Discussion

- 1 Overall, were more typical or atypical behaviours observed? With reference to psychological theory, explain why this might have happened.
- 2 Which psychological criteria was used to categorise behaviours the most? Discuss why this might have occurred.

- 3 Which psychological criteria was used to categorise behaviours the least? Discuss why this might have occurred.
- 4 Identify two potential sources of error in this investigation. Explain their impact on the validity of the results.
- 5 Suggest improvements to increase the validity of this study.

### **Conclusion**

Formulate a conclusion for the present investigation. Comment on any relevant limitations to the conclusion drawn.

### **What if?**

- 1 What if the participants knew they were being observed?
- 2 What if you observed the same participant every day for two weeks?

## 3.1B

### INVESTIGATION: CORRELATIONAL STUDY

# Is there a relationship between the number of atypical behaviours exhibited daily and perceived mental wellbeing?



#### Investigation worksheet

3.1B Is there a relationship between the number of atypical behaviours exhibited daily and perceived mental wellbeing?



#### Risk assessment

3.1B Is there a relationship between the number of atypical behaviours exhibited daily and perceived mental wellbeing?



#### Resource

Tracking sheet and questionnaire

## Context

Atypical behaviours are those that deviate from what is usually displayed by an individual, while typical behaviours are those that are consistent with how an individual usually behaves. When assessing a client, psychologists will often look to identify whether a client has been displaying any atypical behaviours, because this might be indicative of an issue or problem being faced by the client. In this investigation you will determine whether there is a correlation between the number of daily atypical behaviours exhibited and a person's perceived mental wellbeing.

## Aim

To investigate whether there is a correlation between the number of atypical behaviours exhibited daily and the overall levels of wellbeing in a sample of individuals.

## Materials

- Atypical behaviour tracking sheet and wellbeing questionnaire (available in your obook pro)
- A computer with statistical software (Microsoft Excel or Google Sheets)

## Method

- 1 Recruit a sample of 10 participants from your school or community who are willing to take part in the study. Ensure that you inform them of their participant rights and the purpose of the study.

- 2 Provide participants with four copies of the atypical behaviour tracking sheet and wellbeing questionnaire. Instruct them to complete the daily tracker and questionnaire at the end of the day, every day for four days.
- 3 Calculate the average wellbeing score and the average number of atypical behaviours for each participant. Make sure to deidentify participants.
- 4 Use Microsoft Excel (or Google Sheets or similar statistical software) to plot a correlation graph between participants' average number of atypical behaviours and average wellbeing scores and provide a correlation coefficient.

## Discussion

- 1 Interpret the correlation coefficient to describe the strength and direction of the relationship between atypical behaviours and wellbeing.
- 2 Data collected in this correlational study relied on self-reporting. Identify one strength and limitation of self-reports.
- 3 Explain why it was important that participants completed the tracker and questionnaire at the end of the day rather than at the start of the day.
- 4 Identify two implications of your findings.
- 5 Did the results of this investigation establish a causal relationship between the number of atypical behaviours exhibited and perceived wellbeing? Discuss why or why not.

**4.4A****INVESTIGATION:  
MODELLING****How can we model the structure of the brain?****Investigation worksheet**

4.4A How can we model the structure of the brain?

**Risk assessment**

4.4A How can we model the structure of the brain?

**Context**

The brain is a complex organ that controls our behaviours and emotions. Understanding the structure of the brain and its components can help us better understand how processes occur within the brain. Modelling and understanding areas of the brain can also give us information about the impacts of specific brain injuries. In this investigation you will use playdough to construct a model representation of the brain.



**FIGURE 1** In this investigation you will construct a three-dimensional model of the brain using playdough.

**Aim**

To construct a model of the brain showing major brain parts.

**Materials**

- Tubs of playdough or plasticine (in at least five different colours)
- Paper
- Coloured markers
- Scissors
- Toothpicks
- Sticky tape

**Method**

- 1 Break into pairs and ensure that your group has access to all the different colours of playdough.

- 2 Create a three-dimensional model of the brain using the playdough that shows the following key structures:

- left and right frontal lobes and primary motor cortices
- left and right temporal lobes and primary auditory cortices
- left and right parietal lobes and primary somatosensory cortices
- left and right occipital lobes and primary visual cortices
- corpus callosum
- Broca's area
- Wernicke's area
- cerebrum.

- 3 For each part listed in Step 2, write down the name of the part on a piece of paper and stick it onto a toothpick. Stick the toothpick into the area it represents to label your model.

**Discussion**

- 1 Describe the function of each of the following parts:
  - a frontal lobe
  - b occipital lobe
  - c temporal lobe
  - d parietal lobe
  - e primary motor cortex
  - f primary somatosensory cortex
  - g Wernicke's area.
- 2 Explain what impacts someone would experience if they had their corpus callosum severed.
- 3 Suggest why the primary motor cortex and primary somatosensory cortex are located next to each other.

**4.4B**INVESTIGATION:  
CASE STUDY**How can damage to the frontal lobe impact our experience of emotion?****Investigation worksheet**

4.4B How can damage to the frontal lobe impact our experience of emotion?

**Context**

Examine Malcom Myatt's case explained in the article below to answer the discussion questions.

**Unable To Feel Sad, Stroke Victim Malcolm Myatt Is Now A Permanent Smiley Face****By Susan Scutti, 13 August 2013**

Malcolm Myatt, 68, a retired truck driver who lives in Staffordshire, England, thought of himself as generally fit and healthy; he played football until he was 52 and also acted as a referee for games beyond that age, he told the *Daily Mail*. But around the time he turned 62, he suffered a stroke. After warning his wife that he might not make it through the night, the doctors explained that the stroke had damaged his frontal lobe. After a 19-week stay in the hospital, Myatt left with little feeling in his left side – he has no function in his left arm and must walk with a stick – and damage to his short-term memory. He also suffered another significant after-effect from the stroke, though “suffer” may not be the right word to use.

Myatt no longer feels sadness.

The frontal lobes, which stretch across both the right and left hemispheres of the brain, are the parts of our minds that participate in motor function, critical thinking, language, problem solving, memory, impulse control, and socialization, including sexual behavior. Because they provide the foundation of emotion and judgment, they are frequently seen as the seat of personality. Specifically, the right frontal lobe negotiates the non-verbal aspects of communication

and negative emotions, while the left frontal lobe deals with logic, language abilities, and positive emotions.

The right lobe is also perceived as the seat of empathy as it is the part of ourselves that can detect when someone is angry, sad, or scared by the tone of his or her voice or facial expression. Both lobes are also generally thought to play a role in our spatial orientation and how we pick up clues from our environment. In cases of mild to moderate traumatic brain injury, magnetic resonance imaging reviews show that the frontal area is the most common region of injury, according to the *Journal of Neurosurgery*. Many people who suffer brain injury, then, may have difficulty with reasoning and emotion.

The part of Myatt's brain that was damaged by the stroke was the right frontal lobe. Although frontal lobe damage is often permanent, rehabilitation often helps people regain some amount of functioning. Unfortunately, in many cases of frontal lobe damage, sufferers have problems with controlling their emotion, but it is rare for someone to entirely lose one emotion. Yet, by all accounts, that is certainly Myatt's experience.

“I am never depressed. Being sad wouldn't help anything anyway. It's an advantage really,” this grandfather of two, who now has a permanent smile on his face, told the *Daily Mail*.

His wife, Kath, puts it another way. “When he starts laughing everyone in the room does. He's infectious,” she told the *Telegraph*.



**FIGURE 1** Malcolm Myatt, pictured with his wife after his stroke

### Discussion

- 1 Using your knowledge of the link between brain structure and function, explain why emotional and motor problems are not uncommon after brain damage.
- 2 With reference to the role of the frontal lobe, explain why Malcolm was left with motor damage and an inability to feel sadness.

- 3 Create a visual representation of the motor homunculus indicating the area that was most likely damaged in Malcolm. Make sure to indicate which hemisphere was affected.
- 4 Outline the role of the hemisphere to which Malcolm suffered damage.
- 5 Explain how Malcolm's doctors could use observation to gather data on the effects of Malcolm's brain damage.
- 6 Identify the advantages and disadvantages of case studies as scientific investigations.
- 7 Discuss which neuroimaging technique would be helpful in locating the damage to the brain when Malcolm performed motor tasks with his hand.

### Conclusion

What conclusions can be made about the role of the frontal lobe in mental processes and behaviour, based on Malcolm's case?

### What if?

- 1 What if Malcolm's stroke caused damage to his left frontal lobe? Suggest the behavioural observations that would indicate that damage has occurred in this area.

## 5.1

### INVESTIGATION: LITERATURE REVIEW

# What strategies are effective in maximising brain plasticity and function?



#### Investigation worksheet

5.1 What strategies are effective in maximising brain plasticity and function?

### Context

Brain plasticity, also known as neuroplasticity, refers to the brain's ability to adapt, reorganise and optimise its function. Factors that can promote brain plasticity can, by extension, also play a pivotal role in enhancing cognitive function. In this activity, you will explore research on brain plasticity and the factors that influence plasticity to evaluate which strategies can be applied to help maximise brain plasticity and function.



**FIGURE 1** Keeping hydrated is important for maximising brain function

### Aim

To investigate which strategies are effective in maximising brain plasticity and function.

### Method

- 1 Gather secondary data related to brain plasticity and function to answer the discussion prompts below. You can source your secondary data from the internet, scientific journals, books, scientific magazines, videos or podcasts.
- 2 Use the CRAAP method (refer to Topic 6.1 in Chapter 6) to evaluate the reliability of your sources.
- 3 Make notes about what you have learnt. You can organise your information in different ways.
- 4 Prepare a written report that answers the discussion questions below.

### Discussion

- 1 What is brain plasticity and what factors influence brain plasticity?
- 2 What factors (biological, psychological, social) promote brain plasticity and optimal brain functioning and how do they work?
- 3 What are the strategies, interventions or practices that have been studied or proposed to promote brain plasticity? How effective are these strategies?
- 4 How can the insights gained from research on brain plasticity be applied in educational settings, clinical practice or everyday life?

## 5.6

INVESTIGATION:  
PRODUCT, PROCESS OR  
SYSTEM DEVELOPMENT

## How can we minimise head injuries in contact sports?



## Investigation worksheet

5.6 How can we minimise head injuries in contact sports?

**Context**

Chronic traumatic encephalopathy (CTE) has become an important topic of discussion within sports and neuroscience. Research suggests that those who have played and currently play high-contact sports are at a high risk of developing the progressive brain disorder. The damage and degeneration of the brain caused by the impact of head injuries is probably associated with the development of CTE, but this is yet to be confirmed. Contact sports can often lead to concussions, which are traumatic brain injuries that alter the way the brain functions. At present, athletes must wear the recommended protective wear for their sport and follow a doctor's recommendations if they want to return to the sport after a concussion.

**Aim**

To design a preventative piece of sporting equipment that can be used to minimise head injuries in contact sport.

**Method**

- 1 Research a contact sport or range of sports and investigate how head injuries and concussions usually occur in that sport(s).

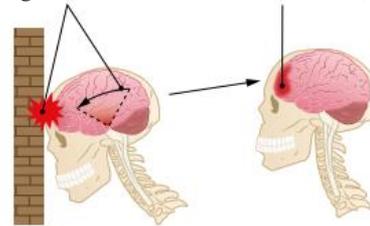
In your research you will want to consider:

- areas of the brain that are frequently affected
- how most injuries occur (collisions, falling, etc.)
- the types of impact (for example, blows, shaking, jolting) that can occur
- how much force is usually behind the injury
- the sort of surface and equipment the sport is played on and whether this can affect head injuries.

Make notes on the following research prompts and use them to guide your research in the next design steps.

When the brain is knocked, jolted or shaken by something it can shift and hit against the skull.

This can cause concussion through bruising, swelling and breaking of blood vessels and/or nerves.



**FIGURE 1** How concussion and head injury occurs in contact sports

- 2 Use your findings from step 1 to research what sort of safety equipment might be effective in preventing injury in your chosen sport. Identify what features could be added or modified to maximise protection in relation to your specific sport. Research different materials used for safety equipment and compare their effectiveness in preventing injury.
- 3 Use the research you have collected to design your product. Sketch a labelled diagram of your design that shows a justification for your choice of features and materials used (you may choose to do this by hand or on your device).

**Discussion**

- 1 Explain the link between head injuries in athletes and CTE.
- 2 Describe the measure you have designed to help prevent or reduce head injuries in sport.
- 3 Discuss the scientific knowledge you have used to support the use of your preventative measure in contact sport.
- 4 Identify one limitation of your product design. Explain how this limitation could be improved next time.
- 5 State whether you believe your product would be able to eliminate the chances of concussion occurring in your chosen sport. Justify your answer.

# 7.1

INVESTIGATION:  
CONTROLLED  
EXPERIMENT

## How does age affect person perception?



### Investigation worksheet

7.1 How does age affect person perception?



### Risk assessment

7.1 How does age affect person perception?



### Resource

Image test

### Context

Whenever we meet and interact with another person, we gather information about them, such as their personality, intelligence, occupation, hobbies, likes and dislikes. We gradually develop an accumulation of this information that contributes to our social cognition.

Because social cognition develops over time and experience, it is possible to infer that understandings we base our person perception on change as we grow older and have more wisdom. In this experiment, you will explore whether there are general differences in person perception across different age groups, and the extent to which they are different.

### Aim

To determine whether person perception, as a measure of social cognition, is different across age groups.

### Materials

- Copy of the image test (available in your obook pro). The image test can be distributed electronically or in hard copy.

### Method

- 1 Using a sampling procedure of your choice, generate three sample groups consisting of at least 10 participants per group. Each group must consist of participants in a specific age group. For example, participants aged 14 to 18 years, participants aged 25 to 35 years and participants aged 50 years and over. Ensure that your sample groups cover a range of years.
- 2 Instruct participants to complete the image test in a quiet environment free from distractions. Participants should complete the image test individually.

- 3 Inform participants that they need to be honest in their responses, and that it is not a test, but a measure of their personal opinions regarding the images.
- 4 Debrief participants following the conclusion of the image test. Analyse the data to determine patterns of person perception across the age groups.

### Results

- 1 Determine which personality traits were most commonly used for each of the images (the mode).
- 2 Of personality traits chosen, determine whether there were trends in the preferences of traits.
- 3 Determine whether there were common themes for the reasons participants chose those personality traits.
- 4 Determine whether there were common occupations that were indicated by participants for each of the images.
- 5 Determine whether there were common themes for the reasons participants chose those occupations.

### Discussion

- 1 Write a hypothesis for this experiment.
- 2 Outline the reasons why the results support or do not support the hypothesis, making direct reference to your data.
- 3 Summarise any key themes and commonly occurring personality traits that were evident in the results. Include reference to any relevant ideas on social categorisation, saliency detection and physical cues.
- 4 Discuss what your results suggest about age and person perception.

- 5 Identify two potential issues or factors that may have affected your results and explain their potential impact.
- 6 Propose two improvements to the experiment that could address any potential issues you identified in the previous question.

### **Conclusion**

Provide a paragraph to summarise the purpose of the experiment, results and the key findings that could be drawn from the experiment in relation to age, person perception and social cognition.

### **What if?**

- 1 What if the independent variable was changed to gender?
- 2 What if you used priming on participants before they conduct the image test?

## 8.4A

### INVESTIGATION: CORRELATIONAL STUDY

# Is there a relationship between time spent on social media and perceived social connectedness?



#### Investigation worksheet

8.4A Is there a relationship between time spent on social media and perceived social connectedness?



#### Risk assessment

8.4A Is there a relationship between time spent on social media and perceived social connectedness?



#### Resource

Participant questionnaire and results table

### Context

Social media has become an essential part of day-to-day life for most people, particularly adolescents. While social media can keep us connected to people we care about and connect us to different groups and networks, studies have linked excessive social media use to feelings of loneliness (Savci & Aysan, 2016; Marttila et al., 2021). In this task, you will conduct a correlational study by surveying members of your class or school and examining results to determine whether a relationship exists between time spent on social media and perception of social connectedness.



**FIGURE 1** Spending time on social media each day is common among young people, but can it leave us feeling more disconnected?

### Aim

To determine whether a relationship exists between time spent on social media and perception of social connectedness.

### Materials

- Copy of a questionnaire for each participant (available in your [obook pro](#))
- Results table (available in your [obook pro](#))
- Computer with access to a graphing program, such as Microsoft Excel

### Method

- 1 Find 20 participants to participate in your correlational study.
- 2 Supply each participant with a copy of the questionnaire and inform them of their participant rights.
- 3 Collect all responses from the questionnaires and enter this data into the results table.

- 4 Enter the results into Microsoft Excel to create a scatterplot that shows the relationship between time spent on social media and perception of social connectedness.
- 5 Use your understanding of correlation (refer to Topic 1.6 in your Psychology toolkit if needed) to determine if a relationship between the two variables exists.

### Discussion

- 1 Identify the independent and dependent variables in this study.
- 2 Write a hypothesis for this investigation.
- 3 Use the scatterplot you created to answer the following:
  - a What sort of relationship was shown from your scatterplot? Justify your answer.
  - b What does the relationship seen in your scatterplot suggest about time spent on social media and perceived social connectedness?
- 4 Describe how social media use can positively and negatively affect our sense of social connectedness.
- 5 What other factors (apart from social media use) could have influenced participants' perception of social connectedness?
- 6 Describe one change you could make to this study to improve the reliability of results.
- 7 Explain why this study is considered a correlational study rather than a controlled experiment.

### Conclusion

- 1 Collate all your responses from the discussion questions/prompts and generate a final summary about the relationship between time spent on social media and perceived social connectedness.

### What if?

- 1 What if time spent on social media was changed to time spent playing video games – would you expect to see a similar relationship?

**8.4B**INVESTIGATION:  
CASE STUDY**How can advertising affect our individual behaviour?**

## Investigation worksheet

8.4B How can advertising affect our individual behaviour?

**Context**

Corporations and businesses have a long history of using advertising as a means of encouraging the public to use a particular service or purchase a particular product. Methods of advertising have changed along with technology. Advertisements now extend beyond printed media, such as newspapers and magazines, to television advertisements, websites and social media platforms. The intended purpose of advertising, however, has remained constant, with producers and designers of advertisements deliberately and strategically designing advertisements to influence individual behaviour through social psychology concepts.

In this task, you will conduct a case study by examining three advertisements of different mediums. You will then use psychological theory to analyse your observations on the design of the advertisements.

**Aim**

To analyse which social psychology concepts are used in advertising.

**Materials**

- Computer with internet access

**Method**

- 1 Select a product or service that you are interested in (such as food, clothing, a cleaning service or a similar product or service).
- 2 Conduct online research to find three different advertisements related to the product or service of your choice. Your advertisements should come from different companies and be varied in their approach to communicating their message (for example, different media formats, styles, who or what is being involved in the advertisement).
- 3 Write a written report on your case study, based on the discussion questions/prompts below.

**Discussion**

- 1 Analyse each advertisement by addressing the following:

- a Summarise the events of the advertisement, addressing the story of the advertisement and how it is portrayed.
- b Identify whether there are any figures of authority in the advertisement.
- c Identify the types of powers that are being used in the advertisement.
- d Identify whether concepts of obedience or conformity are used in the advertisement.
- e If obedience is being used in the advertisement, identify which factors contributing to obedience are being used in the advertisement and how they are used.
- f If conformity is being used in the advertisement, identify which factors contributing to conformity are being used in the advertisement and how they are used.
- g Identify whether upward and/or downward comparison is being promoted in the advertisement and how it is being promoted.
- h Summarise the effects of social comparison being used in the advertisement.

- 2 Using your responses from the previous step, write a comparison of the three advertisements. Highlight similarities and differences for any approaches or social psychology concepts used between the advertisements.
- 3 Use the internet or information from Chapter 8 to explain the psychological strategies used in advertising to influence behaviours.

**Conclusion**

- 1 Collate all your responses from the discussion questions/prompts and generate a final summary about how advertising can be used to influence individual behaviours.

**What if?**

- 1 What if the advertisements you examined were only printed? Would the same strategies and social psychology concepts be as effective in printed advertisements?

# 9.1

INVESTIGATION:  
FIELDWORK

## Have you been paying attention?



### Investigation worksheet

9.1 Have you been paying attention?



### Risk assessment

9.1 Have you been paying attention?

### Context

We live in a fast-paced world where environmental stimuli are constantly competing for our attention. Something as simple as walking through a shopping centre can be challenging if we cannot maintain our attention on the takeaway shop we want to buy lunch from, direct our attention to where we are walking so that we do not bump into other people, or tune out the music playing from each shop we pass.

In this investigation, you will observe the behaviour of people in a busy environment and explore how they use their attention to interact with the world.

### Aim

To observe the behaviour of people in your local environment and evaluate how they are using their attention to interact with the world.

### Materials

- A pen or pencil to record observations.  
**Note:** this investigation can also be completed using a laptop.

### Method

- Visit a busy environment. Examples include the school yard during lunchtime, your local shopping centre or a café. Find a spot at your location where you can sit down and observe at least five different people (ideally, between 10 and 15).
- Assign each person an identifier, such as a number, letter, colour or simply use a description of their appearance. **Note:** When you organise your responses later, you will need to deidentify them.
- Observe their behaviour and record this data in a table similar to that shown in Table 1. You might like to note down things such as where their vision is directed, whether or how they are engaging with objects or people around them, whether there is a discrete task they are completing and how long it takes them to complete it.

### Results

**TABLE 1** Observations from investigation. Add as many rows as required.

Participant	Description	Observations	Types of attention
1			
2			
3			
4			
5			
6			

### Discussion

- In Topic 9.1 of Chapter 9, you learnt about three types of attention: sustained attention, selective attention and divided attention.
  - Define the three types of attention and give examples of each from your investigation.
  - Identify whether or not you (the investigator) are demonstrating the three types of attention during your data collection. Justify your response.
- For each individual, identify the types of attention that they are demonstrating and justify your responses.
- Select an example of divided attention from your investigation.
  - List the tasks that the individual is performing and classify them as automatic or controlled processes.
  - Explain how the individual is able to perform the tasks simultaneously.
  - Predict what will happen if the individual begins an additional task.
- Explain why selective attention is an important process that allows us to demonstrate sustained attention. Provide evidence of this relationship by referring to an example from your investigation.

## 9.2

### INVESTIGATION: CONTROLLED EXPERIMENT

# How does perceptual set affect your perception of rat-man?



#### Investigation worksheet

9.2 How does perceptual set affect your perception of rat-man?



#### Risk assessment

9.2 How does perceptual set affect your perception of rat-man?



#### Resource

Figure 1 and Figure 2 printout

### Context

Bugelski and Alampay (1961) performed the famous rat-man experiment. One group of participants was shown a series of line drawings of animals. The other group was shown a series of line drawings of human faces. Both of these are shown in Figure 1.

All participants were then shown the ambiguous rat-man stimulus shown in Figure 2. The majority of the first group identified it as a rat or mouse, while the majority of the second group identified it as an old man. This shows how perceptual set, created by immediate prior experience, influences perception.

In this investigation, you will conduct your own experiment on the effect of perceptual set on the perception of an ambiguous figure.

### Aim

To investigate the effect of perceptual set on the perception of an ambiguous figure.

### Materials

- Four black line drawings of different animals (Figure 1)
- Four black line drawings of different human faces (Figure 1)



FIGURE 1 Participants were shown either line drawings of animals or human faces.



FIGURE 2 The ambiguous “rat-man” stimuli – do you see a rat or a man?

- Image of ambiguous figure, “rat-man” (Figure 2)
- A pen or pencil to record responses. **Note:** this investigation can also be completed using a laptop.
- Ideally, a total of 20 participants for each group (animals line drawings; human faces line drawings). **Note:** you will also need one person to show the images and one to record the results.

### Method

- 1 Divide the participants into two groups and place them in different areas or rooms (independent groups design).
- 2 Show each participant in Group 1 the series of four animals for 30 seconds and then the ambiguous figure (rat-man) in one room or area. Record responses in a table similar to Table 1.
- 3 Show each participant in Group 2 the series of four faces for 30 seconds and then the ambiguous figure in another room or area. Record responses in a table similar to Table 1.

## Results

**TABLE 1** An example of a data sheet to collect data for this investigation. Add as many rows as required.

Participant	Group	What is the ambiguous figure? An animal, face or other?
1	1	
2	1	
3	1	
4	2	
5	2	
6	2	

- 1 Collate individual results to create a class set of data.
- 2 Calculate the percentages of participants perceiving the ambiguous figure as an “animal”, “face”, or “other”. Record your results in Table 2.

**TABLE 2** Calculated percentages

Group	% seen as “animal”	% seen as “face”	% seen as “other”
1 (animals)			
2 (faces)			

## Discussion

- 1 Identify the operationalised IV and operationalised DV from this experiment.
- 2 Write a hypothesis for this experiment.
- 3 Explain whether your hypothesis was supported by the results of your experiment.
- 4 Identify whether this experiment demonstrates bottom-up or top-down processing. Justify your response.
- 5 Explain how perceptual set affects perception.
- 6 Identify and explain any possible extraneous or confounding variables.
- 7 Outline the steps you could take to control these unwanted variables in the future.

## Conclusion

Formulate a conclusion for the experiment you conducted.

## What if?

- 1 What if you used photographs of people instead of black line drawings?
- 2 What if you used a different ambiguous figure such as “young woman/old woman”?

## 9.3

INVESTIGATION:  
SIMULATION

## What does the world look like with red-green colour vision deficiency?



## Investigation worksheet

9.3 What does the world look like with red-green colour vision deficiency?



## Resource

Color Blind Pal

## Context

Colour vision deficiency or colour blindness affects many people worldwide. In fact, it is estimated that 1 in 12 men (8 per cent) and 1 in 200 women (0.5 per cent) across the globe have red-green colour vision deficiency. There are four categories of red-green colour vision deficiency (Figure 1).

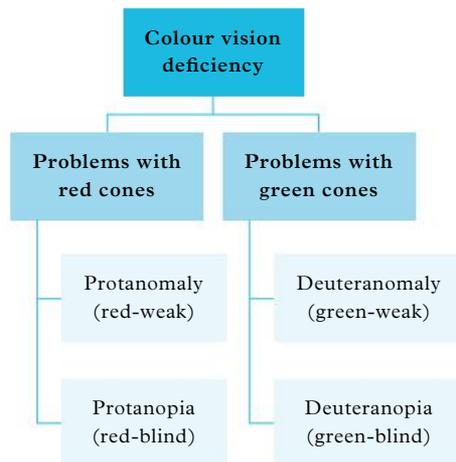


FIGURE 1 Red-green colour blindness

In this investigation, you will use an app to simulate deficiencies in red and green colour vision, as well as complete red and green colour blindness, and make predictions about how this will affect your visual perception.

## Aim

To investigate colour vision deficiency and colour blindness using a simulator.

## Materials

- Either an iOS or Android mobile phone or tablet with a camera, or a Mac laptop with a camera
- The Color Blind Pal app

## Method

- 1 Go to the Color Blind Pal website (link in your obook pro) and follow the instructions to download the Color Blind Pal app for iOS, Android or Mac devices.
- 2 Launch the app and go to Preferences by clicking the cog icon (⚙️ – second icon in the top left corner). Select Color Blindness Type. There are four types of filters you will use:
  - “Protanopia (red deficiency)” – protanomaly
  - “Deuteranopia (green deficiency)” – deuteranomaly
  - “Simulate protanopia” – protanopia
  - “Simulate deuteranopia” – deuteranopia.

**Note:** Alternatively, you can select the levels icon (≡ – first icon in the top right corner) to easily switch between types of filters. **R** is protanomaly, **G** is deuteranomaly, **R** is protanopia and **G** is deuteranopia.

- 3 Once you have selected your filter, click the magnifying glass icon (🔍 – large middle icon on the top) to switch it to the filter mode. The icon should become three rings overlapping in the middle like a Venn diagram (🔍).

## Part A - Simulating colour deficiency

- 1 Look at Figures 1 to 8 using the “Protanopia (red deficiency)” and “Deuteranopia (green deficiency)” filters. You can either use the camera on your device or load the image file directly into the app using the gallery icon (  ). Describe your observations. You might like to record your results in a table.



FIGURE 1 A red apple tree



FIGURE 2 Data represented by pie charts and column graphs



FIGURE 3 Composite image of a park in spring, summer, autumn and winter



FIGURE 4 Pencils in different shades of green



FIGURE 5 Bananas of different ripeness



FIGURE 6 Slippery road warning sign on a mountain road



FIGURE 7 Traffic light



FIGURE 8 Rash on baby's cheek

### Part B – Simulating colour blindness

- 1 Look at Figures 1 to 8 using the “Simulate protanopia” and “Simulate deuteranopia” filters. Describe your observations.

### Discussion

#### Part A – Simulating colour deficiency

- 1 Identify the type of photoreceptor affected in colour vision deficiency.
- 2 Compare each of the images viewed with the protanomaly and deuteranomaly and describe any differences in colour perception.
- 3 People with deuteranomaly have greater sensitivity to shades of khaki (tan). Suggest an advantage of this.

#### Part B – Simulating colour blindness

- 1 Describe the main biological difference between colour deficiency (–anomaly) and colour blindness (–anopia).
- 2 Summarise the differences between your observations with the colour deficiency filter compared to the colour blindness filter.

- 3 Colour is an important factor that affects how you make sense of and interact with the world around you.
  - a Describe the implications of red–green colour vision deficiency on your visual perception of Figures 1 to 8.
  - b For each, explain how altered colour perception could affect your behaviour.
  - c Select one image and suggest some colour-independent clues that people with red–green colour vision deficiency could use to make sense of their surroundings.
- 4 Short- and long-sightedness can be corrected using glasses that contain different shaped lenses. Conduct some research to determine whether colour deficiency can be corrected in a similar manner. If it can, provide a brief summary of how.

## 10.2

INVESTIGATION:  
CONTROLLED EXPERIMENT

# Does perceptual set influence our judgment of flavours?



### Investigation worksheet

10.2 Does perceptual set influence our judgment of flavours?



### Risk assessment

10.2 Does perceptual set influence our judgment of flavours?

**DISCLAIMER:** This investigation involves participants consuming a range of foods. Ensure that allergies are checked and full consent is given prior to conducting. Be sure to inform participants that the variety of foods might include items they would not normally be accustomed to eating.

### Context

Our expectations of what food will taste like can strongly influence our judgment of food flavours. Our perception is influenced by our past experiences and culture. Foods that have been considered “normal” to our culture and experience are likely to be judged as desirable, whereas foods that are foreign to our culture and experience are likely to be considered undesirable.



**FIGURE 1** Did you know that dried cricket powder can contain up to three times more protein than red meat per gram? Insect protein sources could be the way of the future, that is, if many people can change their perception of insects!

### Aim

To determine whether perceptual set has an effect on the judgment of food flavours.

### Materials

- Two “exotic” food samples (for example, insect lollipops, green ant marmalade, flavoured crickets)
- Two popular food samples (such as avocado, strawberries, potato chips)
- Napkin or plate for food samples to be placed on for each subject

- Tongs or utensils for serving food samples
- Labels for food samples (experimental group)
- Blindfolds
- Cups
- Water
- Data table
- Pen for recording

### Method

- 1 Recruit volunteer subjects. Identify subjects with any known food allergies and excuse them from participating.
- 2 Explain participants’ rights to each subject.
- 3 Randomly place subjects into either the control or experimental condition by placing names in a hat, drawing out one by one and allocating in turn to each condition.
- 4 Prepare food samples by placing a small amount for “tasting” onto a plate or napkin. Prepare a set of labels for the foods to be presented to the experimental group and place next to each food sample.
- 5 Ideally, set up a space to test each subject individually if possible.
- 6 Create a data table to record results for both the control and experimental groups that includes:
  - a confidential subject identification (such as a number) for each subject
  - rating scale of 1 to 5 for each food to be tested, where 1 = strongly disliked taste and 5 = strongly liked taste.

Alternatively, you can use the example results table provided in your obook pro.
- 7 Test your control group by:
  - placing blindfolds on subjects so they are unable to see the food samples
  - providing a cup of water to each subject to take a small sip in between food samples

- presenting each subject with their plate of samples (ask them to taste each food sample in a specified order)
  - asking subjects to identify their enjoyment of the flavour of each food on a scale of 1 to 5.
- 8 Record the rating on a scale of 1 to 5 in a data table.
  - 9 Repeat Step 7 for your experimental group, but do not blindfold participants.

### Results

- 1 Calculate a mean rating score for the experimental and control groups.
- 2 Present the data in a graph with labelled axes. Include a title for your graph.
- 3 Describe the data for each group.

### Discussion

- 1 Was there a difference between the mean scores for each group? Describe the difference.
- 2 Identify the IV and DV for this experiment.
- 3 Was this data objective or subjective? Give reasons for your choice.
- 4 What experimental research design was used in this experiment?
- 5 Why was water given to subjects in between each food sample?

- 6 If there was a difference in mean scores for each group, explain the reasons for this difference. Include a reference to perceptual set, and how this may have influenced any difference observed.
- 7 Explain why the control group was blindfolded and the experimental group was not.
- 8 Identify ways in which this was a fair test.
- 9 Identify potential extraneous variables that may have influenced the results of this experiment.
- 10 Discuss the importance of ethical considerations in conducting this experiment and explain how each ethical consideration was addressed by the experimenter.

### Conclusion

With reference to the findings of this experiment, discuss whether perceptual set can influence the judgment of food.

### What if?

- 1 What if foods were not labelled for the experimental group?
- 2 What if only exotic foods were used in this experiment?
- 3 What if only commonly eaten foods were used in this experiment?

**10.3****INVESTIGATION:  
LITERATURE REVIEW****How can a non-synaesthete acquire synaesthesia?****Investigation worksheet**

10.3 How can a non-synaesthete acquire synaesthesia?

**Context**

Synaesthesia is a neurological condition that describes when a person experiences more than one sensory response when exposed to a stimulus. The experience of synaesthesia can result from genetics, where genes are passed on that alter the neural pruning stages during development. Non-synaesthetes can also acquire synaesthesia later in life due to changes in brain structure and function. In this investigation, you will examine the events that can cause acquired synaesthesia and explore how this may alter a person's perception of the world.



**FIGURE 1** Most synaesthetes are born with their condition, but there have been cases of people developing synaesthesia later on in life. Imagine if your perception changed so that you began to associate each letter with a colour or each sound with a taste.

**Aim**

To investigate the events can cause acquired synaesthesia and examine how acquired synaesthesia affects a person's perception of the world.

**Method**

- 1 Gather secondary data related to synaesthesia and discussion prompts below. You can source your secondary data from the internet, scientific journals, books, scientific magazines, videos or podcasts.
- 2 Use the CRAAP method (refer to Topic 6.1 in Chapter 6) to evaluate the reliability of your sources.
- 3 Make notes about what you have learnt. You can organise your information in different ways.
- 4 Prepare a written report that answers the discussion questions below.

**Discussion**

- 1 What is synaesthesia and what types of synaesthesia exist?
- 2 What causes the occurrence of synaesthesia in people who have always been synaesthetes?
- 3 What causes the occurrence of synaesthesia in people who are non-synaesthetes? Give specific examples where possible and include descriptions of the types of synaesthesia acquired.
- 4 How do people who acquire synaesthesia later in life find the experience compared to their previous perception of the world?

# GLOSSARY

## A

### **abnormality**

deviation from the norm

### **Aboriginal and Torres Strait Islander health worker**

allied health worker who has an understanding of the health issues relevant to Aboriginal and Torres Strait Islander peoples and uses this to provide culturally responsive health services

### **Aboriginal and Torres Strait Islander peoples**

past and current descendants of the original inhabitants and custodians of the land we know today as Australia

### **absolute threshold**

the minimum strength or amount of stimulus required to perceive a stimulus, in ideal conditions, 50 per cent of the time

### **abstract thinking**

the ability to perform mental operations without reliance on seeing or hearing physical elements of the world, but instead being able to perform these in one's head

### **accommodation**

the process whereby pre-existing ideas are changed or adapted to fit new information or experiences

### **accommodation (eyes)**

the ability of the lens to change shape in order to focus light on the retina

### **accuracy**

how close experimental data is to the true value

### **acquired**

a disease or condition that develops after birth

### **acquired brain injury (ABI)**

injury to the brain that occurs after birth

### **adaptive**

a term used to describe when something is considered beneficial for survival or functioning

### **adaptive behaviour**

a behaviour that allows a person to successfully cope in their environment

### **adaptive cognition**

mental process that is beneficial for survival

### **adaptive emotion**

psychological feeling that is beneficial to survival

### **addiction**

a compulsive, chronic, physiological or psychological need for a substance, behaviour or activity that is difficult to control or stop despite harmful effects

### **affect heuristic**

the tendency to rely on our emotions, rather than facts, knowledge or cognitions to make decisions in social interactions

### **affective component**

in relation to the tri-component model of attitudes, the feelings and emotions we have towards an attitude object

### **agnosia**

neurological disorder resulting in difficulty recognising objects, faces, voices or places

### **agoraphobia**

an anxiety disorder characterised by fear of leaving environments that a person knows or considers to be safe

### **aim**

the primary focus of the research that states the purpose of the research

### **Alzheimer's disease**

a progressive neurological condition that leads to brain atrophy and the decline of mental function

### **Ames room illusion**

an illusion created by a deliberately misshapen trapezoidal room where people walking across the room appear to be growing and shrinking in size

### **anecdote**

a personal account or story that is often used to illustrate a point or make an argument

### **aneurysm**

an abnormal bulge in the wall of a blood vessel

### **animism**

a limitation of young children's thinking where they believe that everything is alive and conscious

### **anoxic brain injury**

injury to the brain caused by cutting off oxygen supply

### **anterograde amnesia**

a partial or complete inability to create new memories

### **anticonformity**

an individual's position or opinion in relation to the group that directly opposes the group majority

### **assimilation**

the process whereby new experiences and ideas are made to fit in with pre-existing ideas and understanding

### **association area**

part of the cerebral cortex that receives inputs from multiple areas

### **attachment**

the emotional bond formed between an infant and a caregiver

### **attention**

the behavioural and cognitive ability to process specific information actively, while ignoring other competing information

### **attention deficit hyperactivity disorder (ADHD)**

a neurodevelopmental disorder characterised by inattentive and/or hyperactive-impulsive symptoms

### **attitude**

a relatively enduring positive or negative evaluation of an attitude object

### **attitude object**

what you make a judgment about or have positive or negative feelings towards

### **attribution**

an inference made about the causes of events and behaviours (our own and others')

### **atypical behaviour**

behaviour that is unexpected or inconsistent with what would generally occur within a particular situation or circumstance

### **auditory tactile synaesthesia**

a form of synaesthesia where sounds are perceived to have a physical sensation, such as pressure, heat or pain

### **authority**

the capacity to influence others

### **autism spectrum disorder (ASD)**

neurodevelopmental disorder characterised by problems with social communication and restrictive or repetitive behaviours and interests

### **automatic process**

motor/procedural action or cognitive process that requires little mental effort, such as walking or riding a bike

### **autonomy**

Erikson's term for children wanting independence as their mental and physical abilities develop

### **autopsy**

medical examination of a body after death

### **availability heuristic**

the tendency to make decisions based on how easily memories and thoughts about a person, event or object come to mind

## B

### **bar chart**

a pictorial representation of data where the numeric values of variables are represented by height or lengths of bars

### **base-rate fallacy**

an error in decision-making that stems from information about the rate of occurrence of a trait in a population (the base rate) being ignored

**behaviour**

physical action undertaken by individuals

**behavioural component**

in relation to the tri-component model of attitudes, our observable actions in response to an attitude object

**beneficence**

the ethical principle of a commitment to minimising risk and doing good

**between-subjects design**

a subject-selection procedure where participants are allocated at random to either E-group(s) or the C-group

**bibliography**

a full list of all the resources used in some research, provided at the end of a report or submitted along with another form of presentation

**bidirectional**

where a relationship of influence travels in two directions

**binocular depth cue**

a depth cue that requires information from both eyes to be made sense of by our brains

**biological factor**

factor relating to physiological functioning that originates from within the body

**biopsychosocial model**

a holistic framework used to consider and categorise all the biological, psychological and social factors that influence a person's psychological development and mental wellbeing

**bottom-up processing**

a type of perceptual processing that involves gathering all the sensory information before adding meaning to it

**brain mapping**

a technique that uses a combination of tools to record brain activity and create a visual map that shows information about brain functioning

**brainstem**

a structure of the brain (composed of the midbrain, pons and medulla) that connects the cerebrum to the spinal cord and cerebellum

**brand**

the unique name or identity of a company selling a product

**Broca's aphasia**

a language disorder that occurs when Broca's area is damaged and patients cannot produce clear speech

**Broca's area**

brain region in the frontal lobe responsible for language production

**C****camouflage**

the blending of figures into the background by breaking up contour lines

**carpentered world hypothesis**

a theory applied to the Müller-Lyer illusion that proposes that our familiarity with the straight lines and angles of buildings informs our interpretation of linear perspective in pictorial depth perception

**case study**

in-depth study of one person, a group or event

**causation**

a cause-and-effect relationship, where changes in one variable lead directly to changes in another variable

**central nervous system**

the brain and spinal cord

**centration**

a limitation of young children's cognition that only allows them to focus on one aspect of a task at a time

**cerebellum**

major structure of the hindbrain, located at the base of the brain; plays a key role in coordinating voluntary movements and maintaining balance and posture

**cerebral cortex**

the outer layer of the cerebrum

**cerebral hemisphere**

one of the two major parts of the cerebrum; left and right hemispheres of the brain

**cerebrum**

the biggest part of the forebrain and where most of the important brain functions happen, such as higher cognitive functions like thinking, planning, learning and reasoning

**chemoreceptor**

a protein or cell in the body that responds to chemical stimuli

**chromaesthesia**

a form of synaesthesia where sounds are perceived to have colours

**chronic traumatic encephalopathy (CTE)**

a progressive brain condition associated with repeated head trauma and concussion

**clinical interview**

a qualitative research technique where an interviewer has a dialogue or conversation with the participant that is not structured or contains unstructured questions

**clique**

a group type consisting of a smaller number of friends, often of similar age and gender, who are able to communicate more easily with each other and have more significant levels of attachment and complex interactions

**cognition**

the mental process that individuals undertake, such as planning, thinking and evaluating

**cognitive behavioural therapy (CBT)**

a form of psychotherapy based on the presumption that thoughts and behaviours influence one another; patients are encouraged to identify maladaptive thoughts and behaviours and replace them with more adaptive alternatives

**cognitive bias**

systematic errors in thought processes and thinking that affect decision-making and problem-solving

**cognitive component**

in relation to the tri-component model of attitudes, the knowledge and understanding we have about an attitude object

**cognitive development**

the development of mental processes and abilities throughout the life span

**cognitive dissonance**

an unpleasant psychological state of tension or anxiety created when two or more cognitions (thoughts, attitudes or beliefs) or a cognition and behaviour are inconsistent with one another

**cognitive load**

the amount of information that our brains can handle at one time

**collective group**

a group type of two or more individuals who have minimal interaction with each other, yet still influence each other and share similar goals

**collectivist culture**

culture that emphasises the needs and desires of the group more than the needs and desires of individuals

**colour intensity**

depth of colour

**colour vision deficiency**

an eye condition in which sensitivity to certain wavelengths of light is reduced; previously known as "colour blindness"

**command term**

verb that relates to performing a particular task, set of tasks or mental processes

**comorbid**

present at the same time as another condition

**concept**

a mental representation that organises ideas and observations into a clear structure or framework

**conclusion**

a summary of the findings and results obtained from the study or investigation

**concrete operational stage**

the third stage in Piaget's theory of cognitive development, where children aged seven to 12 years can perform basic mental operations that involve physical objects

**concussion**

a brain injury caused by a bump, blow or jolt to the head

**confederate**

a person in a psychological experiment who pretends to be a subject but is actually working for the experimenter

**confidentiality**

participants must not be identified in any way in terms of test results, their involvement in the study or any other confidential data

**conformity**

the act of changing one's behaviour to match the responses of others in a group

**confounding variable**

an unwanted variable that has a systematic effect on the value of the dependent variable. If a confounding variable exists, no valid conclusions about the research can be drawn.

**congenital**

a disease or condition present at birth

**congenital achromotopsia**

an eye condition in which individuals are born with black and white vision

**conservation**

a development in cognition where children become able to understand that the same object can take different forms, or that an object can stay the same even if it changes appearance

**contact comfort**

the positive emotional state experienced by organisms when they are in proximity to something soft, such as their mother or other soft material

**contemporary psychological research**

a recent (relevant to the last 12 months) area of psychological research

**contradictory data**

incorrect data

**contralateral organisation**

where the arrangement of an area is responsible for controlling the opposite side

**control group (C-group)**

the group of research participants not exposed to variations in the independent variable; the results are compared with the experimental group so that the effects of the independent variable can be determined

**controlled observation**

observation of voluntary behaviours within a structured environment such as a laboratory

**controlled process**

action that requires significant focus and mental effort to be performed, such as writing an essay or talking to a friend

**controlled variable**

a variable that a researcher keeps constant (controls) in an investigation

**convergence**

the ability of the eyeballs to relax or turn inwards to focus on objects at different distances

**corpus callosum**

bundle of nerve fibres separating the left and right 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 are different in relation to each other

**cortical lobes**

the major identifiable regions of the cerebral cortex that are each associated with specific functions

**counterbalancing**

a method for controlling order effects in a repeated measures design

**Country**

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

**craniotomy**

a surgical procedure where part of the skull is removed to expose the brain

**critical period**

a period of time during development when an individual is especially susceptible to specific environmental experiences that shape their development, and their development is particularly vulnerable to deprivation of this experience

**cross-cultural study**

an investigation comparing two or more different cultures

**cultural norm**

an informal rule or standard understood by members of a group or society

**cultural perspective**

a criterion used to classify behaviour as typical or atypical according to what would be expected in line with the beliefs and values of a given culture

**culturally responsive practice**

approach towards mental health care where diverse factors, such as cultural beliefs, are considered and respected in terms of their possible impacts on an individual's psychological development and mental wellbeing

**culture**

the various characteristics, such as values, beliefs and knowledges, that are shared among members of a particular group or society

**cyberbullying**

the use of electronic media to bully or intimidate a person

**D**

**debriefing**

the experimental process during which, 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**

the provision of false or incomplete information for the purpose of misleading research participants

**deficit discourse**

a mode of thinking that frames and represents people through a negative or lacking perspective

**degeneration**

the process of declining or deteriorating

**deindividuation**

the loss of identity or individual characteristics

**dependent variable (DV)**

the variable that is observed or measured when the independent variable is changed during an investigation

**depressant**

a class of drug that slows down the messages in the nervous system

**depth cue**

a stimulus that allows us to perceive depth

**depth perception**

the ability to perceive distance and judge three-dimensional spaces

**descriptive statistic**

measure or point of information that describes the characteristics of a data set

**despair**

Erikson's term for when an older adult has not achieved integrity and feels regret about the path their life has taken

**diagnosis**

identification of a disease or condition through its signs and symptoms

**Diagnostic and Statistical Manual of Mental Disorders (DSM-5-TR)**

a widely used classification system for psychological and neurodevelopmental disorders published by the American Psychiatric Association

**direct discrimination**

when a person or group is treated less favourably than others because of group membership or other characteristics

**direct observation**

a research method in which the researcher watches and records behaviour as it occurs naturally without intervention or interference

**discrete categories**

groups of data that have gaps or spaces between values (are not continuous)

**discrimination**

unfair behaviour or unequal treatment towards others based upon their group membership or other characteristics

**disinformation**

inaccurate information spread with malicious intent

**disorganised attachment**

an attachment style added to complement Ainsworth's research where infants demonstrate conflicting or inconsistent patterns of behaviour towards their caregiver

**dispositional factor**

(internal factor) factor that stems from an individual's personality characteristics that affect a person's behaviour; used to assign internal attributions to a person's behaviour

**dissenting**

providing an alternative opinion

### **divided attention**

the ability to direct focus towards two or more tasks at the same time

### **downward comparison**

the act of comparing ourselves to those who have traits, knowledge or abilities that are worse than our own

### **dualism**

the view that the mind and the body are separate entities

## **E**

### **egocentric pattern projection**

the tendency for people to project their own traits and behaviours onto others

### **egocentrism**

a limitation of young children's cognition which means they are unable to view the world from someone else's perspective

### **electrical brain stimulation (EBS)**

a procedure that uses electrotherapy to stimulate neural pathways in the brain

### **electroencephalogram (EEG)**

a tool that measures the electrical activity in the brain through the application of small discs (electrodes) to the scalp

### **emotion**

physical or psychological change that influences your response to a feeling or situation

### **endocrine system**

the body's network of glands and organs that regulate bodily functions through producing hormones

### **environmental factor**

factor originating from a person's external environment that influences their development

### **epilepsy**

a neurological condition that leads a person to experience repeated seizures

### **error**

the difference between the measured value and the true value

### **ethical concept**

idea that helps explore ethical conduct in investigations; can be used to decide whether an action or course of action is ethically acceptable

### **Eurocentrism**

a worldview that focuses on or favours Western or European histories and thinking

### **evidence**

data, observations or facts obtained from valid research

### **expanding question**

a smaller and more specific question that you can derive from the investigation question to help you answer it

### **experience-dependent plasticity**

the development of neural connections in response to personalised experiences

### **experience-expectant plasticity**

the development of neural connections as a result of common "expected" experiences

### **experimental group (E-group)**

the group of research participants exposed to the independent variable; the results are compared with the control group so that the effects of the independent variable can be determined

### **explicit attitude**

an attitude that we are conscious of and able to self-report

### **extended contact hypothesis**

a theory suggesting that prejudice can be reduced by an in-group member sharing positive information about an out-group member that challenges the exclusionary ideas held by the in-group

### **external attribution**

an inference that attributes an event of person's behaviour to environmental factors

### **external factor**

factor affecting psychological development and wellbeing that originates from outside the individual

### **external validity**

the extent to which the investigation results are applicable to other settings outside of the experiment

### **extraneous variable**

a variable other than the independent variable that may cause changes in the value of the dependent variable

## **F**

### **fake news**

false or misleading stories presented in a way to come off as authentic or to push an agenda

### **fallible**

prone to error, which can occur when judging sensory stimuli

### **family group**

a group type where membership is based on blood or by marital, adoptive or other intimate ties

### **flavour**

a complex system of perception that involves taste, smell, vision and touch

### **focus group**

a research technique that involves collecting data from a small group of people as they discuss or respond to different ideas or products

### **forebrain**

one of the three major regions of the brain, located above the midbrain; where the most important brain functions happen

### **formal operational stage**

the fourth and final stage in Piaget's theory of cognitive development, where children aged 12 and above can think logically and methodically about both physical and abstract problems

### **friendship group**

a group type of two or more individuals who share positive interactions, have norms or standards of behaviours, share similar attitudes, and possess idiosyncrasies

### **frontal lobe**

largest lobe of the cerebral cortex, responsible for higher-order functions

### **functional plasticity**

the brain's ability to change after brain trauma has occurred to compensate for damage

### **fundamental attribution error**

the tendency to attribute actions and behaviours to a person's personal traits and overlook the influence of external factors

## **G**

### **generalisability**

the extent to which findings of research can be applied to other situations or populations

### **generativity**

Erikson's term for older adults' investment in the next generation

### **genes**

sections of DNA that have a functional purpose, such as coding for proteins that determine different traits

### **genetic predisposition**

where an individual has an increased chance of developing a specific trait or disorder due to genetic material passed down to them by their biological parents

### **genetic vulnerability**

a person's increased susceptibility to a particular disorder due to genetic factors

### **genetics**

the basic plan for the development of psychological and physiological characteristics, the unfolding of which is influenced by our environment

### **Gestalt principle**

the principles of visual perception that describe our ability to make sense of visual information by treating it as a meaningful whole

### **graph**

a pictorial representation that displays values and data in an organised way

### **grapheme-colour synaesthesia**

a form of synaesthesia where letters, digits or words are perceived as having colours

### **grey matter**

neural tissue of the brain and spinal cord

### **group**

a collection of two or more individuals who interact with each other, are aware of their membership in the group and strive to achieve mutual goals

### **group pressure**

when the majority of a group place social pressure on others in the group to influence their behaviour

### **group shift**

a phenomenon that occurs in groups where an individual's behaviours and decision-making are more exaggerated

### **group size**

the number of individuals that make up a group

### **groupthink**

a phenomenon that occurs in groups where group decision-making suppresses individual opinions in the interest of positive group dynamics

**guiding word**

a word used to ask a question, such as how, what, when, why, where, who

**guilt**

Erikson's term for when initiative is not achieved because children do not feel comfortable exploring, playing or asking questions

**gustatory cortex**

the region of the brain where taste information is processed

**gustatory perception**

the ability to experience and interpret what we have consumed; also known as taste perception

**H****haemorrhagic stroke**

stroke caused by a rupturing of blood vessels in the brain

**hemispheric specialisation**

the different role the left and right hemispheres have in processing information and behaviour

**hereditary factor**

genetic material transmitted by biological parents to their offspring at the time of conception that influences development

**heuristic**

cognitive shortcut (general rule) that guides our decision-making and problem-solving

**hindbrain**

one of the three major regions of the brain, located at the base of the brain and skull; plays an important role in coordinating bodily functions necessary for survival

**holistic**

taking into account all the individual parts of a whole

**homeostasis**

self-regulating processes that keep the body performing at optimal levels

**hyperactive-impulsive symptom**

symptom present in a person with ADHD that is characterised by an inability to remain still and quiet

**hypothalamus**

a small structure which, despite its size, plays a crucial role in controlling basic survival actions such as sleep, thirst, hunger, sex drive and the regulation of body temperature and the sleep-wake cycle

**hypothesis**

a testable statement that includes a prediction about the outcome of an investigation based on scientific reasoning

**hypoxic brain injury**

injury to the brain caused by a reduction of oxygen supply

**I****idea**

a mental construct representing a vague thought or notion that lacks a specific structure or framework

**idealistic thinking**

according to Piaget, a child's ability to imagine a perfect world, even though it does not exist

**identity**

Erikson's term for when adolescents build a steady and authentic identity for themselves

**implication**

potential consequence or effect of scientific results or conclusions

**implicit attitude**

unconscious attitudes that are involuntarily formed and that we are typically unaware of

**inattentive symptom**

symptom present in a person with ADHD that is characterised by difficulty maintaining attention

**incomplete data**

data that is missing or unfinished in some way due to errors in data collection, processing or limitations in the data itself

**independence**

an individual's decision or opinion in a group that is not influenced by the group's position or opinion

**independent variable (IV)**

the variable that is changed or manipulated during an investigation

**Indigenous knowledge system**

Aboriginal and Torres Strait Islander traditional system of knowledge, that includes understandings, practices, skills, spirituality and innovations

**indirect discrimination**

when an unreasonable rule or law that applies to everyone has an adverse effect that disadvantages a group or person because of group membership or other characteristics

**individualist culture**

culture that emphasises the needs and desires of individuals more than the needs and desires of the group

**industry**

Erikson's term describing how children feel when they are praised and encouraged for their interest in how things are made and how they work

**inference**

conclusion drawn from reasoning or evidence

**inferiority**

Erikson's term for when industry is not achieved, leaving children to feel inadequate

**informational influence**

when individuals are more likely to conform to others' positions or opinions when the concern is to make accurate and valid judgments

**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, before they agree to participate

**in-group**

a social group that an individual feels loyalty and respect towards due to membership

**initiative**

Erikson's term for children feeling as though they are safe to play, explore and use their imagination

**insecure avoidant attachment**

one of Ainsworth's attachment styles, where infants are protective of themselves and remain distant from others

**insecure resistant attachment**

one of Ainsworth's attachment styles, where infants appear anxious and have an overall negative disposition. They cling to caregivers but also resist their contact

**integrity**

Erikson's term for successfully resolving the final psychosocial dilemma where older adults feel a sense of self-worth and are not afraid of death, having achieved what they feel they have needed to

**integrity (ethics)**

the ethical principle about the commitment to search for knowledge and be honest in the approach

**intergenerational trauma**

trauma that is passed down from those who have directly experienced an incident to their future generations

**intergroup contact hypothesis**

a theory used to reduce prejudice where members of an out-group and in-group meet and make sustained contact according to the preconditions of equal status, common goals, institutional support and cooperation

**internal attribution**

an inference that attributes an event or person's behaviour to personal factors

**internal factor**

factor affecting psychological development and wellbeing that originates within the individual

**internal validity**

the extent to which the investigation results truly measured what was intended to be measured

**internet gaming disorder (IGD)**

addiction to video games characterised by a lack of control of gaming habits that leads to disrupted behaviour

**intersectional discrimination**

when people experience overlapping forms of discrimination

**in-text reference**

an acknowledgment of the source immediately after the research or information is referred to

**intimacy**

Erikson's term for adults feeling as though they can share their lives with others and develop caring relationships

**investigation design**

the framework of research methods and techniques used by a researcher to conduct an investigation

**involuntary function**

action that is performed unconsciously by the autonomic nervous system (for example, breathing, heartbeat)

### irreversibility

the inability to understand that actions can be done and then undone

### ischaemic stroke

stroke caused by reduced or interrupted blood supply to a section of the brain

### isolation

Erikson's term for when an adult feels as though they are unable to develop caring relationships

## J

### jargon

specific terminology or language relevant to a field of study that might be difficult for others to understand

### justice

the ethical principle of ensuring fair and equal consideration of all factors

## K

### key term

a word that relates to the key topic you are investigating

## L

### lateralised

controlled by one cerebral hemisphere

### learning disorder

neurodevelopmental disorder that affects a person's ability to learn in one or more specific areas such as reading, writing or maths

### left-sided neglect

spatial neglect characterised by the inability to perceive and interact with stimuli appearing on the left side of the body due to damage in the right hemisphere

### legitimacy of the authority figure

the perception of a figure to be legitimate or hold higher authority that can cause us to more readily obey them

### lexical-gustatory synaesthesia

a form of synaesthesia where letters or words are perceived to have a particular taste

### Likert-type scale

questions that use a scale for responses, ranging from one extreme to another

### limitation

factor or condition that may affect the accuracy or validity of results

### 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 trendline that gives an approximation of the linear relationship between two variables on a graph

### lobotomy

a surgery that was used to treat mental health conditions, such as mood, by causing damage to areas of the prefrontal cortex

### logbook

a record of investigation ideas, events, results and interpretations

### long-term condition

an ongoing, persistent or recurring condition that has a significant impact on a person's life

### long-term depression (LTD)

the long-term weakening of synapses that decreases signal transmission between neurons

### long-term memory

the storage of information indefinitely

### long-term potentiation (LTP)

the long-term strengthening of synapses that increases signal transmission between neurons

### longitudinal fissure

a deep groove that separates the two cerebral hemispheres of the brain

## M

### maladaptive

a term used to describe when something is considered detrimental to survival or functioning

### maladaptive behaviour

a criterion used to classify behaviour as typical or atypical according to whether the behaviour is useful or detrimental to the organism performing the behaviour

### maladaptive cognition

mental process that is detrimental to survival

### maladaptive emotion

psychological feeling that is detrimental to survival

### mass multiplayer online role-playing game (MMORPG)

online game with a large collective of players that involves players taking on a character role in the game

### mean

the calculated central number or "average" of a set of numbers

### measure of central tendency

summary statistic that represents the central point of a data set

### measure of variability

summary statistic describing how spread out the data is in a data set

### media

a platform, service or physical record of information that is communicated to the wider population

### median

the middle number in a set of numbers that are listed in an ascending or descending order

### medium taster

a person who falls within the average range of taste sensitivity (without extreme sensitivity or insensitivity to certain flavours)

### medulla

long stem structure located at the lowest part of the brain that controls involuntary functions essential for survival

### mental health nurse

nurse who is specially trained to care for people who have mental health problems

### mental health organisation

organisation that works to promote or support mental health

### mental health worker

a person who works in the mental health care sector, often providing support in addition to that of psychiatrists and psychologists

### mental wellbeing

a person's overall mental state in terms of their level of functioning, their social and emotional wellbeing, and their resilience to cope with change and uncertainty

### methodology

the approach used to plan and conduct a scientific investigation

### midbrain

one of the three major regions of the brain, located between the hindbrain and the forebrain; plays a key role in movement, processing visual and auditory information, the sleep-wake cycle, arousal (alertness) and regulating temperature

### miraculin

a chemical extracted from the "miracle fruit" that causes sour foods to taste sweet

### misapplication of size constancy

the incorrect use of cues that would normally assist us in accurately perceiving properties such as size

### misdiagnosis

an incorrect diagnosis

### misinformation

inaccurate information spread due to ignorance

### mistrust

Erikson's term for when an infant does not achieve trust, leading to insecurity, suspiciousness and an inability to relate to others

### mixed design

a study that combines features of both a between-subjects design and a within-subjects design

### Mob

a family unit, Traditional Owner group, Nation or wider community group that a First Nations person identifies with

### mode

the number that occurs most frequently in a data set

### model

a simplified version of a complex system that helps inform, make predictions, or provide explanations about different phenomena

### monism

the belief that the mind and the brain are the same thing

### monocular depth cue

a depth cue that can be made sense of by our brains using information from just one eye

### motor learning

acquiring and developing skills that require or are related to movement

**Müller-Lyer illusion**

an illusion created by a misinterpretation of two identical length lines that appear to be different due to differently shaped ends

**N**

**Nation**

a collective of language groups linked through geographic, social, political and or linguistic ties

**negative correlation**

a relationship in which the two variables change in the opposite direction – that is, as one increases, the other decreases

**neurodevelopmental disorder**

condition that affects the development of the nervous system, causing variations in brain function that may affect processes involved with emotion, learning, motor control and memory

**neurodivergent**

where a person's thoughts, feelings and behaviours are not aligned with those of a person who is considered to be neurotypical

**neurodiversity**

the differences that can exist among the population with regard to psychological development and function

**neurogenesis**

the growth and development of new neurons

**neuroimaging**

a technique that captures a picture of the brain

**neurological disorder**

condition that affects the regular functioning of the nervous system

**neurology**

a branch of medicine that focuses on the diagnosis and treatment of nervous system disorders

**neuronal migration**

the process of neurons migrating from their site of formation to another location in the nervous system

**neuron**

nerve cell in the nervous system that receives and transmits information

**neuroplasticity**

the brain's ability to change in response to experience

**neuroscience**

the scientific study of the nervous system and its functioning

**neurotoxic**

damaging to the nervous system

**neurotypicality**

a term used to describe brain development and function that is aligned with what would be considered normal or typical for most individuals within society

**nonconformity**

expressing opinions, judgments or actions that differ from the norms of a social group or situation

**non-maleficence**

the ethical principle of avoiding harm or decreasing the amount of harm inflicted

**non-scientific idea**

idea or theory that is not based on empirical (experimental) evidence and has not been rigorously tested or supported through observation or scientific investigation; not supported by the scientific method

**non-surgical procedure**

procedure used to obtain information, usually in a non-invasive manner

**non-taster**

an individual who has a decreased sensitivity to taste due to less sensitive taste perception

**non-verbal communication**

communication that conveys and exchanges messages without using spoken words (such as eye contact or hand gestures)

**normal distribution**

a statistical distribution where data is symmetrically distributed around the mean

**normality**

typical behaviours, thoughts or emotions that align with those common in society

**normative influence**

when individuals are more likely to conform to others because they seek approval or social harmony

**O**

**obedience**

behaviour that complies with the demands of a direct order

**object permanence**

a development in cognition where children learn that objects continue to exist even when they cannot be seen

**occipital lobe**

lobe of the cerebral cortex responsible for processing visual information

**off-colouring**

the discrepancy between our expectation of a food's appearance and its actual appearance

**opinion**

a personal view or belief about a particular topic or issue

**order effect**

effect on results that occurs due to the order or sequence in which the treatments in an experiment are given

**out-group**

a group that an individual does not belong to or identify with

**outlier**

value that lies outside the expected data set

**overdiagnosis**

the diagnosis of a condition that would not have produced any symptoms or led to any health problems if it had been left undiagnosed

**P**

**papillae**

small round bumps located on the surface of the tongue that play a role in taste and gripping food

**parietal lobe**

lobe of the cerebral cortex responsible for processing bodily sensations

**Parkinson's disease**

a neurological condition that disrupts motor functioning

**participant characteristic**

individual factor such as age, sex, health levels, education and socioeconomic status

**participant observation**

a data collection method where the researcher immerses themselves or "participates" in a specific setting or group to make observations of the target of their research

**Pearson correlation coefficient (*r*)**

a measure of the strength of the linear relationship between two continuous variables

**percentage**

a number or ratio expressed as a fraction of 100

**percentage change**

the factor by which an initial data percentage changes after time or an event

**perception**

the process by which our brains organise and interpret sensory information; allows us to consciously experience the information

**perceptual compromise theory**

an explanation for the Müller-Lyer illusion that proposes that we perceive the line with the feathertail ends as being longer than the arrowhead line due to application of the Gestalt principle of closure

**perceptual constancy**

the ability to maintain a constant perception of familiar stimulus, even if the image projected onto the retina changes

**perceptual error**

mistakes made during the perception of a stimulus

**perceptual hypothesis**

a prediction about what we are perceiving

**perceptual set**

a unique combination of past experiences, knowledge, expectations, motivations, culture, beliefs and emotions that determines how we perceive sensory information

**person perception**

the impression formed of another person based on our first hand interactions with them and second-hand information learnt about them

**personal distress**

a criterion used to classify behaviour as typical or atypical according to whether the behaviour results in an overall pleasant or unpleasant emotional state

**personal error**

mistakes, miscalculations and observer errors that occur when conducting research

**philosophy**

the study of knowledge, reality and existence

**photoreceptor**

receptor located in the retina that senses details in black and white (rods) and colour (cones)

**phrenology**

a pseudoscience based around the belief that the shape of the skull could indicate personality traits and characteristics

**physical cue**

physical feature of a person that contributes to our impression of them

**pictorial cue**

depth cue that allows us to judge distance; also known as monocular cue

**pineal gland**

a small gland in the brain responsible for secreting hormones

**pituitary gland**

a pea-sized gland attached to the base of the brain that acts as the body's major endocrine gland, controlling the growth and function of other endocrine glands

**Place**

a space confined by physical or intangible boundaries occupied and regarded as belonging to individuals or groups of Torres Strait Islander peoples; spaces have varying spiritual meaning to different peoples

**plagiarism**

the act of taking and passing off someone else's work or ideas as your own

**plasticity**

the ability of the brain's synapses to be modified

**poly-synaesthete**

an individual who experiences more than one type of synaesthesia

**pons**

structure on the brain stem located above the medulla; acts as a pathway for sensory and motor information to travel between the brain and the rest of the body

**population**

the group of people about whom scientists want to draw conclusions

**positive correlation**

a relationship in which the two variables change in the same direction – that is, as one increases (or decreases), so does the other

**power**

the capacity to influence others and resist attempts of influence by others

**precision**

how close a set of data values are to each other

**prefrontal cortex**

an area of the brain that modulates higher-order cognitive processes

**prejudice**

an attitude where people are evaluated and defined by their race, ethnicity, religion, gender identity, sexual orientation or other social group and its respective members

**premotor cortex**

an area of the brain that processes and controls the movement of voluntary muscles

**preoperational stage**

the second stage in Piaget's theory of cognitive development, where children aged two to seven years use symbols, images and language to represent their world

**presbyopia**

an eye condition in which the lens of the eyes lose their flexibility over time, making it more difficult to focus on close objects

**primary auditory cortex**

an area in the temporal lobe responsible for the ability to hear

**primary data**

data collected by the investigator from firsthand sources

**primary motor cortex**

an area in the frontal lobe responsible for movement of the body

**primary somatosensory cortex**

an area in the parietal lobe that receives information from sense receptors in the skin

**primary taste**

sweet, salty, sour, bitter and umami

**primary visual cortex**

an area in the occipital lobe responsible for processing these different types of visual stimuli

**priming**

a phenomenon in which exposure to previous stimuli can influence how a person reacts or responds to a following stimulus

**prosopagnosia**

a condition that results in the inability to recognise faces

**proximity**

how physically or emotionally close one person is to another

**pseudoscience**

beliefs and practices that claim to be scientific but are not based around the scientific method

**psychiatrist**

a mental health professional trained in psychology as well as medicine, who can prescribe medication as part of their treatment

**psychoeducation**

a form of psychotherapy that involves providing information about a diagnosis or condition to patients and their support networks to help them cope with their diagnosis

**psychological development**

how a person's social, emotional and cognitive capabilities change over time

**psychological factor**

factor relating to mental processes that originates or occurs within the individual

**psychological test**

assessment used to evaluate various aspects of emotions, cognitions or behaviours (such as personality tests or intelligence assessments)

**psychologist**

a mental health professional trained in thoughts, feelings and behaviours, who uses psychotherapy to support the development and wellbeing of their patients; they cannot prescribe medication as part of treatment

**psychology**

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

**psychosocial dilemma**

a conflict between the individual and the outside world, the outcome of which Erikson believed shapes our personality

**Q****qualitative data**

descriptive characteristics of what is being studied

**quantitative data**

measurements (numerical information) about the variables being studied

**questionnaire**

a list of questions used for data collection

**R****random allocation**

a subject-selection procedure where all participants who have been selected for an experiment have an equal chance of being in either the E-group or C-group

**random error**

an error that affects the precision of the data set due to an unknown and unpredictable error in the experimental process

**random sampling**

a sampling procedure in which every member of the population has an equal chance of being selected

**range**

the difference between the lowest and highest value in a data set

**raw data**

unprocessed data

**reception**

the process in which stimulus energy enters the sense organ

**refute**

contradicts or does not support (in relation to the hypothesis)

**repeatability**

the degree to which an experiment can produce the same results when repeated under the same conditions

**representativeness heuristic**

the tendency to make decisions based on the classification of people, objects and events into categories of similar people, objects and events

**reproducibility**

the degree to which results can be independently confirmed by other researchers using different methods, techniques or instruments than the original conditions of the experiment

**rerouting**

when a neuron removes some existing connections and forms new connections to other neurons

**research outline**

a tool to help you organise your ideas; can be a skeleton for presenting information later

**research question**

a clear, focused and concise query that guides an investigation and forms the foundation of a research study

**resilience**

the ability to mentally cope with or adapt to uncertainty, challenges and adversity

**respect**

the ethical principle that considers the value of living things and the ability for living things to make their own decisions where possible

**reticular formation**

a network of neurons that plays a significant role in filtering sensory information and selecting the valuable information to enter consciousness

**retinal disparity**

the difference in visual information received in each retina

**retinis pigmentosa**

an eye condition in which the retina degenerates and causes loss of peripheral vision and night blindness

**right-sided neglect**

spatial neglect characterised by the inability to perceive and interact with stimuli appearing on the right side of the body due to damage in the left hemisphere

**risk assessment**

a system or document that evaluates any potential risks involved with a particular activity

**robust**

the degree to which a result is consistent across different studies, methods and/or samples

**role confusion**

Erikson's term for the uncertainty that adolescents can feel about themselves and their place in the world if they have not achieved a sense of identity

**role**

pattern of behaviour that distinguishes between different activities within the group that are done for the greater good of the group as a whole

**S****safety data sheet (SDS)**

a document that lists information related to hazardous and non-hazardous materials

**saliency detection**

the focused attention towards specific pieces of information about a person over other pieces of information

**sample**

the members of the population who have been chosen to take part in the research

**scatterplot**

a diagram showing the values of the two variables for each result in the sample by representing the intersection of those two values with a dot on a graph

**schema**

(pl: schemata) an organised mental framework of knowledge about a person, place or thing

**scientific idea**

idea or theory based on empirical (experimental) evidence that has been rigorously tested through observation or scientific investigation; supported by the scientific method

**scientific method**

a standardised way of making observations, gathering data, testing hypotheses and interpreting results to establish theories to describe and measure behaviour

**secondary data**

data collected by another person, not the investigator, which is relevant to the scientific investigation

**secure attachment**

one of Ainsworth's attachment styles, where infants feel safe and confident because they feel they can rely on their caregivers, allowing them to explore and be social

**selective attention**

the limited ability to focus on specific stimuli, while filtering out others

**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-schema**

a mental framework of knowledge about oneself, self-identity

**self-stigma**

internalisation of the stigma or prejudice associated with stereotypes that leads to self-discrimination

**sensation**

the process by which our brains receive and process stimulus energy into sensory information

**sensitive period**

a period of time during development when an individual is more responsive to specific experiences from their environment that can shape their development

**sensorimotor stage**

the first stage in Piaget's theory of cognitive development, where infants aged from birth to two years learn about their world through their senses and actions

**sensory memory**

the collection of schema stored in your memory relating to how the elements of the world look, sound, feel, smell and taste

**seriation**

the ability to arrange items in order

**shame and doubt**

Erikson's term for what children feel when they do not achieve autonomy, which is a lack of independence corresponding with their abilities

**short-term memory**

the capacity to hold a small amount of information for a short period of time

**situational factor**

(external factor) environmental factor that affects or causes an individual's behaviour; used to assign external attributions to a person's behaviour

**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 categorisation**

placing someone into a group or groups based on impressions we have formed about people with certain characteristics

**social cognition**

how people attend to, perceive, interpret and respond to social interactions

**social comparison**

assessing or evaluating ourselves through comparing our own traits against those of other people

**social connectedness**

the sense of closeness and belonging to other people or groups

**social connection**

the bond, tie or connection that an individual forms with other people

**social factor**

factor relating to interactions with others and the environment that originates from outside the individual

**social loafing**

when an individual is less likely to put in effort in a group task compared to the effort they would put into an individual task

**social media**

a form of media that uses the internet to provide electronic communication of information

**social media influencer**

a person with authority or expertise in an area that uses their position to engage with a large number of followers

**social norm**

an informal rule or standard understood by members of a group or society

**social stigma**

society's or the general public's negative thoughts or actions in response to the stigma around a person or group

**social worker**

allied health professional who assists people needing mental health support, particularly when they are in crisis

**spatial neglect**

a disorder created by a damaged parietal lobe where a patient ignores the one side of their world

**spinal cord**

a long structure of nerves running centrally from the brain to the lower back that sends messages to and from the brain and body

**Spinning Dancer illusion**

a spinning dancer silhouette that appears to spin both clockwise and counterclockwise

**sprouting**

when a neuron forms new branches

**stagnation**

Erikson's term for how older adults can feel frustrated at not having achieved generativity and so struggle to feel connected to society

**standard deviation**

a measure that tells us how far, on average, scores are different from the mean

**statistical rarity**

a criterion used to classify behaviour as typical or atypical according to how prevalent that behaviour is within the population

**status**

the position a person holds in a group or society relative to others

**stereotype**

a commonly held, oversimplified belief about members of a particular group

**stigma**

a negative social attitude or stereotype attached to a characteristic of an individual or group

**stigmatisation**

treating someone or something unfairly by publicly disapproving of them or perpetuating negative stereotypes

**stimulus energy**

the form of energy that is detected by receptors in our sense organs; for example, light or chemical energy

**Strange Situation**

the contrived setting where Ainsworth conducted her research into infant attachment, which consisted of a chair for the mother and stranger, some toys for the infant, and a one-way mirror for observation

**stratified sampling**

a sampling process by which the effects of a certain variable can be eliminated as a possible confound in an experiment

**strengths-based approach**

a mode of thinking that frames and represents people through their resilience and strengths

**stroke**

injury to the brain caused by disruption of blood flow

**structural plasticity**

the brain's ability to change in physical structure because of experiences throughout life

**structured interview**

a research technique that involves an interviewer asking a participant a set of pre-determined questions

**supertaster**

an individual who has an increased sensitivity to taste

**supplementary motor cortex**

part of the motor cortex that prepares the body for voluntary movement

**support**

agrees with (in relation to the hypothesis)

**surgical procedure**

medical operation performed on a living human

**survey**

the collection and analysis of the experiences and/or opinions of participants who have been asked questions

**sustained attention**

a specific focus directed to a stimulus for the duration of a cognitive task

**symbolic thinking**

according to Piaget, the cognitive process of using symbols or other objects to represent things that are not there

**synaesthesia**

a phenomenon where individuals experience an integration of senses when one sense is stimulated

**synaesthete**

an individual with synaesthesia

**synapse**

the small space between neurons where neurotransmitters are released to allow neurons to communicate with one another

**synaptic plasticity**

the ability of synapses to strengthen or weaken over time

**synaptic pruning**

the brain's process of eliminating extra synapses

**synaptogenesis**

the formation of synapses between neurons in the nervous system

**systematic error**

an error that affects the accuracy of the data by causing the reading to differ from the true value

**T**

**table**

a format of presenting data using rows (horizontal) and columns (vertical)

**tachistoscope**

an instrument used to briefly expose the eye to visual stimuli

**task word**

a word that provides direction on what you need to do, such as identify, explain, analyse, evaluate

**taste**

the sensation experienced by the mouth and tongue when we consume food and drinks

**taste bud**

a structure on the tongue that contains taste receptor cells; a taste sense organ

**temporal lobe**

lobe of the cerebral cortex responsible for processing auditory information

**texture**

the way food feels in our mouth

**thalamus**

a small structure that sits just above the brain stem, responsible for acting as the control centre of the brain for sensory information

**theory**

a well-supported reason or descriptive account of a phenomenon that has been established through rigorous scientific investigation

**top-down processing**

a type of perceptual processing that involves making inferences about what is being presented, based on our perceptual set

**transduction**

the process in which stimulus energy is converted to nerve impulses

**transmission**

the process in which the nerve impulses are sent to the correct regions or cortexes of the brain

**traumatic brain injury**

a type of acquired brain injury caused by blows or jolts to the head

**trephination**

a surgical procedure where holes were drilled into the skull

**tri-component model of attitudes**

the most common model used to describe the structure of attitudes, where all attitudes consist of an affective, behavioural and cognitive component

**true value**

the value that accurately represents the measurement if the experiment ran perfectly

**trust**

Erikson's term for when children successfully form attachment to their caregiver and establish a trusting relationship with them

**typical behaviour**

behaviour that would be expected or is consistent with the behaviours usually shown by a specific person in a particular situation, or behaviour that conforms with standards deemed acceptable for that situation

**U**

**unanimity**

complete agreement of a shared opinion among the group

**uncertainty**

the degree to which the result of a measurement does not reflect the exact value of what is being measured

**upward comparison**

the act of comparing ourselves to those who have abilities, traits or knowledge that are slightly better than our own

**V**

**validity**

a measure of whether the investigation is sound

**variable**

a factor, trait or condition that can exist in differing amounts or types

**variance**

a measure of how spread out data is from the mean

**verbal communication**

communication that relies on speech to convey and exchange messages

**video game**

game played on a personal electronic device or console

**visible light region**

the wavelength region of the electromagnetic spectrum that is visible to the human eye; 360–760 nanometres

**visual agnosia**

a condition that results in the inability to describe, recognise or name an object seen

**visual illusion**

when we misinterpret real sensory stimuli to create a mismatch between the real-world stimulus and our perception

**visual perception**

the ability to interpret the surrounding environment to make sense of what we see

**voluntary participation**

participants have the right 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**

a language disorder that occurs when Wernicke's area is damaged and patients experience difficulty with language comprehension

**Wernicke's area**

brain area in the temporal lobe responsible for language comprehension

**white matter**

neural tissue in the form of densely packed bundles of myelinated (insulated) nerve fibres

**withdrawal right**

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

**within-subjects design**

a subject-selection procedure where each participant is part of both the E-group and the C-group

**Y**

**yarning circle**

a harmonious, creative and collaborative way of communicating to encourage responsible, respectful and honest interactions

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