KAREN MARANGIO
KERRI MOREY

OXFORD PSYCHOLOGY year 10

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Introduction—to the student

Welcome to the wonderful world of psychology! A world in which you have lived all your life, but one you are about to explore on a journey of discovery.

How can a world you have lived in your entire life also be a new world of discovery? All your life, you have lived in your body, used your brain, grown and developed your skills of learning, thinking, relating to others and socialising in groups, but this book will help you to come to a new understanding of all those processes. The study of psychology will help you see the world with new eyes, so that you will find yourself being able to say 'Oh, so that's why I do/think/feel that!'

In this book you can discover the answers to questions such as:

- How does my brain work? Are there things I can do to make it work better?
- Why do I find some people attractive and not others?
- How can I tell if someone is telling me the truth?
- Does hypnosis really work?
- Why do we dream? What do my dreams mean, if anything?
- Do sportspeople really need psychologists?
- How do advertisers suck us in? How can we guard against their tricks of persuasion?
- If a person swears in court 'I saw it with my own eyes!' should we believe them?
- Can psychology explain magic?
- The medical profession says that 30 per cent of Australians will suffer a mental illness at some stage in their life. What does this mean? Can anything be done to prevent this?

Oxford Psychology Year 10 is written as a series of self-contained chapters. Many schools will run Psychology as a unit within a science course, while others may use this text as an elective subject. All or some of the chapters may be covered in class, but each user-friendly chapter is easily explored by the students on their own as well.

Each chapter explains the theory of its topic in easy-to-understand language and provides learning activities and links to other resources that make learning easier and more fun. Details for all website links referred to in the text can be found on the OUP website. When you see the WWW>> icon, go to www.oup.com.au/psych10 to find the full website link. Throughout each chapter are exercises to check your understanding and tips to help with learning. Multiple-choice and short-answer questions at the end of each chapter give you experience in the types of questions that are asked in the examinations for VCE Psychology Units 3 and 4.

In writing this book, the authors have been very aware that everyone has their own style of learning—some like to read paragraphs, some like clear, concise dot-points, some like to see visual images, such as diagrams, flow charts and tables, and others like to learn by doing. The book has been designed so that it is accessible to all of these different learning styles.

As series editor of this book, as well as for the VCE texts for Unit 1 and 2 and for Unit 3 and 4, I am really delighted with what Karen Marangio and Kerri Morey have written. Both of them are very experienced teachers of VCE Psychology but, more importantly, both have also taught Year 10 Psychology, and really understand what is of interest to you at that level. Karen has also taught Psychology in the International Baccalaureate (IB) program and has taught many teachers how to teach Psychology, in the Education Faculty at the University of Melbourne. The content of the book has also been checked by psychology staff from the Krongold Centre at Monash University to ensure the material is correct and up to date.

This book is a fantastic introduction to Psychology. I'm confident that many students will be so enthusiastic as a result of what they learn from this text that they will go on to VCE (and even perhaps to university) courses in the subject. I am confident that those who have used this book and learnt from it will have a head start on others when they begin VCE Psychology.

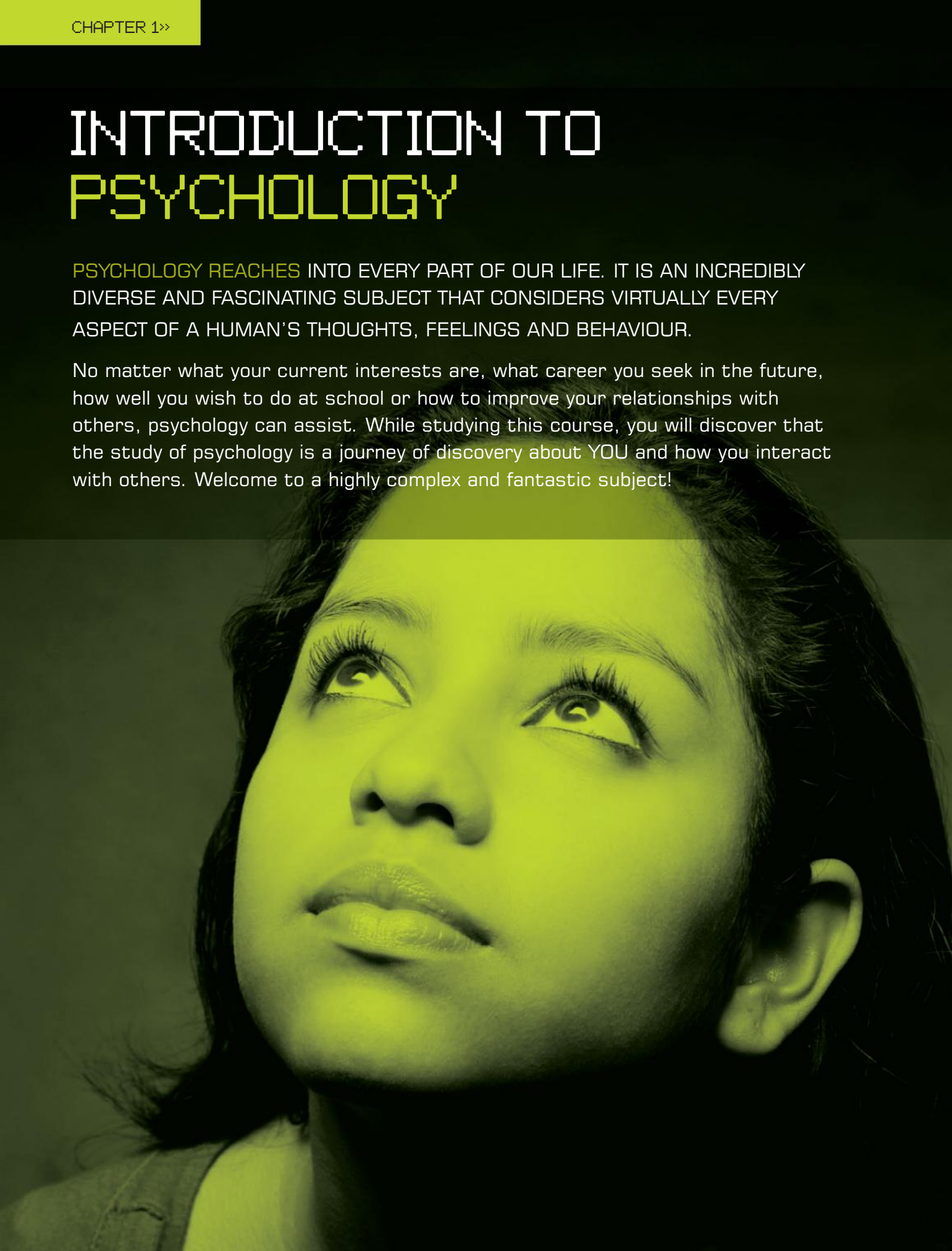
I wish you great enjoyment from this book and from your studies of psychology—this year and in the years to come.

Roger Edwards
Series Editor

INTRODUCTION TO PSYCHOLOGY

PSYCHOLOGY REACHES INTO EVERY PART OF OUR LIFE. IT IS AN INCREDIBLY DIVERSE AND FASCINATING SUBJECT THAT CONSIDERS VIRTUALLY EVERY ASPECT OF A HUMAN'S THOUGHTS, FEELINGS AND BEHAVIOUR.

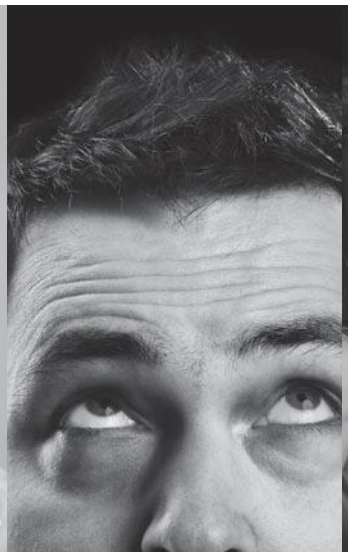
No matter what your current interests are, what career you seek in the future, how well you wish to do at school or how to improve your relationships with others, psychology can assist. While studying this course, you will discover that the study of psychology is a journey of discovery about YOU and how you interact with others. Welcome to a highly complex and fantastic subject!



WHAT DO YOU KNOW ABOUT PSYCHOLOGY?

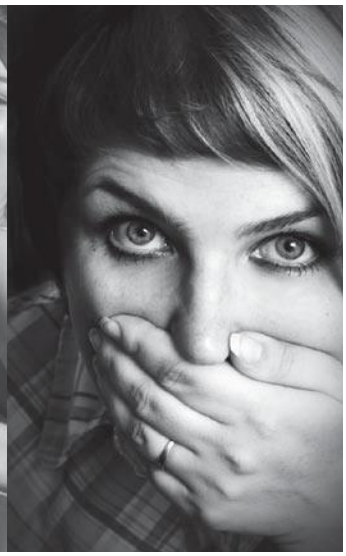
Before you read on, decide whether the following statements are **true** or **false**. You will find the answers on page 10. Each statement, and much more, is investigated in this book.

1 YOU ARE LIKELY TO FEEL HAPPIER IF YOU FORCE YOURSELF TO SMILE FOR ABOUT TEN MINUTES.

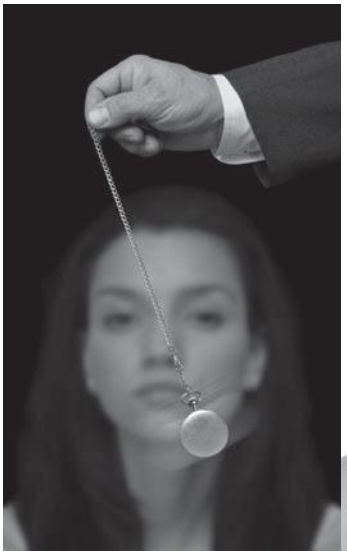


2 WHEN YOU DON'T GET ENOUGH SLEEP FOR A COUPLE OF DAYS, YOU FIND IT HARDER TO COMPLETE SHORT, COMPLEX TASKS.

3 TEENAGERS ARE MORE LIKELY TO BE 'NIGHT OWLS' THAN ADULTS IN THEIR LATE TWENTIES.



4 YOU ARE NOT ABLE TO TRICK A LIE DETECTOR; IT WILL REVEAL A LIE.



5 THE MAIN USE OF HYPNOSIS IS TO ENTERTAIN PEOPLE WITH A STAGE SHOW.

6 YOU ARE EITHER A 'LEFT' OR 'RIGHT' BRAIN THINKER. YOU CAN ONLY LEARN WHEN USING THIS SIDE OF YOUR BRAIN.

7 YOU ARE MORE LIKELY TO BE ATTRACTED TO SOMEONE WITH SIMILAR INTERESTS AND BACKGROUND.

8 SOME PEOPLE NEVER DREAM.

WHAT IS PSYCHOLOGY?

1.1 INVESTIGATE

What exactly is psychology?

Think for a minute about these questions:

- What do you know about psychology?
- Can you define psychology?

Share your thoughts with someone else in your class. Attempt to answer the questions together. Share your answers with the rest of the class.

Many answers will highlight the value of psychology while others may reveal some of the misconceptions, such as learning to read other people's minds or reading horoscopes.

Try asking other people such as family and friends. You will probably get a whole range of answers, some correct and others wildly wrong. While you are at it, ask them to spell 'psychology'. Again, you will receive a range of responses.

Psychology is the scientific study of thoughts, feelings and behaviours, which are all heavily influenced by biology, past experience and cultural aspects.

You are unique. Your thoughts, feelings and behaviours are shaped by your biological make-up and functioning of your brain, past experiences and cultural background. The need to keep all these factors in perspective makes psychology a complex area of study.

While we are all different, many of our thoughts, feelings and behaviours are predictable. Psychology can help people change unwanted thoughts, feelings and behaviours. The goals of psychology are to use a scientific approach to *describe*, *explain*, *predict* and, at times, *influence* thoughts, feelings and behaviours in beneficial ways.

FIG 1.1» Psychologists help people deal with their thoughts, feelings and behaviours—often at very stressful times in their lives.

HOW DO I BECOME A PSYCHOLOGIST?

To become a qualified psychologist and a member of the **Australian Psychological Society (APS)** takes at least six years of study. You need to complete either an approved six-year full-time sequence of psychology at university or an approved four-year full-time sequence followed by a two-year 'apprenticeship' under the supervision of an experienced psychologist.

Many people study psychology without intending to become psychologists. Gaining an understanding into human thoughts, feelings and behaviours can assist greatly in other professions such as management, social work, education, human resources, selling, advertising and nursing. It can also assist in other aspects of everyday life.

FIG 1.2» An educational psychologist works with students in school to improve learning.

HOW DOES PSYCHOLOGY DIFFER FROM PSYCHIATRY?

People often confuse psychologists with psychiatrists. While it is true that both are concerned with mental health, there are important differences.

- The training and qualifications are different. A **psychiatrist** is a medical doctor who has first completed a medical degree (minimum five years) and then further study and supervision to specialise in psychiatry (minimum four years).
- While psychiatrists and psychologists both work in the area of mental illness, psychology is not as narrow a field as psychiatry. Psychologists also work with people who do not suffer from mental illness, to assist with thoughts, feelings and behaviours.
- Psychiatrists, as medical doctors, can prescribe medication. They consider medication plays a major role in the treatment of mental illness. Australian psychologists cannot prescribe medication; their work is more concerned with thought processes and behaviour.

It is not uncommon for a patient to receive assistance from both a psychiatrist and a psychologist. While their treatments differ, a combination of both can often be more beneficial than either treatment alone.

1.2 INVESTIGATE

Job prospects and remuneration

1 WWW» Visit the Australian Government's JobSearch website. Click on Career information. Go to Job Outlook and look up Psychologists. Answer the following questions:
   - **a** How many people in Australia are working as psychologists?
   - **b** What are the average weekly earnings for a psychologist?
   - **c** What are the career prospects?
   - **d** Name at least four different industries that employ psychologists.
   - **e** Find one other fact that interests you about this occupation.

Find a psychologist near you

2 WWW» Go to the Australian Psychological Society website. Click on Find a Psychologist.
   - **a** What are the main categories listed?
   - **b** Search for psychologists in your area.
     How many did you find?
     What types of psychologists are represented in your area?

TYPES OF PSYCHOLOGISTS

There is a huge increase in demand for psychologists in Australia. Psychologists work in diverse areas in almost every industry.

The table below lists some of the types of psychologists and the sorts of questions that they might investigate. All areas can involve teaching and research.

FIG 1.3» A sports psychologist talking to swimmer Libby Trickett about her performance

TABLE 1.1» Types of psychologists

Type of psychologist	Questions considered within this field
Clinical psychologist—focuses on people with mental illness or behavioural disorders	Does smoking marijuana lead to schizophrenia? What can be done to help a person overcome depression?
Cognitive psychologist—looks at thoughts, memories and perception	Why do different people have different approaches to thinking and learning? Why are people sometimes forgetful?
Counselling psychologist—deals with life issues such as family, marriage or school problems	How can stress experienced by a student be reduced? How can families reconnect after difficult situations?
Developmental psychologist—addresses aspects of psychological development from conception to death	Is daycare beneficial for young children? What are the major issues facing teenagers?
Educational psychologist—focuses on teaching and learning in educational settings	Why do some children have difficulties learning in class? What is an effective way to increase contributions to class discussions?
Forensic psychologist—deals with criminal behaviour in legal situations and prisons	Are criminals psychologically fit for trial? Are psychologically abused children more at risk of dangerous criminal behaviour when adults?
Health psychologist—deals with health issues and diseases	How can we get people to take notice of the dangers of binge drinking? Are some personalities more at risk of a certain disease?
Industrial and organisational psychologist—addresses psychological aspects of business and industry work settings	What form of leadership would be most effective for this work? How can motivation among workers be increased?
Sports psychologist—focuses on enhancing sporting performance	What can be done to calm nerves before an event? What short-term goals are best to reach the ultimate sporting performance?
Social psychologist—looks at social influences on individual behaviour and interactions between groups and individuals	Why does prejudice exist? What type of people are attracted to each other?
Environmental psychologist—considers how the physical world affects people's behaviour and vice versa	How can attitudes be changed to make people behave in a more environmentally friendly manner? What are the effects of office design on work output and satisfaction?

1.3 INVESTIGATE

Create a webpage

1 Design a webpage that promotes one area of psychology. Describe the goals within this area of psychology, the most likely workplace and the type of work that a psychologist in this field would carry out.

Interview a psychologist

2 Interview a psychologist of your choice. Ask a number of questions about their role as a psychologist including:

- What inspired you to choose psychology as a career?
- What studies did you undertake to become a psychologist?
- Did you study psychology at secondary school?
- What area of psychology do you specialise in?
- What are your main roles or jobs at work?

PSYCHOLOGY—A SCIENCE

Over the years many people who do not understand the scientific nature of psychology have considered psychology as a pseudoscience, or a fake science. **Pseudosciences**, such as astrology, alchemy and phrenology, are generally well-established beliefs that have not changed over the centuries. They are based on tradition and are difficult to measure and test. They do not use a scientific approach.

Psychology is a science—it follows a set of procedures for collecting and interpreting data known as the **scientific method**. Psychological theories are continually tested and developing. Psychologists are critical thinkers. They take an objective stance and scrutinise research findings. Being critical thinkers does not just mean psychologists make criticisms. They analyse all aspects of the research and often present alternative explanations and constructive ideas.

Psychologists:

- study theories using a scientific approach (i.e theories must be testable)
- avoid jumping to conclusions
- generate new ideas
- evaluate the evidence
- report findings.

1.4 INVESTIGATE

Psychology is more than just common sense

1 Look at the following saying and discuss the questions below.

Absence makes the heart grow fonder.

a What does this saying mean?

b Do you agree or disagree with this saying?

c How does this saying compare with *Out of sight, out of mind*? Can both be true?

d Design a study to test whether these sayings are true.

e Research the following common sayings and answer questions 1a and 1b for each.

- *Birds of a feather flock together.*
- *The early bird gets the worm.*
- *People who live in glass houses shouldn't throw stones.*
- *As you make your bed, so you must lie in it.*
- *Too many cooks spoil the broth.*
- *A rolling stone can gather no moss.*

RESEARCH TECHNIQUES

As part of the scientific method, psychologists employ a number of research techniques to collect and interpret data. These include making observations, self-reports, surveys and questionnaires, and experiments. Brain scanning and measuring physiological responses, including brainwave patterns, heart rate, blood pressure and galvanic skin response (electrical conductivity on the skin, linked to sweating), are often used and provide important psychological insights.

One of the easiest ways to understand the scientific method is to perform an experiment. For example, the activity in Investigate 1.5 relates to psychological research findings on the use of mnemonic techniques that can help you improve your memory.

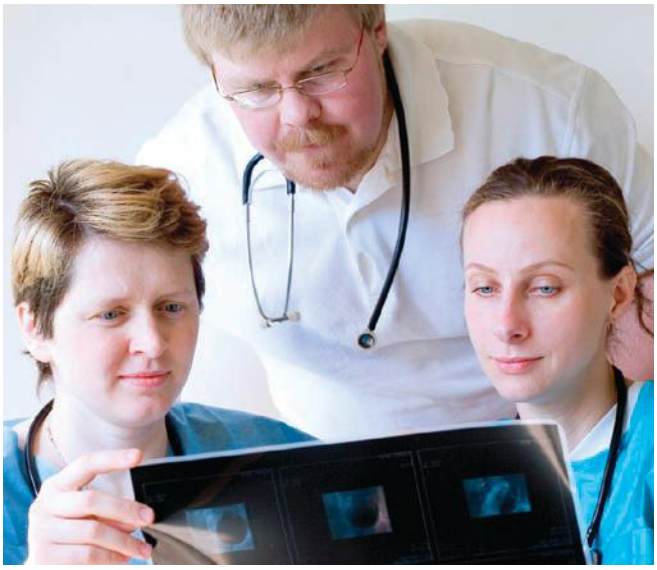


FIG 1.4» Psychologists rely on scientific evidence such as brain scans to provide important insights.

FIG 1.5» Psychologists rely on observation to provide psychological data.

Mnemonic techniques

There are many different ways to remember chunks of information that our brains would otherwise be unable to cope with. Most people can easily recall five to nine bits of information, but a mnemonic technique can increase this to many bits. A **mnemonic technique** is a memory trick or aid. You probably already know some memory tricks. The aim is to make associations, add meaning or create humour to assist us in making the information memorable. A few techniques are:

- *Method of loci*—Visualise your bedroom. Draw a map of your room and 15 objects in it and where they are located. For example, bed, wardrobe, chair, dirty clothes basket, hook on back of door, desk ... Rehearse a logical order for these 15 items until you can readily visualise the order. When you are ready, associate each item with a word from a list to be remembered. As you make the association, take the time to visualise the items together. For example, 'a kite on the bed, a daisy painted on the wardrobe, a hippo squeezed onto the chair ...' until the list is complete. The more bizarre and humorous the associations, the more likely you will remember the list.
- *Narrative chaining*—This involves linking each word to be recalled into a meaningful sequence or story. For example, 'a *bird* dressed in a *costume* jumped into a *boat* that was heading up a *tree*. A *doctor* placed him into a *letterbox* ...'
- *Acrostics*—These are word associations that create rhymes or stories using the first letter of the words to be remembered. For example, the order of the planets from the Sun (Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune) can be remembered with the acrostic 'My Very Excited Mother Jumped Suddenly Under Nana'. An acrostic for remembering the order of 'north, east, south, west' is 'Never Eat Soggy Weetbix'. Try an acrostic for the following list of words: fire, plane, sofa, mug, soap, comic.

1.5 INVESTIGATE

Can mnemonic techniques improve memory?

This activity is a memory recall task. Two participants will learn a mnemonic technique prior to completing the task. Two others will complete the task without learning a specific strategy. Results will be compared to determine the effectiveness of using mnemonic techniques for enhancing recall.

Aim: To compare the results of participants who used a specific mnemonic technique to assist them in recalling a list of 15 words with those of participants who used no technique.

Materials: Two word lists, paper and pens

Method:

- As a class, create one list of 15 words (List A). Ensure the words in your list are unrelated to each other and there are no themes.
- Create a list of instructions to be given to participants prior to completion of the task. It is important that participants agree to take part of their own free will, and that they understand the general nature of the task (without giving away its purpose). It is also important for all experimenters (you) to be as consistent as possible in the way you carry out this task with your own participants.
- Create a prediction of what you think the outcome of the task will be. This is known as your *hypothesis*.
- Allocate two participants to the *control group*. This group will carry out the recall test without learning a mnemonic technique. Follow these steps:
  1. Ensure participants have paper and pen to record words once lists have been read out.
  2. Slowly read out List A. Leave two seconds between words to assist participants in learning each word. Upon completion of the list, instruct your participants to write down as many words as they can. They may be written in any order.
  3. Collect each list. Thank your participants.
  4. Correct each participant's list and record a score out of 15 for the number of words recalled.
  5. Calculate an average score out of 15 for each participant. Bring the average scores to your next class.
- Allocate the other two participants to the *experimental group*. This group will learn a mnemonic technique before the reading of their lists of words for recall. Follow these steps:
  1. Ensure participants have paper and pen to record words once lists have been read out.
  2. Explain to your participants that you will first teach them a mnemonic technique to help them remember words in the task you are going to give them. In class, choose one of the three techniques described earlier. All experimenters must teach the same technique. Ask your participants to use this technique to learn the following list of words as practice: kite, daisy, hippo, spoon, glass, moon, egg, pencil, bike, bottle, grass, diamond, key, brain, candle. Give your participants three minutes to practise this technique; then ask them to recall the lists of words for your task.
  3. Repeat steps 2 to 5 as used with the control group.

Results: Collate class results for the *control group* and the *experimental group*. Calculate the mean (average) score for each group.

Discussion:

1. What did your results show when comparing the average score for both control and experimental groups?
2. Was your hypothesis supported? Refer to your results to support your answer.
3. What was the difference in the way the experiment was performed for the experimental and control groups? This factor is called the *independent variable*: the variable that was deliberately altered by the experimenter in the experiment.
4. What did you measure in this experiment? This is known as the *dependent variable*: the aspect of behaviour that is measured in an experiment to look for effects of the independent variable.
5. A number of other variables could have influenced the data (dependent variable). Explain two such variables and describe how each could have influenced the results. Consider variables such as the consistency of experimenters, how the method was designed and carried out, choice of participants, and method for collating results.

Conclusion: Summarise what you have found out as a result of conducting this experiment.

1.6 INVESTIGATE

Please help Bree

Bree is a Year 10 student. She enjoys school, including most of her subjects, and wishes to improve her learning and memory. Her marks are reasonable but she believes she is capable of better. Bree would like to know more about study techniques, especially since she has examinations this year. Bree needs your help.

1. What is psychology and why are study techniques part of this subject area?
2. Which type(s) of psychologist could investigate different study techniques designed to help learning and memory?
3. Most people who study psychology do not become psychologists. What other professions would be interested in studying learning and memory including study techniques?
4. Where could Bree find more information about study techniques? Include specific types of people and resources.
5. Use library and Internet sources to investigate study techniques further. Create a PowerPoint slide or handout with five valuable points.

ETHICAL CONSIDERATIONS

Ethical considerations are an extremely important part of psychological research. Ethical considerations are precautions taken to protect the physical and psychological well-being of the participant. To do this, ethical guidelines must be followed when carrying out research. All research must first be approved by an ethics committee.

Ethical guidelines include:

- **No lasting harm to participants**—This is the overall goal and must be considered at all times.
- **Confidentiality**—Participants have a right to privacy and must not be identified or named in the research.
- **Voluntary participation**—People must be willing to take part in the study. They cannot be coerced with bribes or pressure.
- **Informed consent**—The researcher must give details of the study including the ethical considerations (informed) in order for volunteers to agree to participate in the study (consent).
- **Right to withdraw**—Participants have the right to remove themselves or their data from the study at any time, including after the event. They are free to go at any time.
- **Minimal deception, only used when absolutely necessary**—Sometimes it is necessary to conduct research without participants knowing the true purpose of the study. Deception can only be used if it is minimal, will not cause lasting harm and is absolutely necessary.
- **Debriefing**—Participants have a right to know the results of the study and where they can seek psychological assistance if needed after the study. They are also reminded that they can withdraw their results after the study.

Psychology is a broad and diverse subject. It draws in aspects of biology and other sciences, and connects with philosophy, sociology and almost all other subject areas. There are many types of psychologists, ranging from those who treat mental illness to those who detect lies or sell commercial products. It is not surprising that psychology is appealing—almost all professions can benefit from its applications.

Answers to page 3 questions: true, false, true, false, false, false, true, false.

CHAPTER SUMMARY

- Psychology is the scientific study of thoughts, feelings and behaviours. Thoughts, feelings and behaviours are heavily influenced by biology, past experience and cultural aspects.
- The goals of psychology are to use a scientific approach to *describe*, *explain*, *predict* and, at times, *influence* thoughts, feelings and behaviours in beneficial ways.
- To become a registered psychologist, you need to complete an approved six-year sequence of psychology at university. Many people study psychology without intending to become psychologists as it is helpful in other areas of everyday life.
- A psychiatrist is a medical doctor who treats people with mental illnesses and is able to prescribe medication. Psychologists also work in this area but use other therapies and cannot prescribe medication; they work in scientific ways to improve people's thoughts, feelings and behaviours. Psychiatrists and psychologists often work together to the benefit of the patient.
- There is a huge increase in demand for psychologists in Australia. Psychologists work in diverse areas in almost every industry.
- Pseudosciences, such as astrology, are generally well-established beliefs that have not changed over the centuries. They are based on tradition and are difficult to measure and test. They do not use a scientific approach.
- Psychology uses the scientific method to test theories. Psychologists generate and welcome new ideas. Critical thinking is crucial and all aspects of the research are analysed and, typically, alternative explanations and constructive ideas are generated.
- Ethical considerations are an extremely important part of psychological research. Many precautions are taken to protect the physical and psychological well-being of the participant. Ethical guidelines must be followed when carrying out research. All research must first be approved by an ethics committee.

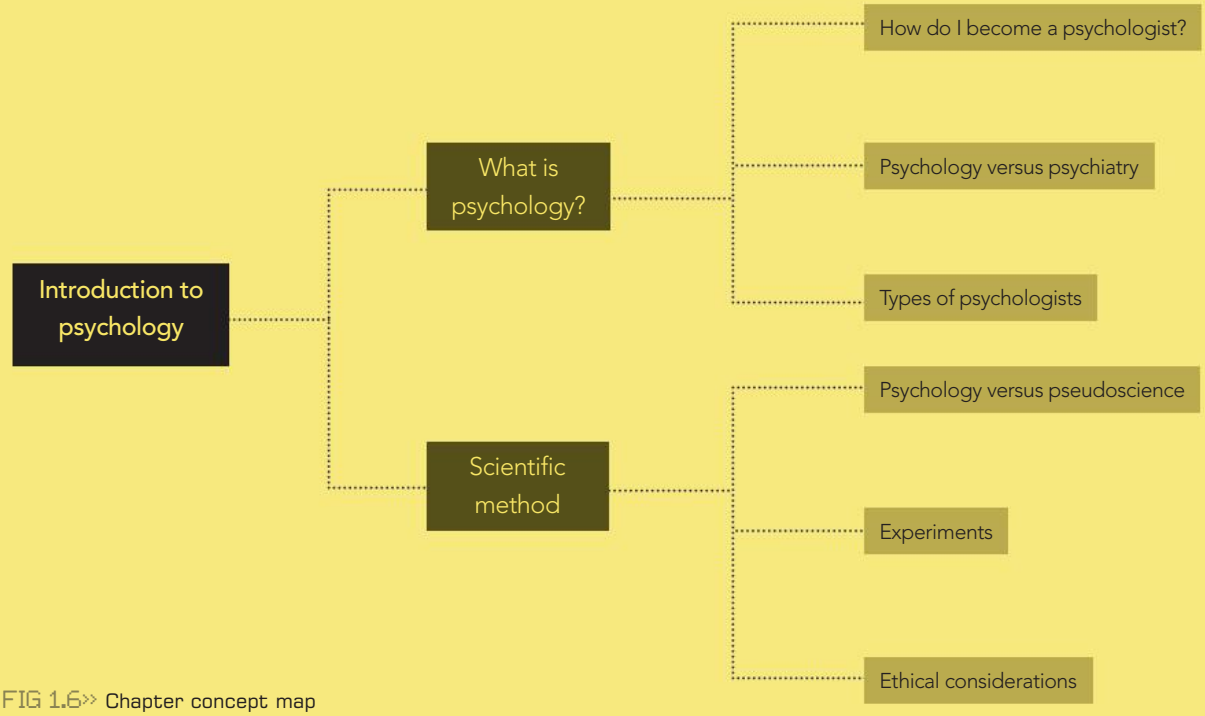


FIG 1.6» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 Which of the following is true of the scientific method?
   - **a** It believes that the theory is correct even when research findings suggest otherwise.
   - **b** It is not open to criticism.
   - **c** It has well-established beliefs that have not changed over the centuries.
   - **d** It follows a set of procedures for collecting and interpreting data.

2 The term *pseudoscience* means:
   - **a** any fake science
   - **b** a real science that investigates fake areas of science
   - **c** early (pre-1900s) research in science
   - **d** a real science that encourages critical thinking.

3 To become a qualified psychologist, you must have completed at least ____ years of full-time study of psychology at university or a combination of university and supervised practice.
   - **a** two
   - **b** four
   - **c** six
   - **d** eight

4 People must not be pressured or forced to participate in a research study. This follows the ethical consideration of:
   - **a** informed consent
   - **b** voluntary participation
   - **c** confidentiality
   - **d** debriefing rights.

5 A psychologist who investigates how to make people more aware of the dangers of using a solarium and sunbathing is likely to be:
   - **a** a clinical psychologist
   - **b** an industrial psychologist
   - **c** a health psychologist
   - **d** a counselling psychologist.

6 What are the main goals of psychology?

7 How does the training to become a psychologist differ from the training to become a psychiatrist?

8 Match the following fields of psychology with their descriptions.

a	clinical psychology	**i**	focuses on social aspects including how we think and interact with others
b	social psychology	**ii**	focuses on all aspects of schooling including learning strategies
c	industrial and organisational psychology	**iii**	focuses on all aspects of behaviour in work settings
d	counselling psychology	**iv**	focuses on the diagnosis, causes and treatment of people with mental illness
e	educational psychology	**v**	focuses on assisting people with many personal life issues that do not involve mental illness

9 Name two areas of psychology that you find interesting. What types of issues and research do psychologists working in these areas deal with?

10 Psychologists are critical thinkers. What does this mean?

11 Why do psychologists take ethical guidelines so seriously?

Extend yourself

12 Is psychology part of the Science Learning Area at your school? Find reasons for your answer.

13 Why has psychology struggled in the past to be recognised as a science?

14 What is *elaborative rehearsal* and how can it assist your studies?

15 What is the Barnum Effect and how does it relate to pseudoscience?

16 Visit the Young Australian Skeptics website and find out more about pseudoscience. WWW»

OUR EXPERIENCE OF THE WORLD

THE BRAIN IS A TRULY AMAZING ORGAN. SCIENTISTS ARE CONSTANTLY MAKING NEW DISCOVERIES THAT UNLOCK FURTHER MYSTERIES INTO WHAT IT IS THAT MAKES US 'TICK'.

The more we learn, the more we realise there is to find out. These discoveries are helping us to understand how the brain controls everything we do, and also why it doesn't always work as it should. Research about the brain is reaching a point where discoveries are exceeding human expectations of what this remarkable organ can do. Science becomes real and exciting when we can apply its research findings to use our brain more effectively or offer real hope to those with a reduced quality of life because of crippling brain disorders.

THE BRAIN

Have you ever been on a roller-coaster? If so, you may recall experiencing elation and excitement, your senses being all confused, the wind in your face, the strange feelings in your stomach, the snatched glimpses of people and buildings below, the screams of fellow passengers and possibly your own, the feeling of your body being glued in position so you feel heavy and unable to move; uncertain of whether you are upright, on the side, or upside down. This experience is created by the brain being bombarded by all your senses. There is so much confusing sensory information being channelled into the brain that it is having a hard time trying to work out what the reality is. It is the brain, however, that is responsible for creating the experience of exhilaration, fear and motion sickness—and maybe even the desire to do it all over again—from the raw sensory data coming into it.

Our **brain** gives us our experience of the world; who we are, what we learn, what we remember, our **senses** (touch, smell, taste, sight and sound), our thoughts, our **emotions** (strong mental or instinctive feelings such as love or fear). Recalling early memories of holidays by the beach, trying to identify constellations in the night sky, feeling exhilarated after a roller-coaster ride, working out the fastest cycling route to town, recognising an aroma as freshly baked bread or choosing music because it makes us feel good all involve complex activity in the soft tissue inside our skull. The brain gives us our personality, and enables us to think and feel. It controls conscious actions such as riding a bike or writing a poem, and unconscious actions such as feeling hungry or breathing faster when we exercise.

FIG 2.2» Riding a roller-coaster bombards all your senses and confuses your brain, creating exhilaration or fear.

The brain communicates with the rest of the body through a complex system of nerves connecting all parts of the body to the brain via the spinal cord. Brain nerve cells or **neurons** are the hardware of the brain that enable us to do all the things we often take for granted. Many neurons are very long because they have to carry

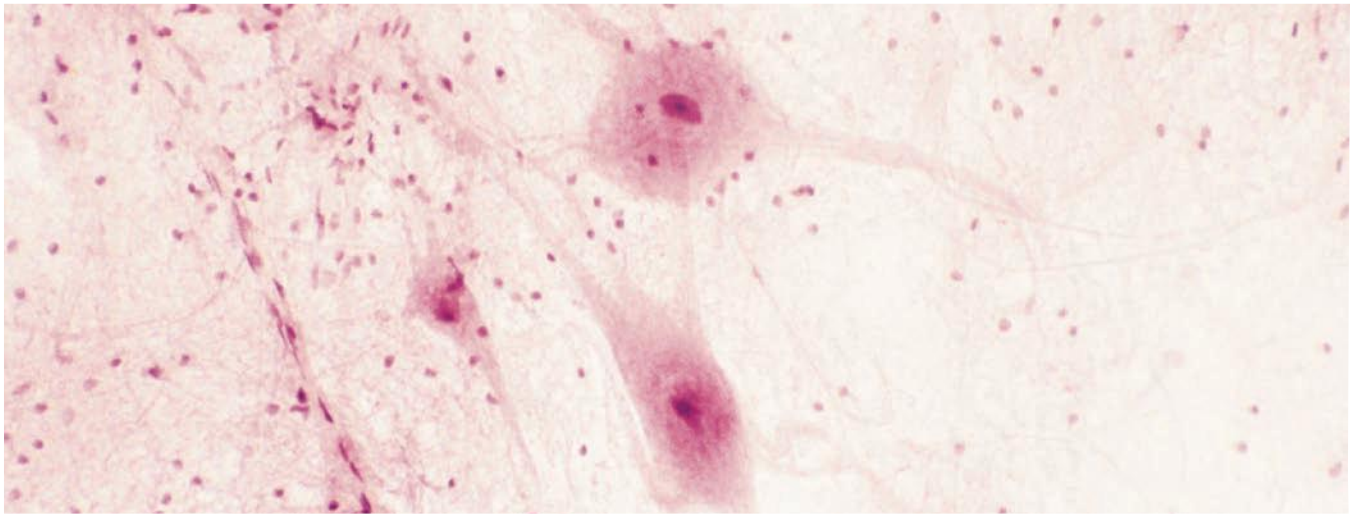


FIG 2.1» Neurons are the nerve cells that carry messages between different parts of the body and the brain.

messages over long distances from organs and tissues to the brain. Brain cells are so active that they require 20 per cent of our blood supply to obtain sufficient glucose and energy, despite the brain taking up only 2 per cent of our body mass.

We are in control of many of the actions coordinated by our brain, such as picking up a glass of water to quench our thirst. Some actions are carried out without thought or control, such as the constant beating of our hearts and breathing. This ensures our survival. Other responses enable us to react rapidly to danger. These are reflexes that include:

- blinking in bright light to avoid damaging our retina and therefore our sight
- withdrawing our hand from something painful or sharp, such as a hot surface or a needle
- swallowing when food touches the back of our throat, so we don't choke on our food.

THE BRAIN AS COORDINATOR

The brain is made up of many different parts that have different functions, but all parts work together to enable us to experience the world.

Imagine standing in front of a painting at an art gallery. When we look at an image, we rely on the brain to understand what it is we are looking at. To make sense of the shapes and colours, and to interpret what the image represents, we rely on **memory** (the ability to store and recall information). For something to make sense, we need to relate it to our own experiences. To allow our brain to register that we are looking at the painting, our eyes must first detect the light that reflects off it. This information is then sent to the visual area of the brain, where it is processed to enable us to make sense of the image. For this process to occur, we rely on specially developed neurons. All these processes occur without our conscious thought. We are only aware of how the image looks, what it makes us think of and how it makes us feel.

2.1 INVESTIGATE

The role of memory in understanding our world

Choose one of the images below and answer the questions.

1. Record the colours and parts of the image that you recognise.
2. What emotions or feelings does this image create for you (e.g. joy, excitement, anger, sadness, pleasure)?
3. What memories (if any) does this image evoke for you?
4. What enabled you to recall the colours, shapes and images in the first part of the activity?
5. Imagine you had no memory at all. What would you see now when you look at each image?



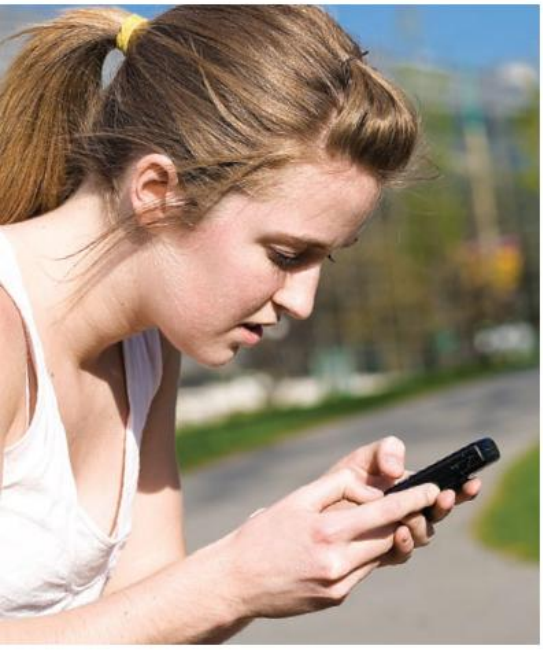



FIG 2.3» To remember a friend's mobile number, we must encode it accurately into short-term memory before it can be stored in long-term memory.

WHAT DOES OUR BRAIN DO?

Without a brain we would not experience emotions such as happiness or excitement, anger or jealousy, fear or sadness. It is also the control centre for all survival functions; it regulates our sleep, hunger, thirst and breathing. When we move towards a soccer ball to kick it to a team-mate, solve a maths problem, text on our mobile phone, or laugh at a friend's joke, the brain is the control centre regulating our actions. Sometimes we can tune in to a dripping tap that we were previously unaware of, although it was there all the time. When we do become aware of it, it enters our conscious thought. Understanding the words as we read this page or participate in conversation relies on complex processes occurring within our brain and memories of what we have done in the past.

MEMORY

Memory is the ability to store and recall information; to remember mobile numbers, friends' names, how to play your favourite computer game. Memories are not stored in a unique place in the brain, but in many different places. Without memory we would be unable to learn.

We have three main types of memory:

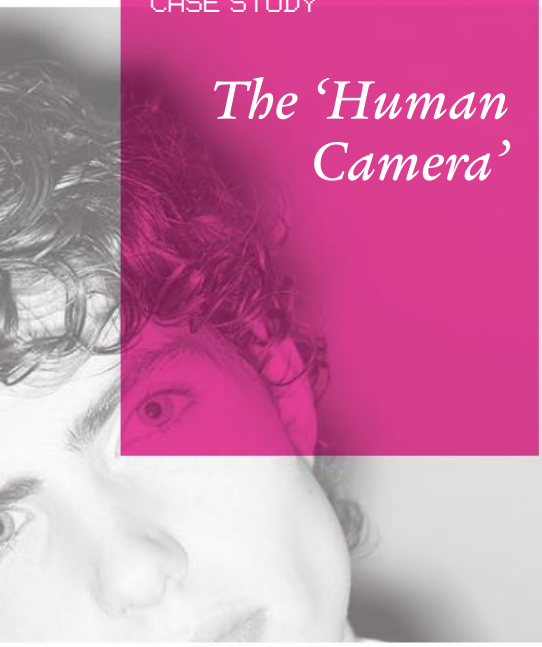
- *Sensory memory*—Information constantly bombards our senses. It is sent from our sense organs such as eyes, ears, tongue, nose and skin to our brain. Once there, it lasts only a few seconds before it is gone again, unless we pay attention to it. It allows us to be aware of our environment.
- *Short-term memory*—This enables us to store the stimuli we experience, but only for a limited time. If there is a meaning to the information, we may transfer it to long-term memory so we can access it again at some stage. When we purchase an item at a shop, we will remember the cost until we have counted the money out of our wallet and paid. The cost may be transferred to our long-term memory if we want to tell a friend about what a good deal we just got. Otherwise, we have no reason to remember it, and it will be lost.
- *Long-term memory*—This stores information for long periods, providing we use it. These may be factual memories such as the date of our birthday or the words to a favourite song. They may also be skill memories such as how to play a violin or ride a skateboard. We have a better chance of remembering information if it is meaningful to us, or if we rehearse it often. For example, many of us will remember the 'times tables' for as long as we live. We are also likely to recall our own phone number because we need to use it a lot. Painful experiences tend to be easily recalled after a long period of time. Remember breaking that arm and still recalling the experience as if it were yesterday?

Some people have an **eidetic** or photographic memory that enables them to accurately reproduce images as if they still have the image in front of them. In specific conditions, such as some types of autism, memory can be exceptionally enhanced. This can enable individuals to reproduce from memory a complex musical piece or detailed drawing after hearing or seeing it just once. Individuals with this type of autism are called autistic savants.

2.2 INVESTIGATE

Just imagine … no senses!

Close your eyes and imagine that you have no sight, no sense of smell, no sense of touch, no sense of taste and no hearing. What can you then recall about your surroundings at this very moment? What temperature is it? Where are you? Who are you with? Reflect on your thoughts. Record your ideas on what you have discovered.



CASE STUDY

The 'Human Camera'

Stephen Wiltshire is an architectural artist who has received an MBE for his services to art. He has been called the 'Human Camera' because of his ability to draw landscapes purely from memory. His drawings are a perfect reproduction of reality. Stephen has autism, a condition that is caused by abnormalities in the brain. He lives in a world of his own and has great difficulty communicating with other people. Stephen also has severe learning difficulties. However, he has a superhuman capacity for remembering detail. This enables him to make detailed drawings of buildings and city views from memory with amazing accuracy. At the age of 11 he drew a perfect aerial drawing of the city of London after his first ride in a helicopter. The detail of buildings, roads and cityscapes looked as if it was a perfect blueprint. The workings of memory are indeed a mystery!

You can see online footage of Stephen drawing a detailed blueprint of Rome as seen from a flight in a helicopter. WWW

2.3 INVESTIGATE

How important is our memory?

The following activities show how complex our brain's capabilities are. Much of our conscious experience comes from using our senses, memory and emotions.

Thought triggers

1 Memory works on associations with other ideas, thoughts and images stored in our brain. Keywords can trigger a range of memories and sensory experiences. Think about the following events and record the memories they create for you. Consider one at a time. Be patient and allow the thoughts to flow so that one thought will lead to another. It may help you to close your eyes and visualise the time and place. Use your senses and focus on visual images, sounds and smells that you recall.

- Christmas Day
- A visit to the beach
- A party that you enjoyed
- A favourite holiday

Memories and emotion

2 Use one of the events above that has an emotional meaning for you. This means that the memory triggers emotions such as happiness, excitement, sadness, fear and anxiety. Write a brief description of the event and the emotions that you recall. Do these memories create strong or weak memories of the emotions? What led to these emotional experiences at the time? How well can you recreate the emotional experience through just recalling the memory?

Getting through the day

3 Think about the things you do each day that rely on memory and other brain functions. Complete your ideas in a table. Use the example below as a guide.

Action	Relies on memory of …	Other necessary brain functions
Going to school	Taking bag and school books, how to get to school (e.g. where to catch the bus, what time it leaves, where to get off, buying a ticket), which way to walk, where the school gates are etc.	Coordinating movement, use of language, problem-solving (e.g. if running late for bus)

How important is your memory in getting you through your day?

REVIEW 2.1

1 List five different ways in which our brain gives us our 'experience' of the world.
2 What type of cells make up our brain's hardware?
3 What is a reflex? Give an example of a reflex from your own experience, and explain why this reflex is important.
4 Describe the role that memory plays in enabling you to appreciate your favourite television show.
5 Our brain can be described as a 'control centre'. Choose one of the contexts below to describe the role that the brain can play in coordinating the activities that make it possible.
   - Playing a game of tennis
   - Shopping with friends
   - Building a skateboard ramp
6 There are three stages involved in memory. Name and describe the features of each stage.
7 What is an eidetic memory?

FIG 2.4» A computer needs a program to be written for it in order to do a task, but humans are born with the ability to learn.

LEARNING

The brain enables us to learn. **Learning** means we are able to acquire new skills and knowledge through what we are taught and what we experience. It is a process that constantly contributes to our understanding of the world and continues until the end of our lives. Most of our learning, however, occurs during childhood, when we acquire important skills such as how to talk and walk. As we get older, we are able to learn more sophisticated skills such as playing the piano or riding a bike.

The ability to learn depends on memory. We do not have to learn how to learn; it is a skill we are born with. As we learn, we produce new pathways within our brain. The more we learn, the more connections we develop between neurons. This makes our learning, and therefore our memory, much more efficient.

BALANCE AND COORDINATION

Humans have an advantage over many other animal species because they can balance on two legs. This means they can use their hands for many purposes such as eating, writing, using a computer and playing basketball. It is the brain that gives us the ability to balance on two legs. Touch sensors in our skin, receptors in our muscles and balance sensors in our ears are all constantly sending information to the brain to keep updating it on our body's position and movement.

The cerebellum is a part of the brain that is responsible for ensuring that our movements are smooth. A gymnast or a trapeze artist would have a finely tuned cerebellum to enable such fine balance.

Inside our ears are important balance receptors that feed back information to our brain about head movements and whether we are standing upright or not. This is controlled by our vestibular system.

The vestibular system regularly feeds information to our brain about balance, motion and body position. It coordinates information from specialised organs in the inner ear with messages to the eyes and muscles to maintain our sense of balance. The vestibular organs include three semicircular canals that are filled with fluid. When we spin in a circle, the rotation causes a movement in this fluid that feeds back information to the brain about our body position.

The semicircular canals are oriented along three planes of movement. Pilots and astronauts call these three planes of rotation pitch (up and down; nod your head 'yes'), roll (tumbling left or right; move your head from your left to your right shoulder or vice versa), and yaw (lateral movement left and right; shake your head 'no'). While semicircular canals respond to rotations, the otolithic organs sense movement backwards and forwards. Together, the vestibular organs are important in creating our sense of balance and spatial awareness.

When the vestibular system is damaged, life is extremely difficult. For example, Cheryl has a rare condition affecting the vestibular system, the sensory organ for balance. As a result, she has no sense of where in space her body is positioned. She is unable to stand without support, and feels she is constantly falling. This makes life extremely difficult for Cheryl, as she has to use a lot of brain power just to stay upright. Her resulting mental fatigue makes it very difficult for her brain to focus on other important things such as memory.

SLEEP AND DREAMS

We spend about one-third of our lives asleep. It must therefore play an important role in our survival. **Sleep** is a unique state of awareness. We are not fully conscious of what is going on around us, but we can be aware of noise such as a barking dog. Neither are we unconscious. Our brainwave patterns during some stages of sleep closely resemble that of an awake state. Sleep serves an important purpose. It gives our body the opportunity to repair and rest, to process the happenings of the day, and to learn and remember.

Sleep is controlled by different parts of the brain, which regulate the timing, duration and quality of our sleep. Our brain produces a hormone called melatonin, which is the 'hormone of sleep'. As it gets dark our brain releases more of it, and we get sleepy.

We have learnt a lot about sleep from pictures of our brainwaves on an EEG (electroencephalogram) and from images depicting active parts of our brain using PET (positron emission tomography) scans. These show that activity levels in the brain change in different stages of sleep.

Our most active brainwaves occur during rapid eye movement (REM) sleep. This is when our eyeballs are constantly moving, and it is the time we do most of our dreaming. Dreaming enables us to sort through the day's events, and to consolidate what we have learnt during the day. Dreams can be made up of a jumbled sequence of events incorporating past and present memories. Making sense of them is not always easy.

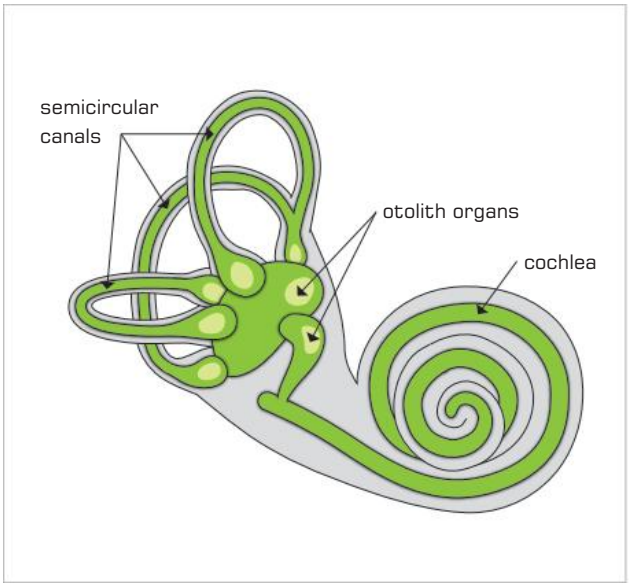


FIG 2.5›› The vestibular system sends information to the brain about balance, motion and body position.

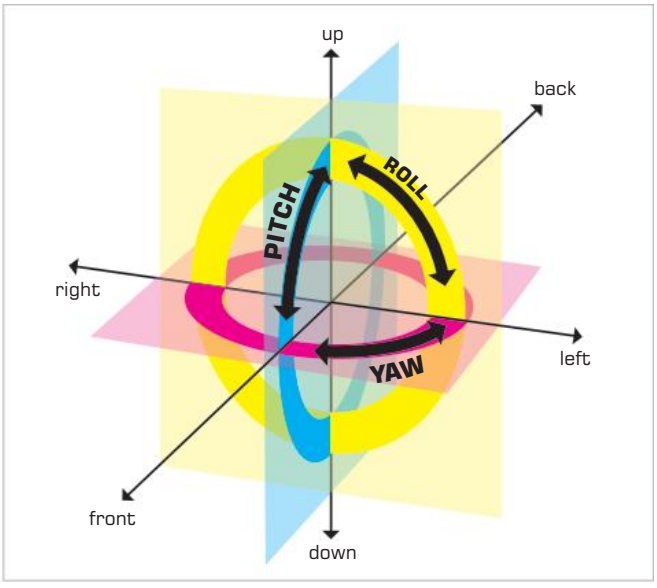


FIG 2.6›› Planes of movement for the semicircular canals

HORMONES

The brain also contributes to the body's functioning through the control of special chemicals called hormones. **Hormones** are the body's chemical messengers, which have an effect on glands distributed throughout the body. The brain's pituitary gland produces hormones that control the activities of the testes, ovaries, pancreas, adrenal and thyroid glands. These in turn have important roles to play in our body's functioning, and their own hormones each have a specific effect on different tissues or cells within the body. Male and female reproductive glands (testes and ovaries) regulate sexual development and activity, the pancreas produces insulin to control blood glucose levels and the thyroid gland regulates our body's metabolism.

The pituitary gland is further controlled by the hypothalamus, which is also located within the brain. This complex interaction of glands and hormones is known as the endocrine system.

The adrenal glands play an important role in preparing the body to react to emergency situations. They release adrenaline, a fast-acting hormone that prepares the body to confront danger (fight) or run away from it (flight). This is known as the 'fight or flight' response.

Imagine walking along a bush track on a warm, sunny day. You encounter a snake curled up on a rock in the middle of your path, and it looks poised to strike. You are likely to feel a surge of adrenaline, which will assist you in dealing with the situation. It will target the parts of your body that increase oxygen intake and the amount of glucose available. Extra blood flow will be diverted to the muscles along with additional oxygen and glucose to enable a surge of energy for a quick getaway if needed. This same process will also enable a sprinter to find the energy to make a final burst for the finish line.

WHAT DOES IT MEAN TO BE HUMAN?

Over many centuries people have tried to discover what distinguishes humans from all other species. Primates, such as humans, apes and monkeys, have many things in common that other species do not have; for example, they can communicate, live in groups with a social structure, recognise emotion and solve problems. One key factor in the survival of the human species is thought to be the capacity for memory. This has enabled humans to evolve actions and behaviours based on past experiences. It also allowed them to develop other abilities such as language and problem-solving.

Humans are alike in many ways, but we all differ in the way we think and feel, and how we react to different situations. This is because the brain is so complex and ever changing, depending on the experiences we have. This quality is known as plasticity, where our nerve cells are constantly forging new connections and losing old ones. As a result, each of us is 'wired' uniquely. There really is nobody else like you!

Computers have surpassed humans in some areas, such as the speed with which they can calculate, locate or organise information. However, the memory capacity of the human brain is far greater than any computer. This is because human memory has flexibility; it can alter its path or thought processes.

TABLE 2.1» Similarities and differences between a computer and a human brain

Similarities	Differences
Both send messages using electrical signals.	A computer uses electricity; the brain uses electrical and chemical signals.
Both can increase memory capacity.	A computer can increase capacity with extra computer chips; the brain can increase its dendrite connections to increase communication between neurons.
Both can function quickly.	A computer is better at multi-tasking; the brain is faster at learning new tasks.
Both have changed over time.	Computers have changed much more quickly as new technology enables increased functions, speed and size; the brain has evolved slowly over time from early humans to increase its capability.
Both need energy.	A computer needs electricity; the brain needs oxygen and sugar.
Both can be damaged.	It is easier to fix or replace parts on a computer; the brain is not easily fixed but other brain parts can take over damaged areas.

did you know? Recent studies have suggested that men with higher testosterone levels make better dancers. Men with better coordination on the dance floor also tend to be more attractive to women. These higher testosterone levels seem to be linked to a higher exposure to the hormone testosterone while in the womb.

2.4 INVESTIGATE

Comparing the human brain and a computer

List the advantages and disadvantages of the human brain and a computer.
What differences can you think of?

Function	Advantages/disadvantages of a computer	Advantages/disadvantages of a human brain	Which is better, computer or human brain? Why?
Thinking			
Learning			
Problem-solving			
Feeling			
Decision making			
Entertainment			
Memory			

REVIEW 2.2

1 'Memory and learning depend on each other.' What does this mean?

2 Why is the brain so important in helping you keep your balance?

3 Sometimes when you have a head cold you feel giddy and light-headed and you lose your balance. Why do you think this may happen?

4 Describe three occasions in the past two days where your cerebellum has played a role.

5 Sleep is an essential function. Describe why sleep is so import

6 Explain why melatonin is called the 'hormone of sleep'.

7 Jake is sleeping on the couch. His eyeballs are moving around under his eyelids. What does this tell you about the stage of sleep he is in?

8 What is a hormone?

9 Explain what is meant by the 'fight or flight' response.

10 Describe a time when you experienced a surge of adrenaline in an emergency situation. What changes did you notice take place in your body? Do you think they helped in this situation?

11 Why is the capacity for memory believed to have been so important in the survival of the human species?

12 Discuss the strengths and limitations of a computer compared to a human brain.

13 A *metaphor* is a term that can be used to represent an object or an idea. For example, the brain can be likened to a spider web because it has many parts that interconnect to create a complex structure.

Choose four of the following metaphors that could be used to describe the brain. For each choice, explain why you think it is a useful comparison.
You may also like to think of your own metaphors!
Possible metaphors for the brain: camera, factory, tree, universe, tool kit, game, garden, mobile phone network, library, forest, encyclopaedia, school.

CHAPTER SUMMARY

- The brain is a truly amazing organ. The more scientists learn about it, the greater their understanding of what it is that makes us 'tick'. These discoveries are helping us to understand how the brain controls everything we do, and also why it doesn't always work as it should.
- Our brain gives us our experience of the world; who we are, what we learn, what we remember, our senses, our thoughts, our emotions. The brain gives us our personality, and enables us to think and feel. It controls conscious actions such as riding a bike, and unconscious actions such as feeling hungry.
- The brain communicates with the rest of the body through a complex system of nerves connecting all parts of the body to the brain via the spinal cord. These individual nerve cells are called neurons.
- The brain is made up of many different parts that have different functions that work together to enable us to experience the world.
- Without a brain we would not experience emotions such as happiness or excitement, anger or jealousy, fear or sadness. It is also the control centre for all survival functions. It regulates our sleep, hunger, thirst and breathing.
- Our brain tunes into things that we are not aware of, until there is a reason for us to become conscious of it. When we become aware of something, it enters our conscious thought.
- Most of what we do relies on having a memory of what we have done in the past. Memories are not stored in a unique place in the brain, but in many different places. Without memory we would be unable to learn.
- The brain enables us to learn. This means we can acquire new skills and knowledge through teaching and experience. The ability to learn depends on memory, and as we learn, we produce new pathways within our brain. These pathways form due to developing new connections between neurons.
- The brain plays a key role in enabling us to balance on two legs. Touch sensors in our skin, receptors in our muscles and balance sensors in our ears are all constantly sending information to the brain to keep updating it on our body's position and movement.
- We spend about one-third of our lives asleep. Sleep serves important purposes. It gives our body the opportunity to repair and rest, to process the happenings of the day, and to learn and remember.
- The brain contributes to the body's functioning through the control of hormones. These are the body's chemical messengers, which have an effect on glands such as the pancreas, ovaries and testes, and are distributed throughout the body.
- Primates, such as humans, apes and monkeys, have many things in common that other species do not have: they can communicate, they live in groups with a social structure, they recognise emotion and solve problems.
- The capacity for memory is thought to be the key factor in the survival of the human species, because it enabled humans to evolve actions and behaviours based on past experiences. It also allowed them to develop other abilities such as language and problem-solving.

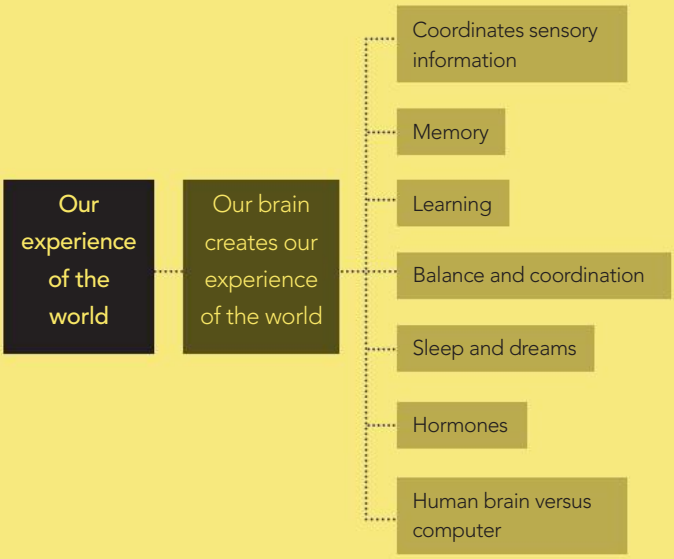


FIG 2.7» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 The brain gives us our experience of the world. This includes a key role in:
   - **a** recalling memories
   - **b** learning new skills
   - **c** understanding information registered by our senses
   - **d** all of the above.

2 We are in control of many of our actions; however, actions that assist in survival and enable us to react automatically are called:
   - **a** memories
   - **b** reflex actions
   - **c** emotions
   - **d** exercise.

3 There are three main types of memory. The memory that enables us to store information for short periods but transfer it if meaningful is called our:
   - **a** sensory memory
   - **b** short-term memory
   - **c** long-term memory
   - **d** limited memory.

4 When Steve is showjumping his horse, which parts of Steve's brain help him to balance and coordinate his body movements?
   - **a** The cerebellum.
   - **b** The vestibular system.
   - **c** The cerebellum and vestibular system.
   - **d** The cerebrum and vestibular system.

5 Our brain produces a hormone called melatonin. The role of this chemical is to:
   - **a** assist in memory
   - **b** enable us to learn more effectively
   - **c** control reproductive cycles
   - **d** help us to sleep.

6 Sleep is important because it enables the following:
   - **a** the repair of our body's cells
   - **b** processing of the day's activities
   - **c** the body and brain to rest
   - **d** all of the above.

7 During REM or 'dream' sleep:
   - **a** we process memories from the future
   - **b** we are in a very deep state of sleep
   - **c** our eyeballs move rapidly
   - **d** all of the above.

8 Determine whether the following statements are true or false. Give an example or explanation to justify your answer.
   - **a** Learning is not dependent on memory.
   - **b** The brain relies on senses to have an understanding of the environment.
   - **c** Brain cells or neurons are very active cells.
   - **d** Learning how to ride a skateboard does not rely on visual memory.
   - **e** Sensory memory will only be transferred to short-term memory if we pay attention to it.
   - **f** Once we reach adulthood, we are unable to develop new connections between neurons.
   - **g** PET scans would show little activity during dream cycles when we are sleeping.
   - **h** The brain can be likened to a conductor coordinating an orchestra.

9 What advantages does a human brain have over a computer?

Extend yourself

10 There are many examples of people who have lost one or more senses, and their remaining senses have been heightened. Find out about a specific case and highlight the sense/s that they have lost or enhanced. How has this changed their interaction with the world?

A TOUR OF OUR AMAZING BRAIN

NEUROPSYCHOLOGY IS A BRANCH OF PSYCHOLOGY AND NEUROLOGY THAT AIMS TO UNDERSTAND THE RELATIONSHIP BETWEEN THE STRUCTURE AND FUNCTION OF THE BRAIN.

Daniel Tammet is a 26-year-old who can perform mind-boggling mathematical calculations in an instant and recall *pi* up to 22 514 decimal places. He is obsessed with counting, and will count anything he lays eyes on. He can speak seven languages, and is even creating his own language; however, he is unable to drive a car or tell the difference between left and right. Daniel is an autistic savant, which means he has an extraordinary mix of abilities and disabilities. At the age of three, he suffered an epileptic fit, which altered the way his brain worked. How can such amazing capability be shown by a damaged brain? Scans of Daniel's brain suggest that his right hemisphere is compensating for the damaged left hemisphere.

OUTSIDE THE BRAIN

Neuropsychology is a branch of psychology and neurology that aims to understand the relationship between the structure and function of the brain.

As the brain is vital to our function and survival, it is protected by the solid bones of the skull. Our skull is made up of 22 bones that are fused together. Newborn babies have soft spots on the top of their head called **fontanelles**, which are areas of the skull where the bone has not yet hardened. This is why it is important to be especially careful to protect a baby's head to avoid brain damage. At the age of one, the skull begins to harden and fuse together, forming visible lines called sutures.

The vertebrae in our spine play a vital role in protecting the spinal cord, which is the bundle of nerves that connects our brain and the nerves communicating with organs and different parts of our body. This 'network' enables messages to go to and from all parts of the body to the brain.

Sensory neurons are nerve cells that are specially developed to detect information from our environment (light, sound, touch, taste and smell). They send messages from our sense organs to the brain so we can understand our environment. The brain then sends messages to muscles in different parts of our body via **motor neurons**, which carry messages from the central nervous system to different parts of the body.

FIG 3.1›› Infant skull showing fontanelles (a) and an adult skull showing sutures where bones have fused (b).

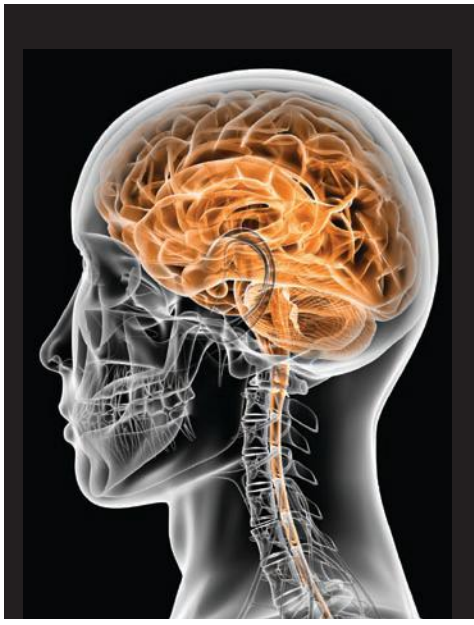


FIG 3.2›› The spinal cord is a bundle of nerves connecting the brain to different parts of the body.

For example, sensory neurons in our eyes will detect the edge of a cliff in front of us, and send a message to our brain. Once it reaches our brain, we have an understanding of what we are seeing and that it will be dangerous to step over the cliff edge! Our brain will then respond by sending a message back to our leg muscles via motor neurons to turn away from the cliff and walk in a safer direction.

INSIDE THE BRAIN

The skull supports our brain in a special fluid called cerebrospinal fluid (CSF). This is a clear and watery fluid that supplies nutrients to our brain cells, removes waste from them, and cushions our brain tissue from a knock to the head. This fluid can be useful to doctors in helping to diagnose illnesses such as meningitis, a critical condition caused when the membrane surrounding the brain and spinal cord becomes inflamed.

Cerebral cortex

The most visible part of the brain is the **cerebral cortex**. This is a thin, 3 to 5-millimetre-thick, highly folded outer layer of the brain. The cortex is further divided into areas that have specialised functions.

Frontal lobes

The **frontal lobes** are the largest lobes located at the front of both hemispheres of the brain. They are associated with thinking, decision making, personality, emotional behaviour, self-awareness, initiative and planning. It is also this part of the brain that enables you to judge the consequences of your behaviour. An area of the frontal lobe in the left hemisphere is also responsible for the production of speech.

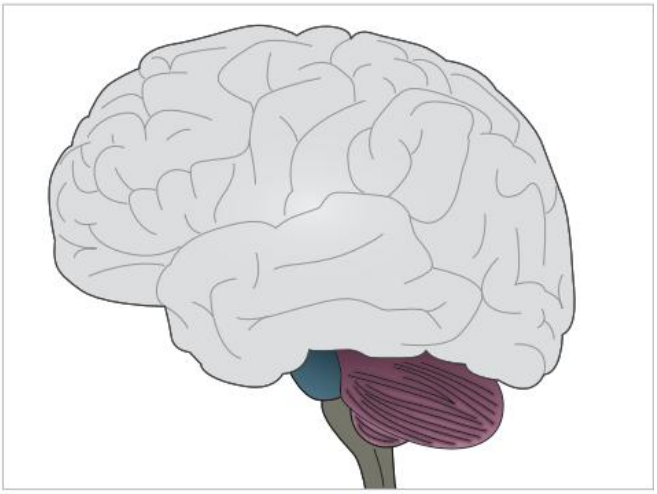


FIG 3.3» The heavily folded surface of the cerebral cortex

Have you ever wondered why, as a teenager, you often find yourself in trouble over behaviour that adults seem to think was dangerous or risky, but you didn't quite see it that way? The frontal lobe is where you judge the consequences of behaviour. This lobe is slower to develop, and until it is mature, teenagers find it difficult to carefully think through the consequences of their behaviour. The delayed development of this brain function until the early twenties is thought to be one of the reasons that teenagers participate in risky pursuits more than adults.

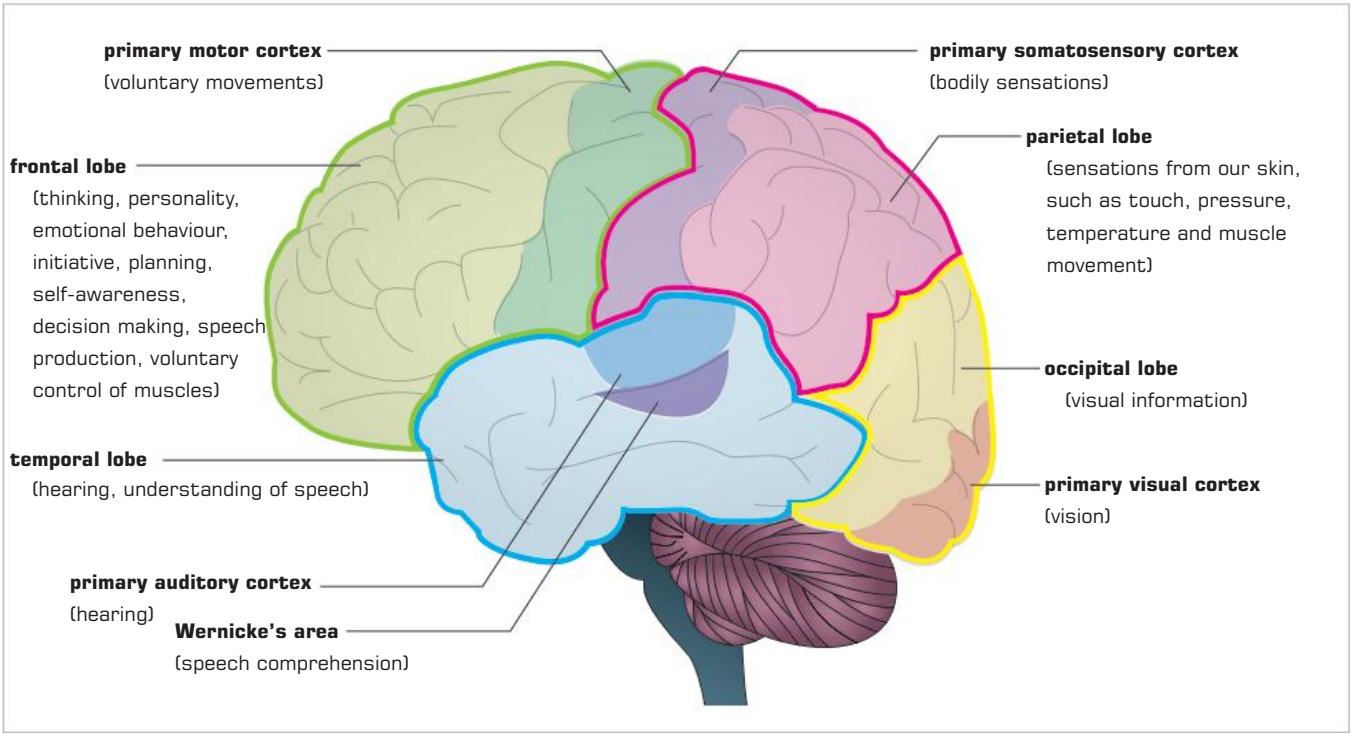


FIG 3.4» The four lobes, the sensory and motor areas, and the areas responsible for speech and comprehension

The back portion of the frontal lobe is called the **primary motor cortex** and is the area involved in controlling our voluntary muscle movement (muscle movement we control ourselves). Electrical stimulation of one area could cause movement in the big toe or, in a different area, could enable the movements necessary for speech. For areas requiring precise muscle movements to carry out an action, there are many nerve cells connecting this cortex area to the necessary muscles. For example, the face is required to carry out precise movements for talking and expressing emotions. It therefore needs more nerve cells to control it and there is a larger area of the primary motor cortex devoted to controlling facial movement compared to areas such as the legs or torso.

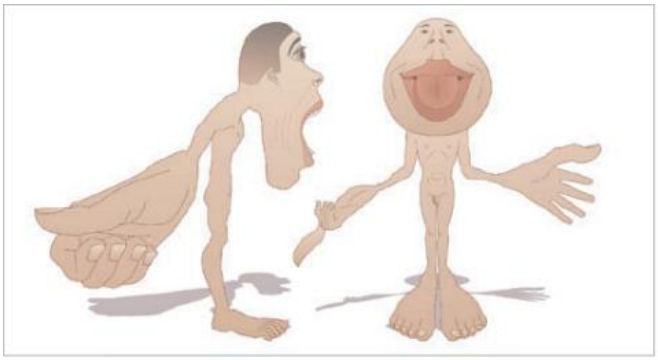


FIG 3.5›› The character on the left illustrates the proportion of nerves leaving the primary motor cortex to different parts of the body. The more control we have over a body part, the more nerve cells it needs and the larger the representation in this diagram. The character on the right illustrates the proportion of nerves leaving the primary somatosensory cortex to different parts of the body. The more sensitivity we have in an area of the body, the more nerve cells it needs to receive the sensations, and the larger the representation in this diagram.

It is possible to locate our primary motor cortex quite easily. The place you would normally wear a headband is directly over this important part of your brain that controls voluntary muscle movement. Place your thumbs on your head in the spot directly over the top of your ears and join your forefingers from each hand on the top of your head. This is approximately where your primary motor cortex is located. Control of the left side of the body is in the right hemisphere, and vice versa.

Parietal lobes

The **parietal lobes** register sensory information from our skin, and are located at the top of the brain. Information about bodily sensations such as touch, pressure, temperature and muscle movement is sent to this area. Messages from the right side of the body are sent to the left parietal lobe, while messages from the left side are sent to the right parietal lobe.

Temporal lobes

Auditory information such as talking, sounds and music is sent directly from the ears to the **temporal lobes**. This area is also responsible for making sense of conversation.

Occipital lobes

Visual information is sent from the retina at the back of each eye directly to the **occipital lobes**. This area of the brain is also responsible for making sense of what we see.

A special case: Ben Underwood

Ben was a teenager who loved doing all the normal things like other kids. What made Ben remarkable was that he used to rollerblade, ride a bike and play basketball despite the fact that he had both eyes removed due to retinal cancer at age two. Ben was therefore totally blind, but still able to do all these things because he used echolocation; which is the same technique dolphins and bats use to navigate. As Ben moved around, he made clicking sounds with his tongue. His brain calculated the distance to an object based on the time it took for his clicking sounds to bounce back off the object's surface. He could distinguish between a rubbish bin and a fire hydrant, and between parked cars and trucks. The quality of the echo also gave him information on the type of surface. For example, metallic surfaces give off a soft echo, glass sounds sharp and wood sounds 'hard'. Ben's brain created a 3-D image using auditory feedback. Ben therefore 'saw' with sound. Find out more about Ben online. WWW»

REVIEW 3.1

1. What type of work would a neuropsychologist do?
2. What roles do the skull and vertebrae play?
3. What is the difference between sensory neurons and motor neurons?
4. What is the role of cerebrospinal fluid (CSF)?
5. List the four lobes of the brain, and outline the key functions of each.
6. Read the story of Ben Underwood above. What lobes of his brain were responsible for his new skill of 'seeing with sound'?

3.1 INVESTIGATE

The four lobes

1 Determine which lobe of the brain is referred to in each description.
   - **a** I am responsible for *vision*.
   - **b** I am responsible for sensing *temperature*, *touch*, *pressure* and *pain*.
   - **c** I am responsible for *thinking*, *personality* and *emotions*.
   - **d** I am responsible for *hearing*.

2 Create a memory tool for remembering the four lobes of the brain. For example, '**F**unny **P**igs **O**rder **T**offee' is a way of remembering frontal, parietal, occipital and temporal lobes in a clockwise direction. What can you come up with to help you remember?

BRAIN DAMAGE

Symptoms associated with brain trauma can indicate the areas of the brain that have suffered damage, e.g. loss of sight can be caused by damage to the occipital lobe; inability to feel hot or cold surfaces can be caused by damage to the parietal lobes; dramatic changes in personality can be caused by damage to the frontal lobe (see Case study 'Phineas Gage's pierced skull').

People with schizophrenia can sometimes experience hallucinations, which occur when people 'see' images that do not really exist. Scans of the areas of electrical activity in the brain show that nerve cells in the occipital lobe are active and therefore create the vision.

did you know? An experimental device called the BrainGate Neural Interface System has enabled a paralysed man to draw shapes and play video games simply by imagining movements. A sensor implanted in his brain detected the electrical activity in his motor cortex and this was converted into computerised signals. This discovery has exciting possibilities for patients with spinal cord injuries. It is hoped that they may be able to control their prosthetic (artificial) limbs by merely thinking about the movement. Find out more about the BrainGate Neural Interface System online. WWW»

CASE STUDY

Phineas Gage's pierced skull

Damage to the frontal lobes may cause dramatic changes to personality and thinking ability. The first documented case of this was of a patient called Phineas Gage, recorded by Dr J Harlow (1868). Phineas was a young man who was injured while working on the railway, blasting with gunpowder. When a spark ignited the gunpowder, it shot an iron rod through his skull and his frontal lobe. Amazingly he survived the accident, and within a short time he was walking and talking normally. However, his personality was permanently affected, and he changed from a friendly and gentle character into a foul-mouthed and angry young man. Go online to find out more about Phineas Gage. WWW»

3.2 INVESTIGATE

Which part of the brain is damaged if … ?

Use the information on the functions of the four lobes of the brain on the previous pages to determine which brain area is most likely damaged in each case below. Choose from the following parts (each may be used more than once): frontal lobe, parietal lobe, occipital lobe, temporal lobe.

	Symptoms	Lobe of the brain most likely affected
1	As a result of a car accident causing brain damage, Bianca is unable to feel any sensation in her hands.	
2	After a stroke, Cyril is unable to accurately process words as they occur in conversation.	
3	Milo seems unable to plan ahead or make decisions. He also has difficulty relating to others.	
4	Sali has a number of blind spots in his vision caused by a tumour.	
5	Sam's personality has changed from being quiet and gentle to loud, disruptive and rude. This can be associated with Alzheimer's disease.	
6	Prue is finding it difficult making sense of sounds.	
7	After a diving accident, Tessa is unable to move her arms and legs.	
8	Lily has unexpected emotional outbursts since she had brain surgery.	

Neglect syndrome

Patients suffering from damage to the right parietal lobe may suffer from neglect syndrome. This may cause them to ignore objects in their left visual field. In March 2009 *Scientific America MIND* reported on a girl named Rachel who had suffered a stroke that caused damage to the right parietal lobe. As she was recovering, her partner soon observed some odd symptoms. Rachel did not appear to notice that she was eating food only from the right side of her plate, she was brushing only the hair on the right side of her head, and she was constantly bumping into objects on her left. Her eyesight was perfectly normal, and when directed to things on her left, she was able to see them. Rachel was suffering from neglect syndrome.

Pseudo-neglect

Pseudo-neglect is a form of neglect found in some normal, healthy individuals. Is it possible that you neglect a part of your field of vision?

Studies conducted by Jewell and McCourt (2000) have revealed that most people show a bias to the left; where they measure the left side as longer than the right. This is especially true for younger right-handed males. Other factors that contribute to such a bias include people who read English and are therefore used to scanning text from left to right, and right-handers are more likely to over-estimate the left side. These results are thought to be due to spatial tasks being mainly processed in the right hemisphere.

Vegetative states: interesting research

How much do severely brain damaged or 'vegetative' patients really understand about their outside world? It has long been thought that a patient in this state is unable to communicate because their brain is 'dead'. However, research by Adrian Owen and his fellow researchers at the University of Cambridge in 2006 found that this may not be the case! When placed in a magnetic scanner and asked to imagine playing tennis or imagine visiting rooms in her house, a vegetative patient was shown to have brain activity in similar areas of the brain as compared to individuals with a healthy brain (Koch, 2009).

3.3 INVESTIGATE

Pseudo-neglect

This activity will investigate whether we can all suffer from pseudo-neglect.

1 On a sheet of paper, draw a horizontal line approximately 12 centimetres long.

2 Sit straight in your seat and place the horizontal line in the centre of your vision.

3 Look carefully at the horizontal line and place a vertical mark at the mid-point.

4 Using a ruler, carefully measure from the left side of the horizontal line to your mark. Record your measurement to the nearest millimetre.

5 Then measure from your mid-point mark to the right side of the horizontal line, and again record your measurement to the nearest millimetre.

6 Think about your results. Were you able to accurately determine the mid-point of this line? If not, which side did you overestimate?

How do your results compare to the research reported by Jewell and McCourt (2000)? Collate the class data. How do your results compare? Does the class data support the research?

An explanation: The right hemisphere is more involved in **visual–spatial tasks** (those involving visual stimuli and an understanding of where objects are in space) and is therefore likely to be more attuned to objects in the left visual field. A bias of attention can therefore be observed on the left.

BENEATH THE CEREBRAL CORTEX

From the outside, a brain looks like a large wrinkled walnut with a soft texture. The highly folded cerebral cortex enables a large surface area to fit inside the skull. This means that many more neurons can be contained in the cerebral cortex for greater capability. Every person has their own unique pattern of folds on the surface of their brain.

The cerebral cortex is the main part that is visible, but beneath this there are many other structures that have their own roles to play in the amazing range of capabilities of the human brain. All parts of the brain have an extensive network of blood vessels to bring nutrients to, and remove waste from, each of the billions of nerve cells.

Structures in the brain include (see Figure 3.6):

- **Cerebral cortex:** covers the cerebrum and is the most visible part of the brain, made up of billions of nerve cells called neurons; responsible for conscious thought
- **Corpus callosum:** thick band of nerve axons connecting the left and right hemispheres
- **Cerebellum:** primitive part of the brain responsible for coordination, balance and movement
- **Brain stem:** regulates survival functions such as our heartbeat, blood pressure and breathing rates
- **Thalamus:** sensory data arrives here and is then relayed to specific areas of the cortex
- **Hypothalamus:** responsible for regulating body temperature, appetite, thirst and hormones
- **Pineal gland:** controls our internal body clock; regulates our sleep–wake cycles and releases our 'sleep' hormone, melatonin
- **Hippocampus:** responsible for making new memories; is also our direction finder or navigator
- **Amygdala:** associated with the emotions of fear and anger; plays a key role in our emotional responses.

REVIEW 3.2

1 Explain why the cerebral cortex has a heavily folded surface.

2 Which parts of the brain would we rely on for surfing or skateboarding? Give reasons for your choices.

3 Which parts of the brain are involved in our hormone or endocrine system?

4 Which brain part plays a key role in creating memories for us?

did you know? Your cerebral cortex, if flattened out, would cover a double-page spread of the *Age* newspaper.

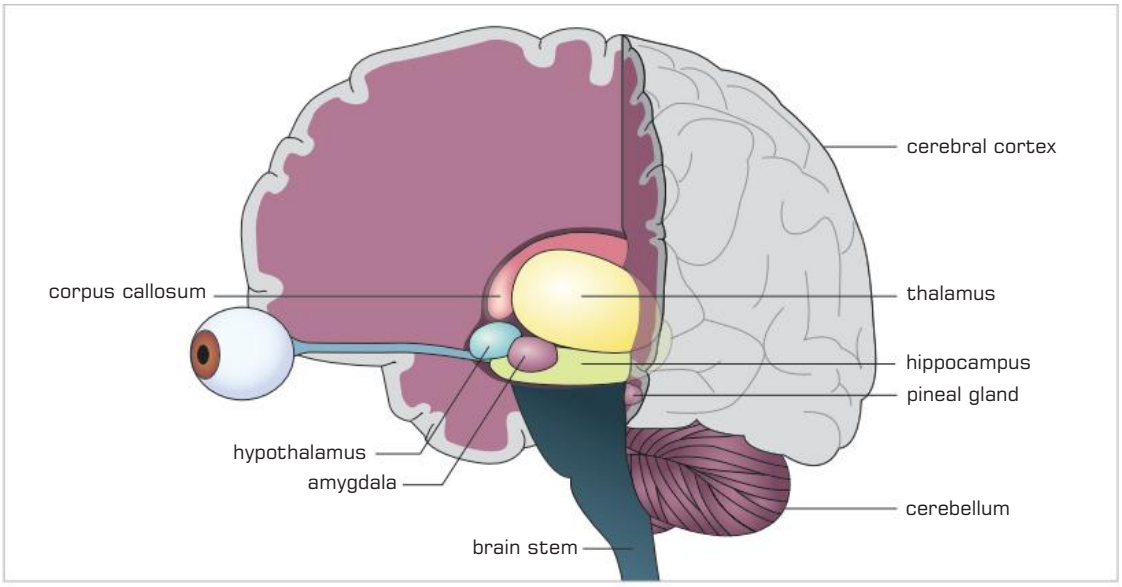


FIG 3.6» Parts of the brain

3.4 INVESTIGATE

Which brain part?

1 Using Figure 3.6 and descriptions on page 30, determine which part of the brain is associated with the following facts.

- **a** A patient is classed as 'brain dead' when the _____ ceases to function.
- **b** Damage to this brain part will cause rats to either overeat or starve themselves to death.
- **c** A patient with problems balancing and coordinating movements is likely to have a problem with their _____.
- **d** Visual information will be sent from our eyes to the _____ before it is sent to the visual cortex for processing.
- **e** This is often the first part of the brain to show damage in Alzheimer's patients who have memory difficulties.
- **f** 'Hypo' means 'under'; under which part of the brain is the hypothalamus located?
- **g** Melatonin is a hormone that plays a key role in sleep–wake cycles. It is produced by the _____.
- **h** Your _____, not your stomach, lets you know when you are hungry.
- **i** A 'knockout' in boxing is declared when the neck and therefore the _____ is twisted to cause unconsciousness.
- **j** London cabbies have been found to have a larger _____ than the general public.
- **k** The _____ is thought to be involved in our reaction to a fearful situation. If we meet an angry tiger in the jungle, this brain part helps us to decide whether we will run, freeze or stay to fight the tiger!
- **l** This part makes up approximately 85 per cent of the total brain mass.

2 Build a model of the brain using plasticine or play-dough. You may choose to build your model as a 3-D brain with all key parts clearly labelled *or* create your model as a cross-section, as if viewed from the side. Describe your model to a partner. Show your knowledge of the brain by labelling key parts and describing what they do.

3 Let's dissect a sheep brain! The following links might be useful for either conducting your own class dissection or else watching a 'virtual' dissection. This is a great way to learn about what brain parts really look like. WWW»

FIG 3.7» Appreciation of music is a right brain task.

BRAIN HEMISPHERES

The brain is divided into two halves: the **left hemisphere** and the **right hemisphere**. Because most of the brain's processes rely on the left and right sides of the brain working together, it is important that they communicate with each other. The corpus callosum connecting the two hemispheres is made up of over 100 million nerve cells. In this way, the brain coordinates all incoming information like a conductor coordinates an orchestra.

Even though the brain works together as a whole, each hemisphere has its own specialised abilities. The left hemisphere of the brain is used for tasks such as speaking, writing and understanding language, mathematical and logical skills and controlling the right side of the body. In contrast, the right hemisphere is especially good at recognising patterns and faces, solving puzzles, reading maps, art and music appreciation and controlling the left side of the body. In essence, the left hemisphere focuses on detail while the right sees patterns and connections and builds them up into one big picture. It is important, however, that both sides work in a coordinated way.

We normally use both sides of the brain for all activities, but we may have preferences for some tasks that involve more left or right brain function. For example, if we have a preference for left brain tasks, we are more likely to enjoy subjects such as science, maths and languages. If we have a preference for right brain tasks, we probably enjoy subjects such as visual arts, music and fashion. We are also more likely to approach tasks in a creative way. Regardless of our preference, however, performing any task well will involve both hemispheres of the brain.

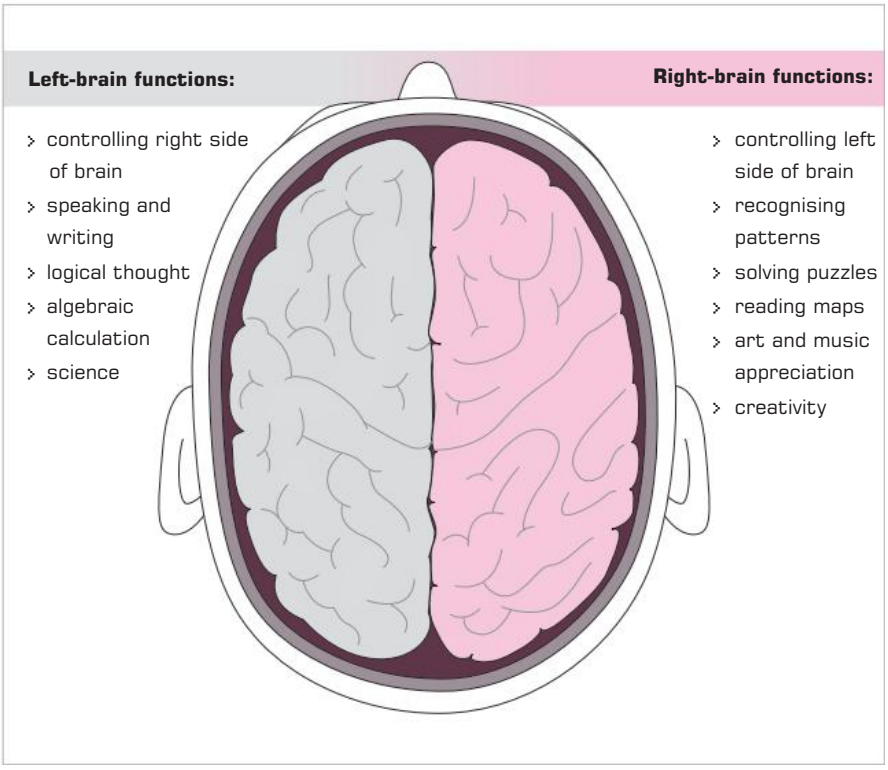


FIG 3.8» Hemispheric specialisation

did you know?

The total number of neurons in your brain, if placed end to end, would stretch over one million kilometres.

Left-handed or right-handed?

The study of left- and right-handedness has interested people for centuries. In the Middle Ages, being a left-hander was even seen by some as a sign of practising witchcraft! Approximately 10 per cent of the population is left-handed and the majority of left-handers are males. It appears that the preference for left- or right-handedness is linked to a gene (Francks et al. 2007).

There is a higher proportion of left-handers among musicians, mathematicians, professional cricketers, architects and artists than in the general population. Famous left-handers are artists Pablo Picasso, Leonardo da Vinci and Michelangelo; tennis players Rafael Nadal and Martina Navratilova; cricket great Adam Gilchrist; musicians Paul McCartney and Jimi Hendrix; actor Nicole Kidman and Ned Flanders from *The Simpsons*!

FIG 3.9›› Rafael Nadal is one of many famous left-handed tennis players.

3.5 INVESTIGATE

Which side is dominant and in control?

1 Which brain hemisphere do you have a preference for? Try these simple tasks. Remember that the left side of your body is controlled by the right side of your brain and the right side of your body by the left side of the brain.

Task	Which side of the body?	Which side of the brain is dominant?
Cross your legs. Which leg is on top?		
Clasp your hands together. Which thumb is on top?		
Kick a ball. Which leg do you use?		
Throw a ball. Which arm do you use?		
Fold your arms. Which arm is on top?		

Count the number of preferences for the *left* and *right* sides of the brain. Which side of the brain do you have a preference for?

2 Which hemisphere is dominant?

	Task	Dominant hemisphere?	Explain why
1	Detecting patterns in a painting		
2	Throwing a boomerang with your right hand		
3	Reciting a French poem		
4	Imagining your future		
5	Planning a scientific experiment		
6	Completing a sudoku puzzle		

3.6 INVESTIGATE

Balance and coordination: which brain part?

1 Find out how coordinated you are.

Step 1: Lift up your right elbow so your upper arm is horizontal. Use your elbow to write your first name in capital letters.

Step 2: Repeat the same action except, this time, use your elbow to write your surname *and* at the same time rotate your left foot in an anticlockwise direction.

a Reflect upon how difficult or easy step 2 was to complete.

b Which brain part do you think was responsible for coordinating these two different movements?

c With practice, do you think you can improve on your performance? Try it out!

Role-play a neuroscientist

2 Role-play a consultation between a neuroscientist and a patient. In pairs, decide on a brain part you have studied in this chapter. Write a brief script of a conversation or a set of behaviours that you imagine may occur between a patient with damage to this brain part and a neuroscientist. Then role-play the consultation to the class. Can your classmates guess which brain part is damaged?

Left- or right-handed, is there a gender difference?

3 Find out the proportion of males and females in your class who are right- or left-handed. Survey the class and enter the results in a table as shown below.

Hand preference	Number of females	Number of males	Class total (number of students in class)	Percentage (number of females and males divided by class total)
Left-handed				
Right-handed				
Ambidextrous (equally left- and right-handed)				
Total				

a Do your results support the research that ten per cent of the general population is left-handed? Explain with reference to your results.

b Is there a gender difference in your results for hand preference? Explain with reference to your results.

c Does your class have a sufficient number of participants to test these ideas on hand preferences? Explain.

REVIEW 3.3

1 What is the role of the corpus callosum, and why is it such an important brain part?

2 Which side of the brain plays a key role in our appreciation of music?

3 Describe an activity that would be considered a right hemisphere specialisation. Explain why it would involve the right side of the brain.

4 Describe an activity that would be considered a left hemisphere specialisation. Explain why it would involve the left side of the brain.

5 Explain why the brain must use both sides of the brain to function most effectively. Use an example to illustrate your answer.

BRAIN IMAGING

Early brain researchers had to rely on their observations of brain-damaged patients who had died. This was somewhat problematic. They often had to wait a long time for patients to die, and they were not always able to get the specimens they were interested in investigating.

All this changed when the first imaging equipment was invented and became available for use in the 1970s. Computerised tomography (CT) scans were the first to produce brain images in living patients. A series of X-rays were taken from different angles to produce a series of 'slices' that could be used to create a 3-D image of the brain.

Many sophisticated imaging techniques are available to researchers today. These have provided them with valuable data enabling a rapid improvement in the understanding of how the brain functions. Neuroscientists can now obtain a detailed snapshot of what is happening inside our brain. This has led to an understanding of the roles different parts of the brain play in both normal and abnormal brain function. It has also led to the development of new treatments for brain disorders.

Over the past 30 years, the combined value of imaging techniques and the ability to share information on the Internet has provided us with an explosion of knowledge on how the brain functions. It is also apparent that the more we find out, the more there is to learn about this amazingly complex organ. The emergence of more refined technologies in the future will continue to enhance our ability to take a peek into the wonders of the brain.

COMPARING BRAIN IMAGING TECHNIQUES

MRI—magnetic resonance imaging

- *How it works:* uses a very strong magnetic field and radio waves to produce high-quality, detailed images of both surface and deep-brain structures.
- *Uses:* creates a clear and specific image of different regions of the brain; can distinguish between normal and abnormal brain tissue.
- *Advantages:* creates a detailed 3-D image; non-invasive technique; painless and safe procedure.
- *Limitations:* expensive procedure; cannot be used in patients with pacemakers or metallic devices; patients must lie still in a very small space.

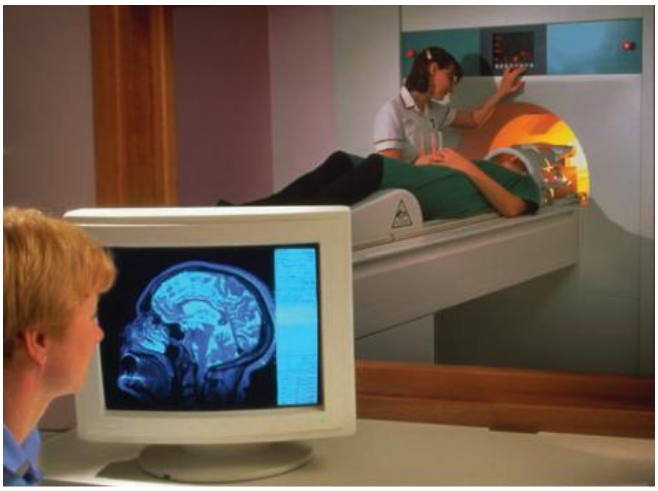


FIG 3.10» MRI scanner with patient being prepared for scanning.

*f*MRI—functional magnetic resonance imaging

- *How it works:* takes images of the brain while it functions, allowing scientists to see images of blood flow in the brain as it is occurring. This enables researchers to monitor changes in brain activity as patients perform various tasks or are exposed to various stimuli.
- *Uses:* associates the parts of the brain involved in specific functions; used to indicate both normal and abnormal structure and function.
- *Advantages:* produces detailed images of structures and their functions; rapidly produces images; creates a 3-D image; non-invasive technique; painless and safe procedure.
- *Limitations:* expensive procedure; cannot be used in patients with pacemakers or metallic devices; patients must lie still in a very small space.

FIG 3.11» *f*MRI image showing the brain activity that is activated when left hand is active (in pink)

PET—positron emission tomography

- *How it works:* detects particles emitted by radioactive glucose as it is used by neurons in the brain; determines areas of the brain that are most active, as glucose is the brain's 'food'; produces a coloured 'map' of brain activity in real-time, showing the parts of the brain that are working (red indicates highest activity levels; blue indicates lowest).
- *Uses:* indicates areas of activity within the brain while performing tasks; can show blood flow, rate of oxygen and glucose metabolism in the brain, which is useful in understanding the brain's chemistry.
- *Advantages:* reveals specific areas of the brain involved in different activities; can be used in combination with MRI to give more precise detail on where in the brain the heightened activity is; non-invasive technique.
- *Limitations:* expensive; uses radioactive material to depict areas of activity; unsafe for pregnant women due to levels of radiation.

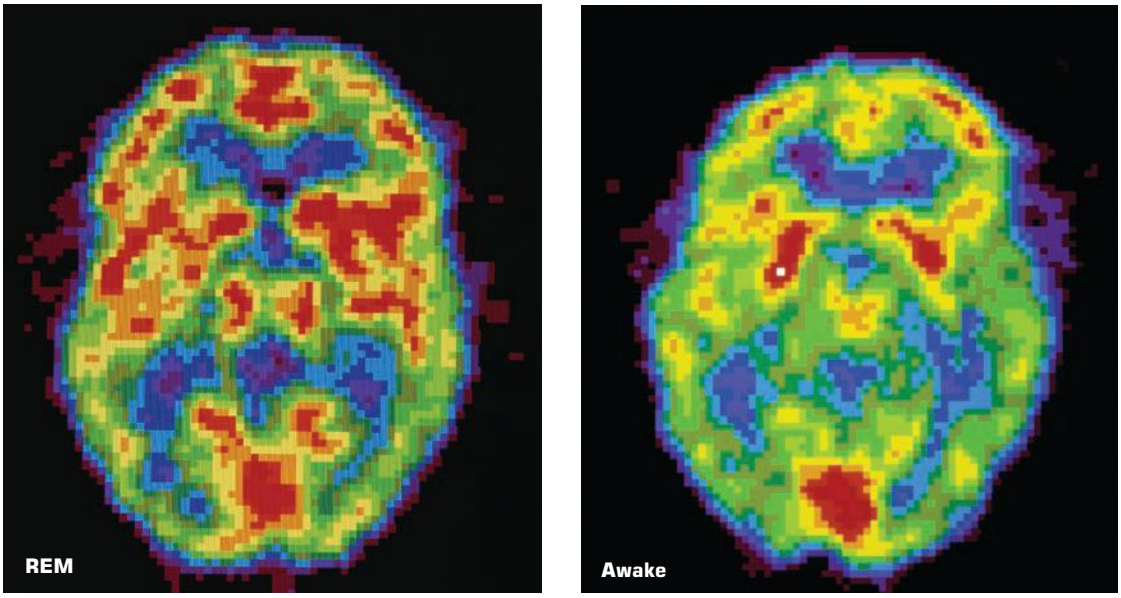


FIG 3.12» PET scans showing the brain asleep and (on right) the brain awake (active areas red, inactive blue)

CT—computerised tomography

- *How it works:* specialised type of X-ray that highlights different parts within the brain; computer collates data to create an image of the brain.
- *Uses:* can detect brain tissue abnormalities.
- *Advantages:* non-invasive technique; shows brain structure.
- *Limitations:* does not show brain function; being a very strong X-ray, cannot be repeated within several months due to dangers of cancer.

did you know? The mystery of why King Tutankhamen, Pharaoh of Egypt, died over 3000 years ago may have been solved thanks to a CT scan. His mummified body was scanned in 2005 to try and determine the cause of death. There appeared to be no suspicious wounds or evidence of poison in the mummified body; however, it did appear that one leg had been broken soon before his death. This led to the conclusion that he may have died from an infection in the open wound caused by the break.

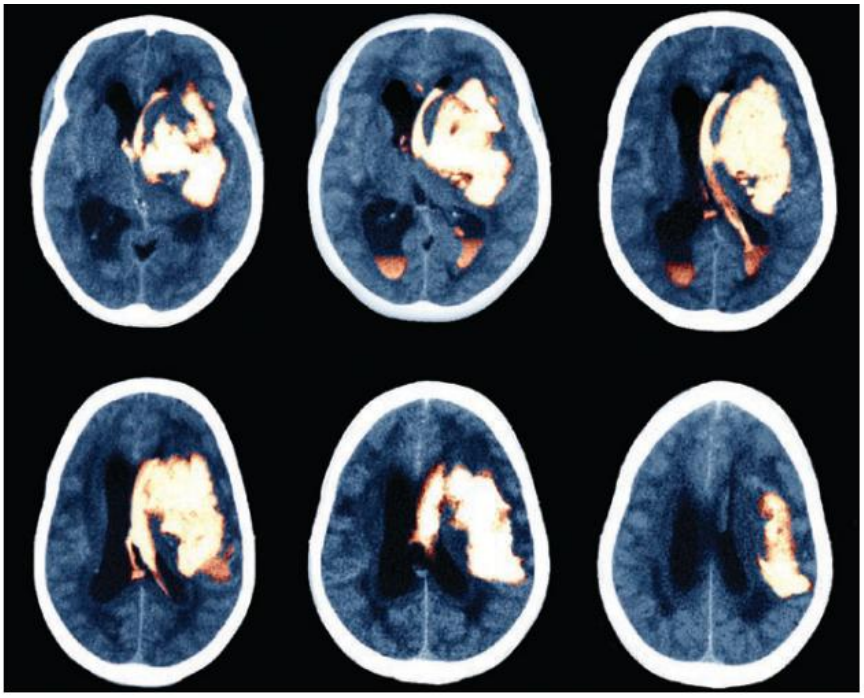


FIG 3.13›› CT scan showing brain areas affected in a stroke patient where blood has leaked into the brain tissue from a brain haemorrhage

3.7 INVESTIGATE

Label the CT scan

This CT scan shows a cross-section of a healthy brain from a side view. Scans such as this are used by doctors to compare with their patient scans and determine whether there is any abnormality. Use of these scans can now mean that surgery is not necessarily required to diagnose brain disorders.

Identify the following brain parts in the CT scan: front of brain, rear of brain, cerebrum, cerebellum, brain stem, corpus callosum, frontal lobe, parietal lobe, occipital lobe.

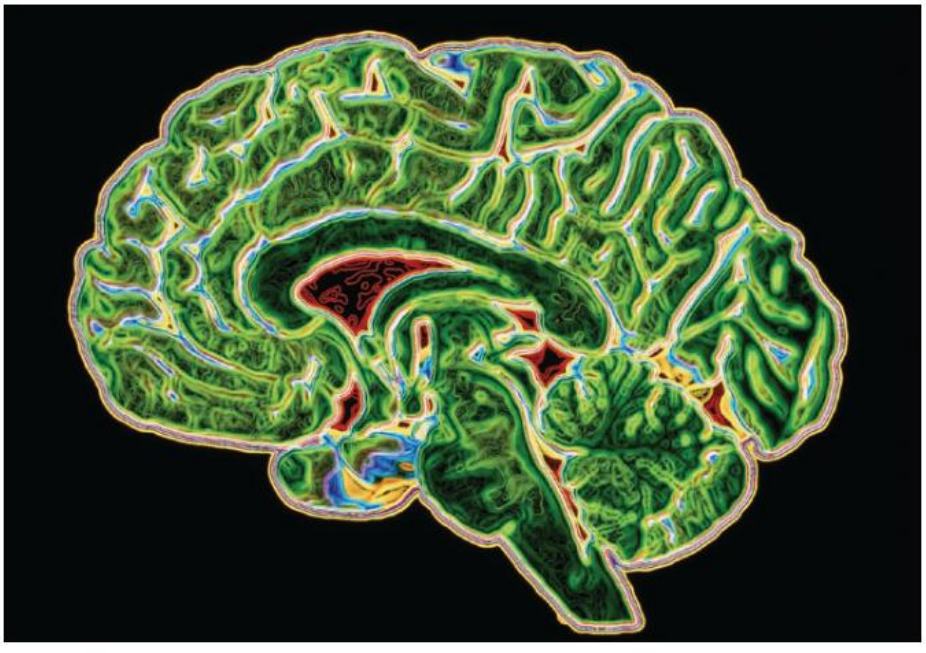


FIG 3.14›› Cross-section of healthy brain (CT scan)

EEG—electroencephalogram

- *How it works:* electrodes placed on the scalp measure electrical activity in the brain; resulting brainwaves are recorded onto a tracing.
- *Uses:* brainwave patterns during different activities, stages of sleep or consciousness can be compared to 'normal' activity; can be used to identify tumours, epilepsy and other diseases of the brain.
- *Advantages:* easy to set up; relatively inexpensive to carry out; non-invasive technique; can record complex patterns of activity quickly after a stimulus is given; researchers often combine EEG recordings with MRI scans to more accurately pinpoint where the brain activity is occurring.
- *Limitations:* shows general patterns of activity; more useful when combined with a technique that provides images of the brain structures involved in the activity.

FIG 3.15» A patient undergoing an EEG

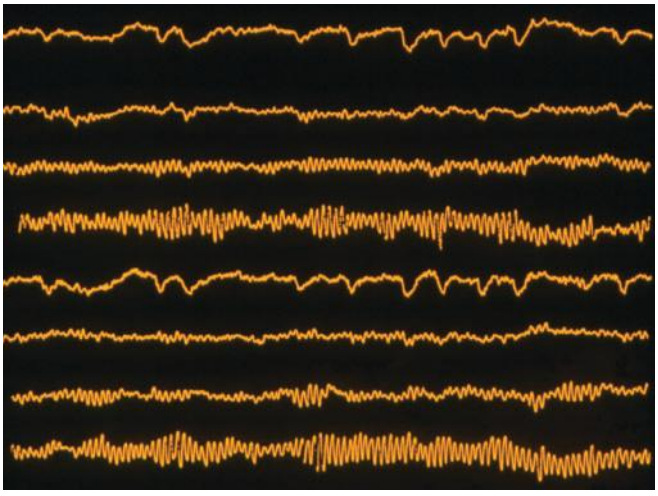


FIG 3.16» EEG trace of normal brainwave patterns

did you know? A study by the Florida Alzheimer's Disease Research Center has shown that MRI scans of the brain can offer hope for the future of people who are yet to be diagnosed with Alzheimer's. Scans have been found to be useful in identifying early brain changes associated with Alzheimer's by showing areas of shrinkage in brain tissue before symptoms start to appear. This breakthrough is particularly useful for testing the potential of new drugs that could possibly slow or even prevent progression of the disease. This devastating disease may not be so common in the future thanks to brain imaging!

REVIEW 3.4

1. Explain why it was a major scientific breakthrough when CT scans were first invented.
2. The range of imaging techniques available today has enabled neuroscientists to advance knowledge in which two key areas?
3. Distinguish between MRI and PET scans, and the way they work.
4. What is the difference between MRI and an *f*MRI?
5. Which brain imaging techniques can be used to determine the function of different parts of the brain?
6. Which brain imaging techniques can be used to provide detail on brain structures?
7. Which brain imaging techniques are not suitable for the following:
   a. patients fitted with a pacemaker
   b. pregnant women
   c. patients who become highly anxious in very small spaces
   d. patients who recently had the same type of scan.
8. Imagine—what type of brain imaging do you think might be available in 2050? Describe what this scanner might look like, and what sort of information it might be able to provide. What uses might it have?

CHAPTER SUMMARY

- Neuropsychology aims to understand the relationship between the structure and function of the brain.
- The cerebral cortex is made up of four lobes: frontal, parietal, occipital and temporal. Each of these areas has its own specialised area of function.
- The primary motor cortex is a part of our frontal lobe that controls our voluntary movement. Areas of our body we can exert greater control over have a greater proportion of nerves in this area of the cortex.
- Symptoms shown by brain-damaged patients can indicate the area of the brain affected.
- The brain is made up of many parts that function together to enable it to do all the tasks we take for granted. Each part has its own key roles in normal brain function, but works by integrating with other areas. Key parts are:
  - cerebrum: most visible part of brain
  - cerebral cortex: outer layer of the brain; responsible for conscious thought
  - corpus callosum: thick band of nerve axons connecting left and right hemispheres
  - cerebellum: primitive part of the brain responsible for coordination, balance and movement
  - brain stem: regulates survival functions such as our heartbeat, blood pressure and breathing rates
  - thalamus: sensory data arrives here and is then relayed to specific areas of the cortex
  - hypothalamus: responsible for regulating body temperature, appetite, thirst and hormones
  - pineal gland: controls our internal body clock; regulates our sleep–wake cycles and releases our 'sleep' hormone melatonin
  - hippocampus: responsible for making new memories; is also our direction finder or navigator
  - amygdala: associated with the emotions fear and anger; plays a key role in our emotional responses.
- The brain is divided into two hemispheres that are connected by the corpus callosum. The left hemisphere is involved in verbal and analytical tasks, logical thought, reading and controlling the right side of the body. The right hemisphere is involved in detecting and expressing emotion, musical and artistic ability, recognising patterns, creativity and controlling the left side of the body.
- Left-handers are more common among males, artists and musicians.
- Brain imaging is responsible for the rapid advancement in knowledge of how the brain functions. It has also enabled a better understanding of brain abnormalities. Different scanning techniques such as MRI, fMRI, PET, CT and EEG have their particular uses in both brain research and in learning more about brain abnormality.

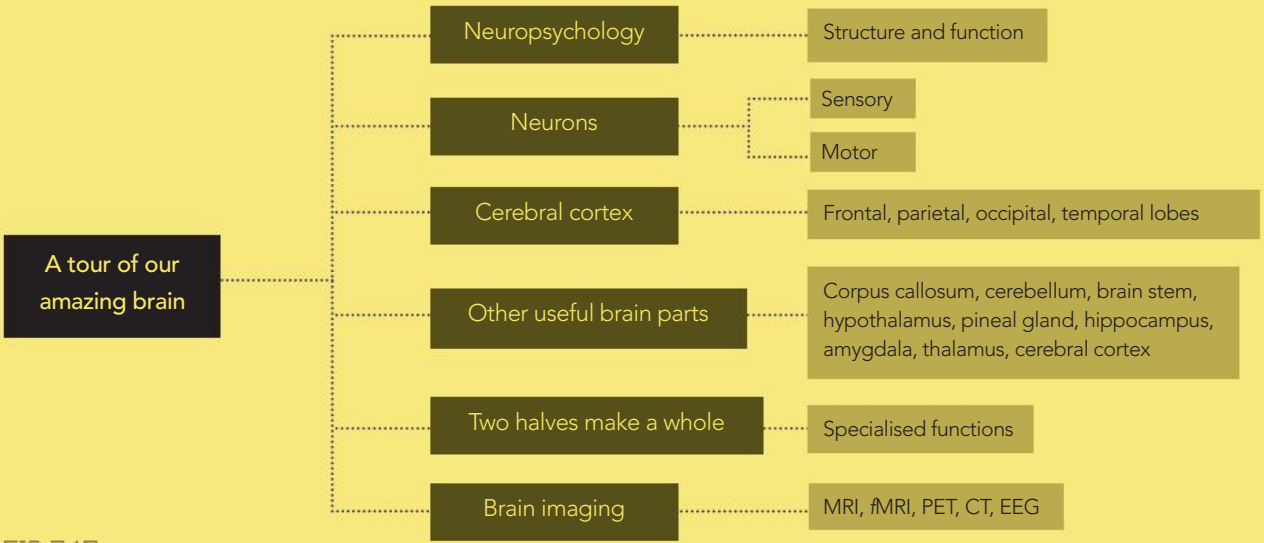


FIG 3.17» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 An adult's skull is made up of:
   - **a** 1 large bone and a jaw bone
   - **b** 22 bones fused together
   - **c** 12 bones tightly placed together
   - **d** 22 bones that will move if we are not careful.

2 The cerebral cortex is made up of:
   - **a** left and right hemispheres of the brain
   - **b** four different lobes, each with specialised functions
   - **c** most of the visible brain tissue
   - **d** all of the above.

3 Visual information is sent to the:
   - **a** frontal lobes
   - **b** temporal lobes
   - **c** parietal lobes
   - **d** occipital lobes.

4 The primary motor cortex shows the proportion of nerves that control voluntary movement in different parts of the body. The largest area of the primary motor cortex is devoted to controlling movement in the:
   - **a** face
   - **b** legs
   - **c** fingers
   - **d** back.

5 The area within the brain regulating our survival functions such as breathing and heartbeat is called the:
   - **a** cerebellum
   - **b** thalamus
   - **c** hypothalamus
   - **d** brain stem.

6 Emilee was woken suddenly by a loud noise and she was conscious of feeling frightened. The part of her brain playing a key role in this response was the:
   - **a** pineal gland
   - **b** cerebrum
   - **c** amygdala
   - **d** hippocampus.

7 The left hemisphere of the brain is used for tasks such as:
   - **a** map reading and recognising patterns
   - **b** appreciating art and music
   - **c** reading and writing
   - **d** coordinating the left side of the body.

8 Determine whether the following statements are true or false. Give an example or explanation to justify each answer.
   - **a** The cerebrum is the most visible part of our brain and is responsible for our conscious thought.
   - **b** The corpus callosum is responsible for the left and right sides of the brain communicating with each other.
   - **c** The pineal gland plays a key role in getting us to sleep and wake up.
   - **d** Our memories are largely formed in our amygdala.
   - **e** The cerebellum is responsible for interpreting sounds.
   - **f** Logical thought and problem-solving largely involve the right hemisphere of the brain.

9 Explain why a newborn's skull does not have its bones fused together.

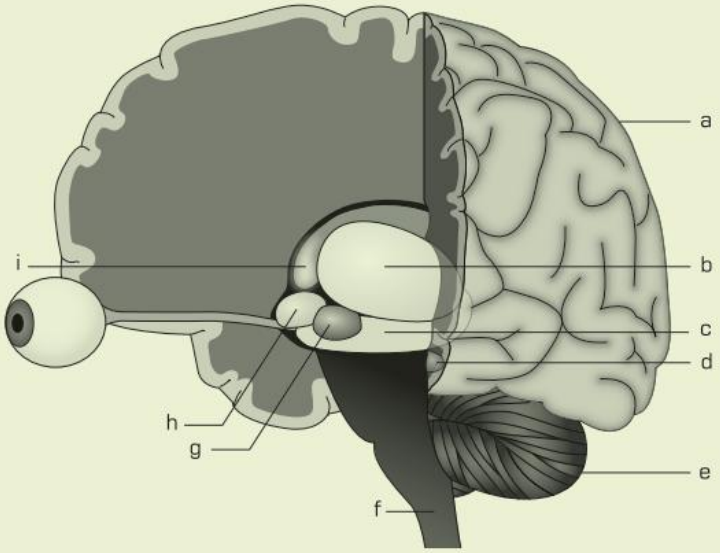
10 During a boxing round, Jake placed a punch on his opponent that twisted the brain stem and so was declared a 'knockout'. Using your knowledge of the parts of the brain, explain what occurs during a knockout, and why this causes unconsciousness.

11 Melatonin is produced by the pineal gland and is known as the hormone of sleep. Explain why a baby's pineal gland might be larger in size than that of an adult.

12 The following techniques are used for brain research and for the diagnosis of different brain disorders: MRI, *f*MRI, PET, CT, EEG. Draw up a table to provide a clear overview of these techniques, including this information:
   - full name of each technique
   - description of its use
   - advantage of each technique.

13 Match up the following brain structures with the correct location and letter (a–h) in the diagram below.

Amygdala _____
Brain stem _____
Cerebellum _____
Cerebral cortex _____
Corpus callosum _____
Hippocampus _____
Hypothalamus _____
Pineal gland _____
Thalamus _____



Extend yourself

14 How can you train your brain to use your left and right hemispheres better?

15 How can electronic 'brain-training' games improve brain function? What do these games claim they can do? How effective are they?

16 The amygdala is thought to play a role in aggression, and has been found to be larger in more aggressive animals. Find out whether there is a link between aggressive tendencies and amygdala size in humans. Do criminals with aggressive tendencies have larger amygdalas?

17 Explore further about the functions of the brain. There are a number of useful sites online.

18 Find out more about some viral or bacterial infections that can affect the brain, such as meningitis, meningococcal meningitis, toxoplasmosis, trichinosis, poliomyelitis, cerebral abscess, rubella, mumps and rabies. Choose one infection and investigate the following:

- **a** What are the symptoms of this illness?
- **b** What is the cause?
- **c** What treatments are available for this illness? How effective are they?
- **d** What parts of the population are at a higher risk of developing this illness? Why?

19 Find out more about the brain condition hydrocephalus, which is sometimes known as 'water on the brain'.

- **a** What do the terms 'hydro' and cephalus' mean?
- **b** What are the symptoms?
- **c** What is the cause?
- **d** What treatments are available? How effective are they?
- **e** Find out what hydrocephalus looks like on a CT scan.

20 What are some practical applications for the use of the imaging techniques discussed in this chapter? Discuss how they are useful in:

- **a** brain research
- **b** assisting patients with brain disorders.

GET YOUR NEURONS FIRING!

WHAT IS IT THAT ENABLES THE BRAIN TO LEARN AND TO RECALL MEMORIES?

How is it that the brain allows us to experience the emotions of fear, sadness and excitement? Just as a computer has hardware that enables it to carry out an enormous range of functions seemingly effortlessly, the brain has hardware that provides it with the ability to carry out its roles. The basic unit that makes it all happen is the specialised brain cell called a neuron.

NERVOUS SYSTEM

There are hundreds of billions of neurons (nerve cells) inside the brain and spinal cord. Each neuron can have connections with up to ten thousand neighbouring cells, producing an extensive and intricate network of neurons that make up the body's nervous system. This is the hardware that controls everything we think, feel and do, and it makes our brain the most complex living structure on Earth.

Simple organisms such as jellyfish have a nervous system of only a few neurons, which allow them to carry out basic functions such as eating and moving. Humans, however, need a much more sophisticated network of nerve cells to enable more complicated tasks such as thinking, problem-solving, communicating with others, having emotions and learning.

How complex is this network? Imagine a city the size of greater Melbourne, with every person in that city holding 10 000 pieces of string that each extend to another person in the city. This would create a very large and intricate network. Yet, to match the brain's vast network, that city would have to be 500 times bigger than Melbourne!

FIG 4.1» The central nervous system is made up of the brain and spinal cord. The nerves in the peripheral nervous system travel to and from the spinal cord to the rest of the body.

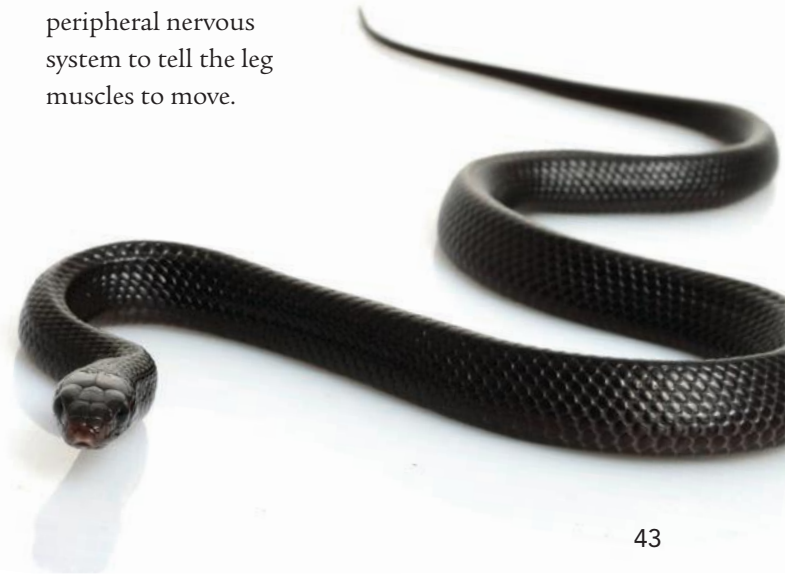
TWO SYSTEMS WORKING TOGETHER

The nervous system is made up of two main systems that work together:

- **Central nervous system** (CNS)—this is made up of the brain and spinal cord; its main role is to process information delivered to it from the peripheral nervous system.
- **Peripheral nervous system** (PNS)—this consists of the outlying neurons that deliver messages from sensory receptors and organs throughout the body to and from the central nervous system.

The following example illustrates how these two systems interact. What happens when a bushwalker sees a snake ahead on the path?

1. The bushwalker's eyes detect a snake.
2. A message is sent from the eyes along sensory neurons in the peripheral nervous system and passed on to the central nervous system.
3. In the central nervous system, the brain will identify 'snake!' and determine the best course of action to avoid being bitten.
4. The most likely action is to walk back along the path, so the central nervous system sends signals to the motor neurons in the peripheral nervous system to tell the leg muscles to move.



NEURONS

Neurons are the basic building blocks of the entire nervous system. Each individual neuron has specialised parts that enable it to receive messages from neighbouring neurons, transmit a message from one end to the other, and then send the message on to other neurons. A typical neuron is made up of dendrites, a soma, an axon surrounded by a myelin sheath and axon terminals, as shown in Figure 4.2.

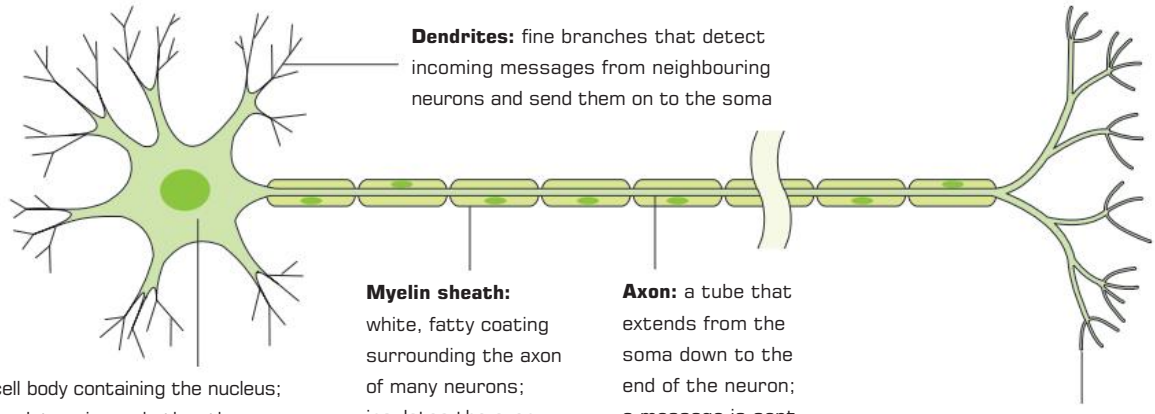


FIG 4.2›› A typical neuron: the key structures and functions of each part that enable the neuron to receive and send messages

There are three different types of neurons, and each type has a specific purpose and structure.

- **Motor neurons** carry messages from the central nervous system to different parts of the body.
- **Sensory neurons** carry messages from the sense organs to the central nervous system.
- **Association neurons** or interneurons are found only in the central nervous system, and connect the motor and sensory neurons.

HOW DO NEURONS WORK?

Neurons transmit messages in the form of an electrical impulse. This tiny electrical charge travels along the neuron at speeds of up to 100 metres per second. Once a neuron's dendrites receive a message from neighbouring neurons, the soma will determine if the message is strong enough to trigger an impulse down the axon. If a neural impulse is triggered, an electrical charge races along the axon towards the axon terminals.

The myelin sheath insulates the axon and ensures the impulse is directed to the end of the axon. Messages are only ever sent in one direction to avoid confusion.

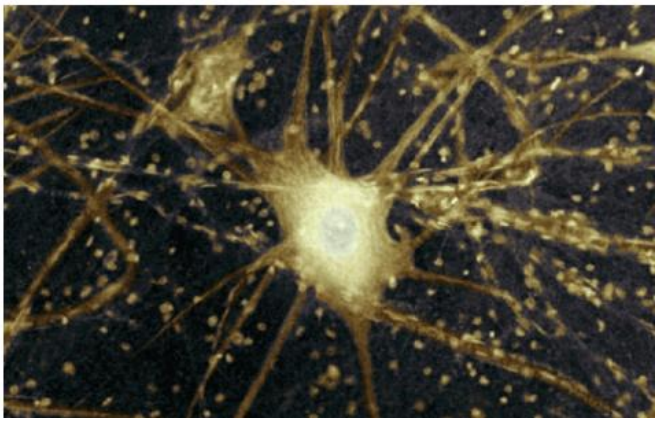


FIG 4.3›› Neurons create complex networks.

At the axon terminals there is a tiny gap called a **synapse** between one neuron and the next. Two neurons will never directly touch, but in this gap an important sequence of events occurs. The electrical message triggers the release of special chemicals (neurotransmitters) across the synapse to the next neuron. When receptors on the surface of the next neuron's dendrites detect the chemical message, the sequence of events occurs again in this next neuron to pass the message on.

4.1 INVESTIGATE

Create a neuron

1 Create a neuron using your own body parts. Think of a way to represent the following structures: dendrites, soma, axon, myelin sheath and axon terminals. Demonstrate your neuron to the class.

2 Create a play-dough neuron and place it on a sheet of A3 paper. Label the key parts of a motor neuron using one of the following ideas. Be creative in your representation.

- Use arrows and boxes to label the key parts on the A3 paper, and describe what they do.
- Create labels and descriptions using toothpicks and paper labels.
- Take a digital photo of your neuron and add labels and functions using your computer software.
- Describe the parts and their functions to someone else.

3 Create an edible neuron. Complete this as a homework task and share your neurons in class. Be able to describe its parts and what they do. Judge on criteria such as the most accurate and the most creative ... then eat it. Vote on the best-tasting neuron!

4 Create a neural impulse. This works best with as many people as possible. Create a circle with every student having each arm outstretched between them and the next person. Instruct all participants to clench their right fist (= axon terminal) and cup their left hand over the next person's fist (= dendrites of neighbouring neuron). The message starts and finishes with the same person. A gentle push of a right fist into the next cupped hand represents the chemical transmission of the message. As the message is received by one set of dendrites (cupped left hand), the person receiving the message passes it on by gently pushing their right fist into the next 'neuron'. With practice, see how quickly you can pass on the message.

FIG 4.4» Artist's interpretation of neurons transmitting messages

5 In small groups, discuss creative ways of representing the process of neural transmission. Include the electrical transmission within a neuron and the chemical transmission between neurons at the synapse. Be creative. Try out your ideas and present your best one to the class.

6 Using computer software, create your own animation of a neuron in action.

7 Create your own neural network. Each student can represent a neuron in a class network of neurons to communicate messages from:

a an optic nerve to the visual cortex
b an auditory nerve to the auditory cortex
c a visual cue to complete a problem-solving task.

REVIEW 4.1

1 Explain why the network of neurons in humans is more complex than the network of neurons in jellyfish.

2 Describe the key roles of the central and the peripheral nervous systems.

3 Explain why the central and peripheral nervous systems rely on each other.

4 How do the roles of the motor neurons, sensory neurons and interneurons differ?

5 Describe how a neuron transmits an electrical message from the dendrites to the axon terminals. In your answer, use the following terms: dendrites, soma, axon, myelin sheath and axon terminals.

6 The myelin sheath is an important part of the neuron's structure. Explain its role.

7 What is a synapse? Why is it an important part of the neuron network?

8 What is a neurotransmitter?

9 Describe how one neuron will send a message to the next neuron at the synapse.

FIG 4.5» Insufficient acetylcholine is a cause of memory loss and Alzheimer's disease.

did you know?

Recent research suggests the teenage brain is a 'work in progress', and that myelin coverage of neurons is still strengthening well into our twenties. In fact, it appears that our brain is constantly undergoing changes—increasing and decreasing dendrite connections—throughout our lifetime.

In a young child's brain, learning is achieved through the growth of new dendrites, creating the potential for new synapses. During childhood, an overproduction of synapses occurs. As a child gets older, the synapses no longer being used are 'pruned back' to make the brain operate more efficiently. This saves the body's oxygen and glucose for the cells that need it.

Mirror neurons are neurons that send messages both when we perform an action and when we observe the same action being performed.

NEUROTRANSMITTERS

Neurotransmitters are the body's natural chemical messengers that can alter the activity of neighbouring neurons. Some neurons excite or trigger a message to be sent along the next neuron, while other neurotransmitters can inhibit (slow down or stop) activity. As a neurotransmitter moves across the synapse to the next neuron, the action that it triggers will be dependent on the type of neurotransmitter received by the receptor sites.

TABLE 4.1» Types of neurotransmitters

Neurotrans-mitter	Effect	Too little or too much?
Acetylcholine	Excites neurons within voluntary muscle, causing contraction. Assists with memory consolidation in the hippocampus.	Insufficient acetylcholine is a cause of memory loss and Alzheimer's disease.
Dopamine	Involved in voluntary movement, learning, arousal and feelings of pleasure.	Too little causes Parkinson's disease. Too much is found in patients with schizophrenia.
Serotonin	Involved in sleep, arousal and the experience of emotions.	Too little or too much can cause mood, anxiety and sleep disorders.
Noradrenalin	Involved in the experience of emotions.	Too little may be involved in depression.
GABA	Involved in motor control and anxiety.	An increase in GABA can reduce anxiety.

NEUROTRANSMITTERS AND MENTAL HEALTH

The discovery of neurotransmitters began to offer psychiatrists explanations for mental disorders. If neurotransmitters enable neurons to communicate, then altered levels within the brain are likely to cause unwanted effects. Bizarre or unusual behaviour can often be explained in terms of increased or decreased levels of these special chemicals, affecting how well messages are passed among neurons in the brain.

Serotonin is a neurotransmitter that can be depleted over time following periods of stress. This can cause reduced levels of concentration and memory, poor sleep patterns, poor organisation, reduced appetite and social withdrawal. As a result, low levels of serotonin can develop into symptoms commonly characterised by clinical depression, obsessive-compulsive disorder and chronic fatigue. Treatment of these conditions therefore may involve medication that increases serotonin levels.

Dopamine is a neurotransmitter that is important for thinking. Reduced levels are associated with conditions such as ADHD (Attention Deficit Hyperactivity Disorder) where individuals have difficulty focusing on a task. Increased levels of dopamine cause neurons to speed up their communication, which can create an increased focus on the environment. This can lead to symptoms such as paranoia and schizophrenia, with an inability to distinguish between reality and the inner world.

NEUROTRANSMITTERS AND DRUGS

Many drugs can mimic or take the place of neurotransmitters and therefore affect our brain and our body. Because many of these drugs are not natural, or are not naturally made by our body, the effects on our brain can be disastrous, especially if taken in large doses or over long periods of time. Specific drugs can have predictable effects on our brain. Sometimes we can take these drugs as medication to create the desired effect. For example, patients with Parkinson's disease produce insufficient dopamine, and so they may take medication that does the job that their natural dopamine would normally do.

4.2 INVESTIGATE

Drugs and their effects on the brain

Research the following drugs. Find out how they affect the brain and which of the body's natural neurotransmitters each drug interferes with. If possible, also find out the effect of each drug on this neurotransmitter.

Drug	Effects on the brain	Which neurotransmitter in the brain does it interfere with?
Alcohol		
Heroin		
LSD		
Diazepam		
Ecstacy		
Marijuana		

did you know? Researchers in Canada have found that depressed people who commit suicide have an abnormal distribution of receptors in the brain for the neurotransmitter GABA. This reduces their ability to utilise GABA which can affect their happiness levels and increase anxiety.

REVIEW 4.2

1. Describe the effects that neurotransmitters can have on the activity of neurons.
2. Which neurotransmitter plays a key role in both Parkinson's disease and schizophrenia?
3. What is the name of the neurotransmitter that plays a key role in sleep?
4. Some recreational drugs can affect our brain function. Explain why this occurs.
5. Explain why medication that does the job of dopamine is useful for patients suffering from Parkinson's disease.
6. What is a mirror neuron? Use an example from your own experience to illustrate your answer.
7. Explain the relationship between dopamine and ADHD.

GROWING MORE DENDRITES

Dendrites, axons and synapses grow and change throughout a person's life. Dendrites grow to increase the area for synapses to be created as more learning is happening and memories are formed. This is known as neuron plasticity or brain plasticity.

We can encourage our dendrites to grow by stimulating our brain through:

- mental activity (e.g. thinking and reading)
- debate and exposure to ideas that challenge our thinking
- creating concept maps and connecting ideas
- challenging ourselves to complete tasks in shorter times.
- crosswords, word games, sudoku and other puzzles
- exercise
- activities that push us outside our comfort zones

A stimulated mind helps us to grow more dendrites. An unstimulating environment, boredom or lack of challenge or contact with other people, however, can cut back our dendrites. This means that the old saying 'use it or lose it' is actually supported by scientific evidence. If we keep our brain challenged and stimulated, then we will be less likely affected by the symptoms of dementia as we age. We will investigate this further in Chapter 6.

REVIEW 4.3

1 What changes occur within our brain's neurons when learning occurs?
2 Explain what the term 'neuron plasticity' means.
3 List five activities that can help us to increase our number of dendrites.
4 What is meant by the saying 'use it or lose it'?
5 Describe ways in which our brain development is influenced by technology.

4.3 INVESTIGATE

Growing dendrites

1 List activities that you do that help to grow dendrites.

Generations and activities

2 Reflect on how different generations carry out various activities. Complete your ideas in a table like the one below.

How would this activity be carried out?	You	Your parents (25 years ago)	Your grandparents (50 years ago)	Your great-great-grandparents (100 years ago)
contact a friend				
have conversations with a group of friends				
be entertained				
research a topic				
play a game				
shop				
read a novel				

3 Following the above, summarise the ways in which your life experience is different from that of your parents and great-great-grandparents. Are these differences good or bad? How might they affect an individual's goals and achievements?

TECHNOLOGY AND OUR BRAIN

Our exposure to digital technology for learning, entertainment and socialising is causing our brains to be wired very differently from those of our ancestors. Digital technology bombards us daily with information, which constantly activates our neurons. We no longer have to wait patiently for information. We no longer need to focus on one thing at a time. We can do many things at once, and do them well. The rewiring of our brain allows us to do this. Thanks to the plasticity of our neurons, our brain can be rewired to process information differently if we become exposed to digital technology for the first time.

FIG 4.6›› Elderly people can stimulate their neurons by learning to use computers.

DIGITAL NATIVE OR DIGITAL IMMIGRANT?

Digital natives have been brought up in the digital world. They know nothing different. These are the children and adolescents of today.

Digital immigrants learnt from books and physical libraries. They have been adapting to a digital environment. These are our parents and many of our teachers. They have adapted well, but do not think as unconsciously as the natives in digital form.

The experiences of both generations of people are very different. Has this enabled a whole different type of brain to evolve?

In the life of digital natives:

- there is constant stimulation of the senses through MP3 or MP4 players and computers
- communication occurs at any time of the day and night through mobile phones, iPhones and social networking sites such as FaceBook and MySpace
- you Google for information on any topic at any time with essentially unlimited access to resources
- entertainment is provided by individualised digital games that create a whole new virtual world where the player makes decisions that determine the play
- music and film can be downloaded to watch on individualised screens (iPhone, computer)
- multitasking (ability to effectively do a number of activities at the same time) is a way of life
- you easily move from one activity to the next, and get bored quickly with the same activity.

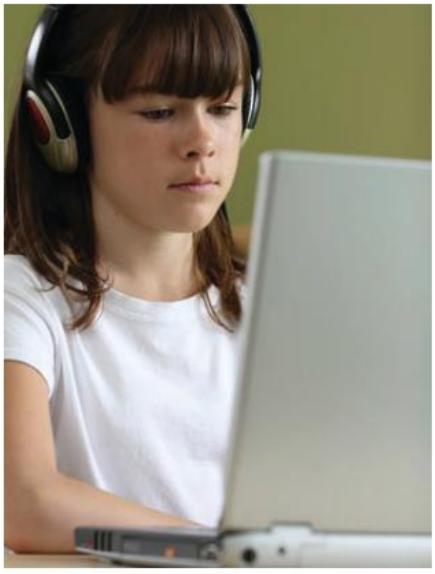


FIG 4.7›› Digital natives are today's children who have grown up always having digital technology to help learning. This has provided easy access to information and enabled them to multitask more easily than digital immigrants.

4.4 INVESTIGATE

Interview a digital immigrant

Interview an adult such as a teacher, parent or grandparent to compare their experiences with technology to yours. Find out what life is like for a digital immigrant! What information would you like to find out?

Some possible questions you might like to ask are: *What do you like about the use of technology? What types of technology do you enjoy? What are the challenges you have faced with technology? What is your preferred means of: entertainment, booking a holiday, communicating with friends, relaxation?*

CHAPTER SUMMARY

- The brain is made up of a complex network of neurons that interconnect to communicate with different parts of the brain and the body.
- The nervous system is made up of the central nervous system (brain and spinal cord) and the peripheral nervous system (outlying neurons).
- A motor neuron consists of a soma, dendrites, axon covered in a myelin sheath, and axon terminals. An electrical impulse travels down an axon from the cell body to the axon terminals, where it triggers a chemical message across the synapse to a neighbouring neuron.
- Neurotransmitters are either natural or synthetic chemicals that trigger a response in a neuron. The response may be either excitatory or inhibitory.
- The discovery of neurotransmitters enabled psychiatrists to explain symptoms of different mental health disorders that occur as a result of too much or too little of the special brain chemicals, altering the way neurons communicate.
- Low levels of the neurotransmitter serotonin over a period of time can cause symptoms of clinical depression, obsessive-compulsive disorder and chronic fatigue. Low levels of dopamine can be seen in cases of ADHD, while high levels can create symptoms associated with schizophrenia and paranoia.
- Many drugs mimic neurotransmitters, thus having an effect on our brain. This may be a helpful effect as in the case of therapeutic applications (e.g. to treat a condition such as Parkinson's disease with a dopamine drug). Alternatively, drugs may have long-term detrimental effects as in the case of recreational drugs such as cannabis.
- We can increase our numbers of dendrites by stimulating our brain with activities such as puzzles, exercise, mental activity and challenging ourselves. This ability to increase our number of synapses is called brain plasticity.
- Technology is rewiring our brains! Adolescent brains will likely look very differently in adulthood compared to the adults of today due to the differences in exposure to technology.

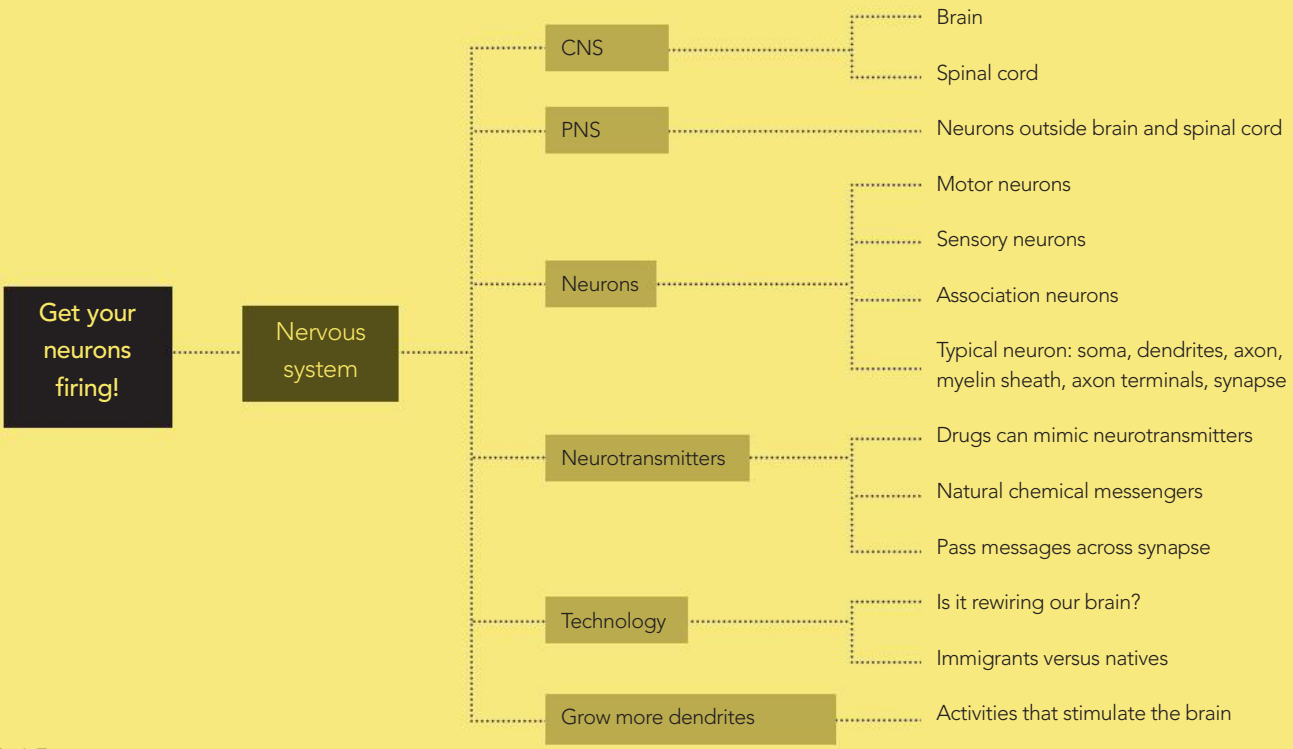


FIG 4.8» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 The brain is _____ while the neuron is the _____ enabling it to carry out its functions.
- **a** a complex network; basic hardware
- **b** a simple network; basic hardware
- **c** a type of nerve cell; specific brain cell
- **d** made up of many different types of cells; specific type of cell.

2 The CNS is made up of:
- **a** nerves that extend throughout the body
- **b** the brain and spinal cord
- **c** the brain only
- **d** the spinal cord only.

3 A key role of the peripheral nervous system is to:
- **a** deliver messages from sensory receptors to the brain and spinal cord
- **b** deliver messages from the brain to the spinal cord and sensory receptors
- **c** process information sent from sensory receptors
- **d** provide communication between the brain and spinal cord.

4 Timothy was standing on the edge of a cliff watching the ocean swell when an area next to him gave way and tumbled into the water below. With his heart pounding, he carefully stepped back and away from danger. What was Timothy's response to this fearful situation controlled by?
- **a** CNS
- **b** PNS
- **c** CNS and PNS
- **d** brain

5 A sensory neuron:
- **a** delivers messages from one sense organ to another
- **b** carries messages from the central nervous system to the leg muscles
- **c** delivers messages from the central nervous system to the ear
- **d** carries messages from the eye to the central nervous system.

6 A message travels along a neuron in the following order:
- **a** soma, dendrites, axon terminals, axon
- **b** axon, axon terminals, dendrites, soma
- **c** dendrites, soma, axon, axon terminals
- **d** axon terminals, dendrites, soma, axon.

7 The role of a neuron's myelin sheath is to:
- **a** detect incoming messages
- **b** direct messages to the end of the axon
- **c** connect with neighbouring neurons
- **d** determine whether the message is sent along the axon.

8 Which of the following occur at the synapse?
- **a** Special chemicals move across the gap to trigger a response at the next neuron.
- **b** Receptors on the surface of the next neuron receive the neurotransmitters to trigger a response.
- **c** Neurotransmitters affect the activity of neighbouring neurons.
- **d** All of the above.

9 Carly is having trouble sleeping and has been diagnosed with a sleep disorder that is caused by a chemical imbalance. It is possible she has abnormal levels of which neurotransmitter?
- **a** acetylcholine
- **b** serotonin
- **c** noradrenalin
- **d** dopamine

10 The number of dendrites in our brain can be affected by our activities. They can be cut back or reduced if we:
- **a** live in an unstimulating environment
- **b** challenge ourselves to try new activities
- **c** participate in mental activities that keep our brain active
- **d** live in a stimulating environment.

TEST YOUR UNDERSTANDING

11 Which of these statements is true?
- **a** Neurons communicate by directly touching neighbouring neurons.
- **b** Messages can be sent in many directions once they arrive at the soma of a neuron.
- **c** Neurotransmitters are involved in an electrical form of neural transmission.
- **d** Neurons communicate by a chemical messenger called a neurotransmitter.

12 What is a neurotransmitter and what does it do?

13 Why was the discovery of the existence of neurotransmitters in the brain significant in the understanding of mental health disorders?

14 Dopamine is an important neurotransmitter produced by the brain.
- **a** What is its role?
- **b** What is a condition that is caused by an insufficient production of dopamine?

15 Which neurotransmitter is involved in both sleep and the experience of emotions?

16 The number of dendrites we have is a constantly changing situation.
- **a** Describe what is meant by the phrase 'to grow more dendrites'.
- **b** What things can be done to 'grow more dendrites'?

17 In what ways can exposure to digital technology affect brain function?

18 Neuroplasticity is an exciting new area of neuroscience. What does it investigate?

Extend yourself

19 There are some drugs that mimic the action of natural neurotransmitters and have the positive side effect of blocking pain. Although best known for its use as an illegal recreational drug, cannabis (marijuana) has been used for many years as a medicinal drug. It is still used in some countries as an effective means of managing chronic pain, and clinical trials are under way in the UK to determine the effectiveness of cannabis-like drugs that may be safely used by patients.
- **a** In what types of medical conditions is marijuana found to be useful in managing pain?
- **b** What are the advantages and disadvantages of using a drug such as cannabis in managing medical conditions?
- **c** How is cannabis thought to be effective in reducing the experience of pain?
- **d** Why is a cannabis-like drug more acceptable than marijuana as a means of treating patients?

20 Morphine is an opiate drug that is commonly prescribed for the management of pain.
- **a** How does morphine work in reducing the experience of pain?
- **b** What are the advantages and disadvantages of using morphine for this purpose?

21 There are a number of neurological diseases affecting the way our neurons work causing debilitating symptoms. Choose one of the following conditions and find out more according to the questions below: multiple sclerosis, motor neuron disease (MND), Parkinson's disease.
- **a** What is the cause of this disease?
- **b** How is the normal functioning of the neurons affected by this condition?
- **c** What are the typical symptoms experienced by a patient with this condition?
- **d** What treatments are available and how effective are they?

MENTAL ILLNESS AND BRAIN INJURY

THE BRAIN IS A FINELY TUNED ORGAN THAT, IN ORDER TO FUNCTION NORMALLY, RELIES ON MANY DIFFERENT PROCESSES OCCURRING. WHEN IT IS WORKING WELL, THE BRAIN IS SO EFFICIENT THAT WE ARE USUALLY UNAWARE OF HOW HARD IT IS WORKING FOR US.

However, the brain does not always work as it is designed to. Mental illness can be an indication that the brain is not functioning as it should. This can change a person's capabilities or cause a person to behave in an unexpected or abnormal way. For some conditions, the changes are mild and may not be noticeable to others. In more severe conditions, the effects can be debilitating. However, research and new technologies can offer hope to people with mental health problems or brain trauma.

FIG 5.1» Brain disorders may not be visible.

CASE STUDY

Samantha has Tourette's syndrome

Samantha is 16 years old. Since the age of three, she has been traumatised by the symptoms of Tourette's syndrome. People with Tourette's syndrome display involuntary repetitive, rapid movements and vocalisations called 'tics'. Samantha was unable to control any of her 'tics', which included severe body jerks, punching walls and people she loved, and vulgar swearing. Because her uncontrollable outbursts were too difficult for her family to manage, she couldn't live at home and had to live in an institution. New advances in neurosurgery, however, have enabled Samantha to have a procedure called deep brain stimulation. This procedure stimulates an area deep within her brain to override the uncontrollable outbursts. Samantha is now almost free of the symptoms of Tourette's syndrome and is starting to lead a normal life.

BRAIN DISORDERS

There are millions of reasons why the brain may not function properly: the neurons in the brain might not pass on messages effectively, brain chemicals might not do their job, or trauma or damage could change the way the brain operates. The effects of this loss of function can be so significant on an individual that normal day-to-day activities are problematic or even impossible. For example, it might become difficult to hold down a job, to have meaningful relationships or even to socialise with other people. As in the case of Samantha (see case study below left), an individual's behaviour can become extremely difficult for others to cope with. For some people, major brain trauma means they can no longer interact with their environment in either a physical or a social sense.

Medical advances are enabling us to live longer lives but an ageing population means a marked increase in the incidence of age-related brain disorders such as dementia. A great deal of money is being invested in research in the pursuit of a cure for this worldwide problem.

Exposure to environmental chemicals and drugs can also have an effect on brain function. For example, research shows that marijuana use increases the risk of mental illnesses such as schizophrenia.

An increase in our knowledge of how the brain functions is enabling us to learn more about the causes of different mental illnesses. This in turn allows medical scientists to develop better treatment options for these conditions.

An understanding of the role of different brain chemicals or neurotransmitters has enabled doctors to more effectively treat conditions such as clinical depression, anxiety disorders and schizophrenia. Such conditions can result from increased or decreased levels of neurotransmitters, so treatments that restore the normal balance can be effective in improving symptoms.

Improved brain scanning techniques have also enabled doctors to be more certain about which parts of the brain have been affected by brain injury or mental illness, enabling them to better target their treatments.

NEUROPLASTICITY … A PROMISING FUTURE

Does **neuroplasticity** mean that the brain is made of plastic? No—it is a term that refers to the lifelong ability of the brain to change and reorganise connections between its neurons. Every new experience alters the neural pathways in the brain. Whenever you learn new skills and acquire new knowledge, changes occur in your brain.

According to Durbach (2000) there appear to be two types of changes that occur with learning:

- a change in the internal structure of the neurons
- an increase in the number of synapse connections between neurons.

As a young child develops, significant changes occur in the brain. While learning to walk, talk, recognise colours, shapes and sounds, and use language creatively, the child's brain is highly active. Each of these experiences creates new connections between neurons.

During a person's teenage years, connections not being used are 'pruned' or disconnected. This is called synaptic pruning. It enables the brain to adapt to a constantly changing environment by increasing useful connections and reducing ones that are not useful. It is an important process because it improves the efficiency of the network and therefore the efficiency of the brain's function.

Neuroplasticity occurs as a normal part of brain development. This also means that the brain can adapt to changes occurring in the brain as a result of brain injury. The brain has a healing capacity that has only recently been realised; following brain injury, changes occur that enable the neurons surrounding the injury to take on the function of damaged cells. Greater knowledge about how the brain compensates for injury provides an enormous amount of hope to those with brain and spinal damage as a result of disease or physical injury.

FIG 5.2» A child's brain is highly active while he or she learns to walk.

CASE STUDY

Recovering from a stroke

Michael Bernstein was an energetic and fit 54-year-old eye surgeon when he suffered a stroke. The blood clot that lodged in his brain deprived the area responsible for controlling movement (called the motor cortex) of oxygen, leaving the left side of his body paralysed. With intensive speech and occupational therapy he showed gradual improvement in his ability to speak and move, but at the end of his treatment was still unable to perform fine-motor skills such as lifting a spoon to his mouth and buttoning his shirt. He participated in a movement therapy program which aimed to strengthen his brain networks through repetitive movements and exercises such as washing windows, lifting cans and stretching rubber bands. After only a short time, Michael's fine-motor skills started returning. Michael's brain was rewired to perform functions that the injured tissue was no longer able to do. This was neuroplasticity at work.

Norman Doidge, 2008

DEPRESSION

Steph has been struggling with many things in her life, and has felt this way for a month or more. She can't remember the last time she felt happy or excited. Each day she has woken up feeling sluggish and lacking in energy, and no longer has any interest in things she used to enjoy. Her thinking processes and movements seem to be in slow motion. Steph is finding it difficult to concentrate and take in anything—she is unable to focus for long enough to read a page of a book. She is feeling negative and lacking in any emotion. Steph is suffering from depression.

Depression is a common disorder in today's society, and is one of the most common mental health issues faced by young people. One in five people will experience depression at some stage in their life. It is also more prevalent in today's youth than in youth from any other period of time.

A view put forward by Kelly Lambert (2008) suggests that the physical work typical of earlier generations may have, in fact, contributed to better mental health. It appears that hand movements activate large areas of our brain's cortex and, in doing so, brain neurotransmitters such as dopamine and serotonin are released. These are chemicals involved in generating positive emotions. In Amish communities in the United States where there is no reliance on mechanisation and physical labour is needed to get jobs done, the incidence of depression is exceptionally low. It appears that our brain values physical effort and meaningful activity. Knitting a jumper or building a shed are great ways to alleviate stress and engage the brain in ways that can benefit mental health. Physical activity seems to be a kind of 'mental vitamin' that builds resilience and protects us against depression.

There is a great deal that can be done to help sufferers deal with depression. Learning about depression and getting a better understanding of what it is and what causes it can go a long way towards feeling better. There is also plenty of support available for people who think they might be suffering from this condition. It is important for someone experiencing symptoms like Steph's to talk to a parent, a counsellor or a doctor. The sooner the symptoms are dealt with, the sooner the person will be feeling back to normal.

FIG 5.3» Deep brain stimulation involves implanting electrodes into the brain.

DEEP BRAIN STIMULATION

In a controversial approach to the treatment of depression, Jonathon underwent deep brain stimulation to treat his severe form of depression. This treatment involved having electrodes implanted in his brain, and an electric current switched on.
Over a period of several years, Jonathon had tried many different drug therapies—as well as electric shock therapy and counselling—but nothing had any impact on his symptoms. Within six months of the new treatment, he felt totally normal again, able to live without the pain, anxiety and fear that had plagued him for years. Deep brain stimulation is also used in other hard-to-treat disorders such as Parkinson's disease, chronic pain disorders, obsessive compulsive disorder, Tourette's syndrome and Alzheimer's disease.

5.1 INVESTIGATE

All about teenage depression

1 Find out more about the debilitating condition of teenage depression. Create an A4 flyer that is aimed at informing teenagers about depression. Include the following information:
   - What is depression?
   - How can people learn to recognise the symptoms of depression?
   - What are possible causes of depression?
   - Who is at risk?
   - What can be done to fight the symptoms of depression?
   - What can you do to reduce the risk of developing depression?

WWW» A useful reference site to visit is the beyondblue website.

2 Discuss, debate or reflect on this question: Would you recommend the controversial treatment of deep brain stimulation for the treatment of depression? Why or why not?

3 Research and evaluate different ways of treating depression. What are the advantages and disadvantages of each?

TRAUMA

There are many reasons someone might suffer an acquired brain injury. It might be the result of an accident or stroke, or due to alcohol or drug abuse. The effects are unique to each case and can be far-reaching, depending on the location and severity of the brain injury, and the extent of neurological damage.

The media has many stories of young people who have received brain injuries through trauma—from car- or work-related accidents, or as a result of violence. All of these situations irrevocably change the lives of the victims and their families.

In one particular case, James Macready-Bryan met with tragic consequences on the night of 13 October 2006 in Melbourne's Central Business District. It was the night of his 20th birthday, but the evening did not go as expected. As the result of an argument with a group of youths, James was assaulted and left with severe head injuries that caused irreversible brain damage. The parts of his brain affected by these head injuries have left James unable to walk, talk or sit up by himself. James is now confined to a wheelchair, unable to talk or communicate with the outside world. He will have to depend on other people to do everything for him for the rest of his life.

Despite this tragic situation for James, he is luckier than many in his situation. His family and friends have rallied around him to make sure his life is as good as it can be, and they are determined that others learn from his unfortunate circumstances. The James Macready-Bryan Foundation has been set up to raise money and public awareness of the plight of young people like James who, through their disability, are forced to live in unsuitable accommodation.

FIG 5.4» After James' tragic assault he was left with brain damage. His friends formed a foundation to raise public awareness about the importance of thinking before acting in a volatile situation.

James' friends have also formed the campaign *Step Back. Think.* to spread the word about the importance of thinking before acting when in a volatile situation. Through educating young people about the potentially tragic consequences of getting in a fight, *Step Back. Think.* hopes to reduce the incidence of violence and assault in Melbourne and throughout Australia.

Hope for the future

The exciting area of stem cell research is offering hope to brain-injured patients as a possible means of treatment in the future. Stem cells are 'master cells' that can mature into specific types of cells, such as nerve cells, and be programmed to carry out their specialised functions. This means that stem cells could potentially replace damaged neurons in the brain and spinal cord. Patients with brain damage may therefore one day be able to undergo treatment that enables their damaged brain cells to be replaced by healthy cells. Normal function could be restored, so that the brain and spinal cord will again function as it should. This research offers hope to many paraplegic, quadriplegic and brain-damaged patients.

Recent research on brain-damaged mice at the University of California has shown that stem cell treatment can improve memory in mice for up to three months (Yamasaki et al. 2007). Such results suggest that humans too may benefit from stem cell research that may restore brain function in people with memory impairment resulting from brain injuries.

FIG 5.5» Stem cell research offers hope to quadriplegics.

5.2 INVESTIGATE

Learning more about ABI

1 Use the Internet to research the impact of ABI (Acquired Brain Injury) or spinal damage to a specific individual. Write a short report that answers the following questions.

- What is the injury, and how was it acquired?
- What are the consequences for the patient?
- What treatment options are available to this patient? How effective are they?
- What quality of life does the patient have?
- What future treatments are on the horizon that may improve the quality of life for these patients?

What hope does stem cell research offer?

2 Find out about stem cell research. What is it? How can it assist patients with brain injury or spinal damage? What hope does it offer to patients with Acquired Brain Injury or spinal damage? Present your findings in dot points.

Design a violence awareness campaign

3 Imagine you were designing a campaign to increase the awareness of young people to the dangers of violence on our streets. What would you do? Prepare a PowerPoint presentation that includes the following points.

- What goals would you set for your campaign?
- How would you carry it out?
- How would you know if it was successful?

BrainLink

4 Find out about BrainLink online. WWW» BrainLink Services Limited is a Victorian service that is dedicated to improving the quality of life of people affected by a variety of brain conditions. What services and support do they offer to patients and families?

James Macready-Bryan

5 View the online documentary about James Macready-Bryan and explore the *Step Back. Think.* website. WWW»

NEUROSURGERY

Neurosurgery is a highly specialised area of medicine that involves operating on the patient's brain or spinal cord. It may be to remove bone fragments from a crushed skull, to insert electrodes for deep brain stimulation, to repair an aneurysm or to remove a tumour. Whatever the nature of the surgery, it is highly risky. A mere millimetre to the left or right could mean the difference between successful and unsuccessful surgery.

CASE STUDY

Dr Charlie Teo and Katie

FIG 5.6>> Dr Charlie Teo

Sydney neurosurgeon Charlie Teo is heralded as being a 'cowboy neurosurgeon' who dares to try surgery that others do not. Charlie is a surgeon that patients go to when all else has failed, and so he is often faced with the most difficult cases.

One of Charlie's patients, eleven-year-old Katie, had recently had an operation to remove a brain tumour that left her paralysed on one side of her body. Without surgery, Katie had only days to live. Her tumour was in the brain stem, the part of the body responsible for vital functions such as breathing, swallowing, eye movements, consciousness and coordination. Any damage to surrounding brain tissue during surgery would cause irreversible and devastating disability, and carried with it the risk of death. Charlie chose to operate on the tumour by opening Katie's skull near her right eyebrow with an incision smaller than a postage stamp. He began to remove the growth, but it was much larger than he had realised. After six hours, he had to revert to operating without his microscope, which greatly increased the difficulty of being accurate. After 10 hours, Charlie believed he had removed the tumour, but had to wait to see if his patient regained consciousness. Katie did wake from her surgery, and found she had full use of both sides of her body. Four years later, she has no sign of the tumour's effects, or of any after-effects of surgery. Without this 'cowboy neurosurgeon', Katie would no longer be alive.

Teo, Charlie, COSMOS, Feb/Mar 2007 'Mission impossible', pp. 38–9

5.3 INVESTIGATE

Diary of a neurosurgeon

1 Research neurosurgery and find out the various reasons why it might be performed. Choose one reason and write a diary entry from the point of view of a neurosurgeon about to perform a tricky operation on a patient for that reason. The following questions should be answered in the entry.
   - What part of the brain are you operating on?
   - What symptoms does your patient have?
   - What do you hope to achieve through this surgery?
   - What is the likely success rate of this surgery?

Too risky

2 In pairs, discuss whether neurosurgeons like Charlie Teo should be allowed to perform such risky surgery. What are the pros and cons?

The future of brain surgery

3 With new imaging techniques such as positron emission tomography (PET) and magnetic resonance imaging (MRI) scans, the accuracy of surgery is improving. Prepare a short oral presentation that outlines what you think is the future of brain surgery, based on current technologies.

DEMENTIA

Dementia is a devastating disease that affects about 230 000 Australians and over 26 million people worldwide. Dementia slowly eats away at memory until the sufferer is a stranger to those around them and can no longer recognise people they once knew. Dementia systematically unravels the cells and networks of the brain so that they no longer communicate with each other. The risk of developing dementia increases with age, but it can affect patients as young as 40 years of age. Early-onset dementia is a rare condition, but it can affect people as young as 20 years.

FIG 5.7» Playing games in the later years of life may help keep your brain active and reduce the risk of dementia.

Alzheimer's disease

David wanders around the kitchen in the home where he has lived for over 45 years. He has been asked to make a cup of coffee, but is not sure what to do or how to go about it. He is now unsure what it is he was asked to do. When reminded, he opens cupboards without any real purpose. He then gets distracted by something on the TV and goes and sits in front of it. When shown photos of his family, he has trouble identifying who they are. David has Alzheimer's disease—a form of dementia.

The most common form of dementia is Alzheimer's disease, which is an incurable condition. The brain loses the ability to form new memories and to make new connections between neurons.

Patients suffering from Alzheimer's can experience a loss of memory about how to perform tasks they used to do easily. They no longer recognise people who were once familiar to them and they may undergo personality changes. Ultimately, they can forget how to eat, get dressed, walk and talk. Eventually, they will forget how to swallow and breathe. It is a terminal condition.

Most people expect to be able to live into old age with good mental health. However, for many who do live to an old age, Alzheimer's is a very real prospect. Patients suffering Alzheimer's today have no hope of being cured of this terrible disease, although research to find a cure continues and modern treatments can slow the progress of the disease.

RIVETING RESEARCH

Right now, dementia can't be cured but can mental gymnastics help to prevent it? A longitudinal study conducted by David Snowdon on health and ageing in nuns found that those with more sophisticated writing skills were less likely to develop dementia in old age. It is thought that complex mental activity (for example, doing crosswords and Sudoku) stimulates the brain to make new synaptic connections. This increases the connections between neurons. Further, it is thought that increasing the capacity of the brain's communication network enables connections to be kept in reserve. This means that when the normal ageing process eliminates connections, the ones in reserve can be put into use (Finkel 2007).

Physical exercise is thought to be good for the brain as well as the body. MRI scans have shown that age-related brain shrinkage (which is a normal part of ageing) is reduced in individuals who are physically fit. It is thought that exercise increases the blood supply to the brain, which enables a better supply of oxygen and glucose.

The biggest risk factors for developing dementia are age and your genes, which are two things you cannot do much about! However, there are a number of lifestyle factors that can contribute to brain health, and help to reduce the risk of dementia:

- keeping the brain active, for example with crosswords, Sudoku and other puzzles
- eating a diet rich in anti-oxidants
- reducing consumption of caffeine and saturated fats
- eating a diet high in omega-3 fatty acids
- undertaking physical exercise at least three times per week
- being socially active
- avoiding excessive alcohol consumption and smoking
- avoiding head injuries.

HOPE FOR THE FUTURE

Studies have shown that patients with Alzheimer's disease have increased amounts of beta-amyloid protein in their brain tissue. This protein forms plaques and tangles that block communication between nerve cells.

In an Australian study led by Professor Ames of the National Ageing Research Institute (NARI), subjects with higher than normal levels of beta-amyloid protein performed less well on a series of cognitive tests than subjects with lower levels of the protein. This is a significant finding, as testing for the protein may lead to detection of the disease at an early stage, when treatments might be more effective. There is also hope that imaging techniques such as PET scans will be able to identify those people at risk of Alzheimer's by showing areas of the brain that have higher than normal levels of beta-amyloid protein (Munro, 2008).

5.4 INVESTIGATE

Preventing dementia

1 Create an information brochure (for distribution in doctors' surgeries, health clinics and hospitals) on how to prevent dementia. The brochure should be designed for the general public and provide information about the risk factors and the symptoms of dementia. Include the following information.

- What is dementia?
- What are its symptoms?
- Who is at risk?
- What can you do to reduce the risk of developing dementia?

Would you like to know?

2 In small groups, discuss whether you would like to know if you are going to develop dementia. Why or why not?

Where should the money be spent?

3 In pairs, debate whether money would be better spent on finding a cure for dementia or on identifying early stages of dementia.

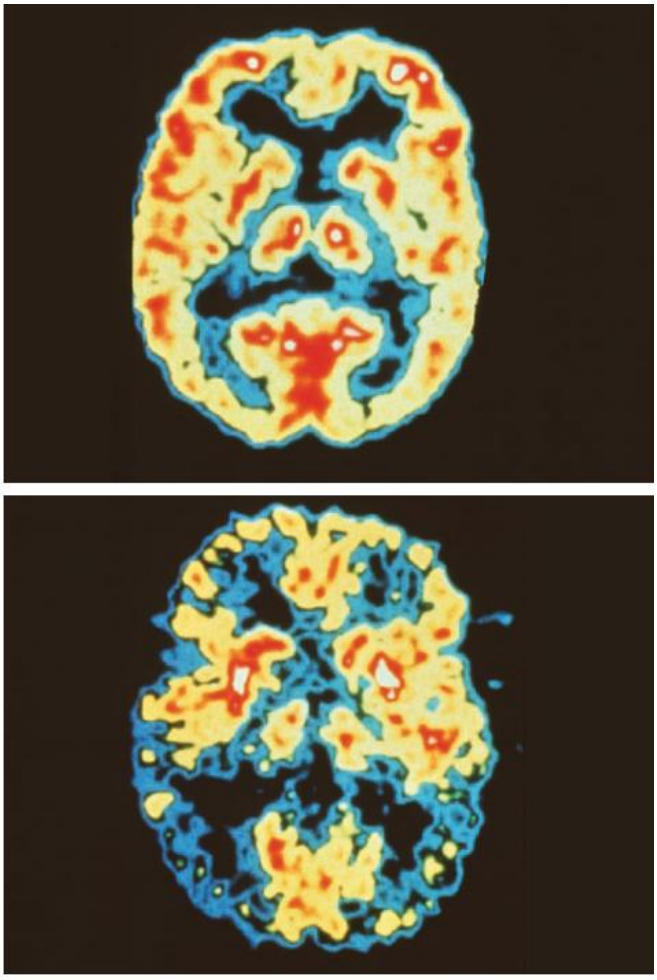


FIG 5.8» PET scans show a normal brain (above) and an Alzheimer's patient brain (below).

REVIEW 5.1

1 What are some reasons why the brain might not function properly?

2 Explain why neuroplasticity might offer hope for a more promising future for those suffering brain injury.

3 It appears that physical activity may help to protect us from the debilitating effects of depression. Describe the evidence that supports this statement.

4 What is deep brain stimulation and why is it used?

5 What is an acquired brain injury?

6 Describe what a neurosurgeon might do for a patient with a brain disorder.

7 What is dementia? What are some factors that can help to reduce the risk of developing dementia?

FIG 5.9» Animals are useful in research due to their similarities to humans. But their use is coming under increasing criticism.

CONTROVERSIAL RESEARCH

The following areas of research have been controversial for different reasons, but each has contributed significantly to knowledge of how to improve the quality of life for some people.

SEWING KITTENS' EYES SHUT TO STUDY NEUROPLASTICITY

In the 1960s and 1970s, Colin Blakemore, Professor of Physiology at Oxford University, performed many experiments on kittens to investigate what would happen to the vision part of the brain in the absence of light stimuli. He wanted to find out if this area of the brain would lose its ability to 'see' if light was not allowed to enter the eye. His research showed that the part of the brain previously used for vision was 'converted' to other functions—it was not 'hardwired' for vision only. This supported the idea that the brain had 'plasticity' (Finkel, 2007b).

5.5 INVESTIGATE

Animal experimentation

The use of animals in experiments for medical and scientific purposes has been a controversial issue for many years. There are strict regulations governing the use of animals in experiments today. Any research involving animals must be clearly justified and all care must be taken to minimise pain and stress to the animals.

1 Do you believe the experiments conducted by Colin Blakemore were justified or not? Explain your answer.

2 What are your views on the use of animals in research such as Colin Blakemore's?

3 Consider the advantages and disadvantages of using animals in research as set out in the following table. Copy this table into your workbook and add any other advantages and disadvantages you can think of.

TABLE 5.1» Advantages and disadvantages of using animals in research

Advantages of using animals in research	Disadvantages of using animals in research
› Animals breed more quickly than humans. › Animals have a shorter life span so researchers can observe effects of different conditions over a life span more easily. › Humans are mammals so results from animals are able to be generalised to humans. › Animals can be kept under controlled conditions for more reliable results. › Large numbers of participants are more easily achieved.	› How far can results be generalised from animals to humans? › Harm and discomfort caused to animals

4 What regulations would you enforce if you had set guidelines for animal experimentation?

WWW» For reference, the American Psychological Association: Guidelines to Animal Experimentation can be found online.

DEVELOPMENT OF DRUGS TO ENHANCE MEMORY

A number of researchers have been investigating drugs that may help in treating diseases affecting memory, such as Alzheimer's disease. Mark Tuszynski and colleagues in San Diego have been working with genetically modified neurons to be implanted into the brains of Alzheimer's patients, with very promising results. Other studies using this same technology have found that gene therapy can be used to improve the normal functioning of memory in mice.

Some studies by memory researchers such as Tim Tully (Neurosciences Institute, San Diego) and Eric Kandel (Columbia University) have been using drugs targeted at improving normal memory. Kandel was awarded the Nobel Prize for Medicine in 2000 for his research on sea slugs, which revealed a great deal about the way memory works in humans. His more recent studies on mice have shown that particular drugs targeting the formation of memories can improve the rate of learning in mice. Such findings have led to the development of a company called Memory Pharmaceuticals Corp in Montvale, New Jersey.

FIG 5.10›› Mice were able to learn more quickly with a memory drug.

Several drugs aimed at improving memory are currently in clinical trials, and could one day be of use in the treatment and prevention of dementia. It is possible that, in the future, these 'memory enhancers' could become 'lifestyle' drugs, and be used to help us learn more effectively.

USE OF LSD IN TREATMENT OF PAIN AND ANXIETY

In the early 1940s, Swiss biochemist Albert Hofmann stumbled on a new compound that he had accidentally absorbed through his skin. Having absorbed the compound, he experienced mind-altering hallucinations that distorted his thinking. The compound was called lysergic acid diethylamide (LSD). Its psychedelic properties became well known to the hippies of the 1960s, and it was associated with anti-war demonstrations, drug abuse and student riots. The effects of long-term use of LSD affected so many people that it became a worldwide prohibited drug in 1971. Today, there are some scientists and medical practitioners who believe that LSD has a number of therapeutic applications in the treatment of anxiety disorders, pain management and substance addiction. As a result of the huge stigma attached to this drug, however, it is difficult for human trials to gain public acceptance.

REVIEW 5.2

1 Describe two advantages and two disadvantages of using animals in scientific research.

2 Drugs aimed at improving memory may be available to dementia patients. What other uses might these drugs have in society?

5.6 INVESTIGATE

Memory drugs as lifestyle drugs

1 What do you think are the advantages and disadvantages of a society that has the potential to learn more quickly through using drugs?

2 Reflect on the future of a human population that has access to memory-enhancing drugs. What are your thoughts on living in such a society?

Use of LSD in treatment of pain and anxiety

1 Reflect on the use of a drug such as LSD in the treatment of anxiety and pain management. What would be the advantages and disadvantages of its use?

2 Imagine you are on a medical board that is responsible for determining whether LSD should be allowed for treating anxiety and for pain management. What issues would you need to consider?

CHAPTER SUMMARY

- There are many reasons why the brain might not function properly. Some conditions are inherited—individuals are born with a condition that affects their brain and, subsequently, their behaviour. These conditions are often difficult to treat effectively. Other conditions are the result of factors such as lifestyle, exposure to chemicals (for example, drugs and alcohol), diet or stress. Some conditions irreversibly affect the hardware of the brain by changing the way the neurons work or communicate with each other.
- Tourette's syndrome can mean that the sufferer is unable to lead a normal life because the condition makes them behave in socially unacceptable ways. There is hope for the future with new advances in neurosurgery such as deep brain stimulation.
- Neuroplasticity refers to the lifelong ability of the brain to change and reorganise connections between its neurons. New knowledge of what this can mean for brain disorders and for improving the functioning of normal brains has exciting implications for the future.
- Depression is a prevalent condition among today's youth, and much research has been devoted both to understanding its causes and to the effectiveness of treatment. A focus on lifestyle factors and alternative approaches to medication might offer more hope for the future of people suffering this debilitating illness.
- Brain trauma is an all-too-common result of work and car accidents or assaults, with severe consequences for both the victim and their family. New technology and therapies offer some hope in an otherwise bleak outlook on such conditions that cause severe brain damage.
- Exciting advances in neurosurgery and technology can offer real hope to patients with brain trauma, brain tumours or other devastating conditions that drastically affect an individual's quality and length of life.
- Dementia systematically unravels the communication networks in the brain until it is no longer able to function. It is a devastating disease with patients suffering loss of memory followed by loss of ability to talk, walk and eat. Many areas of current research are beginning to open up new possibilities for both treating and preventing this disease for future generations.
- The use of animals and drugs in research has led to both controversial and exciting findings that have enabled advances in our understanding of how the brain functions.

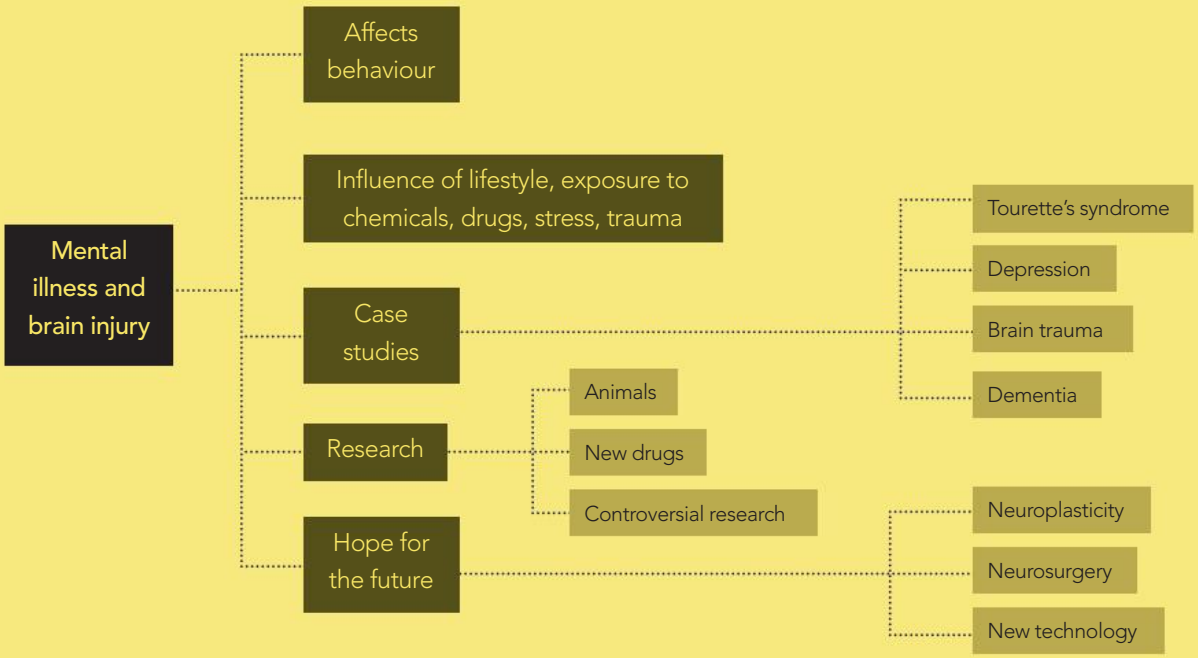


FIG 5.11» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 The brain might not work effectively due to reasons such as:
   - **a** brain chemicals not working properly
   - **b** neurons not communicating well
   - **c** brain tissue damaged
   - **d** all of the above.

2 Neuroplasticity offers hope to those with brain disorders because:
   - **a** one part of the brain can take over the functions of other areas
   - **b** the brain has the ability to change and reorganise itself
   - **c** patients with brain damage have been known to recover from their symptoms
   - **d** all of the above.

3 Learning experiences _____ the connections between neurons, while not using our memory _____ neuron connections.
   - **a** increase; reduces
   - **b** reduce; increases
   - **c** have no effect on; reduces
   - **d** increase; has no effect on

4 It is thought that a key factor in the increased risk of depression in today's society is:
   - **a** the tendency to ignore time-saving devices
   - **b** doing less physical activity
   - **c** taking more responsibility for personal survival
   - **d** having a more relaxed lifestyle.

5 Deep brain stimulation is a treatment for some brain disorders that involves:
   - **a** a brain scanning technique that shows images of the brain
   - **b** sending an electric current through electrodes deep into the brain tissue
   - **c** drug therapies
   - **d** a massaging technique applied to the scalp.

6 An acquired brain injury can result from:
   - **a** trauma
   - **b** accident
   - **c** drug or alcohol abuse
   - **d** all of the above.

7 Dementia is considered to be a greater problem in today's society than in the past because:
   - **a** it is easier to recognise symptoms
   - **b** the population is ageing more due to improved health care
   - **c** people are just getting older
   - **d** brains are less resilient than they once were.

8 With Alzheimer's disease:
   - **a** the brain loses the ability to form new memories
   - **b** the brain loses the ability to make new connections between neurons
   - **c** there is too much activity between neurons
   - **d** both a and b are correct.

9 Factors that can reduce the risk of developing dementia include:
   - **a** resting the brain as much as possible
   - **b** eating a diet high in saturated fats
   - **c** regular physical exercise
   - **d** increasing smoking and alcohol consumption.

10 The study conducted by David Snowden found that nuns:
   - **a** who had well-developed writing skills were less likely to develop dementia
   - **b** who regularly completed puzzles were less likely to develop heart problems
   - **c** who completed crosswords were happier than those who played Sudoku
   - **d** were happier than the general population.

11 What is neurosurgery?

12 Explain the term 'neuroplasticity'.

13 What is meant by 'controversial research'? Give an example of some controversial research that has been conducted and explain why it is considered controversial.

TEST YOUR UNDERSTANDING

Extend yourself

14 Discuss or debate the following statements in a group or with your class. Consider the arguments for and against each statement.

- Drug companies should be encouraged to develop drugs to improve memory.
- LSD should be legalised for medicinal use.
- The use of animals in psychological research for human benefit should be banned.
- Drugs to enhance learning, concentration and memory should only be available for those with brain function disorders.

15 What is gene therapy? What is the potential for the use of gene therapies such as genetically modified neurons in the treatment of diseases such as Alzheimer's?

16 Research one of the following brain or nervous system disorders: schizophrenia, Parkinson's disease, multiple sclerosis, motor neurone disease, stroke or brain trauma.

- What are the symptoms, causes, treatments of this disease?
- Is there a cure available, or is there hope for a cure in the future?

17 Use your research from question 16 and present it in one of the following ways.

- Imagine you have this disease. Write a diary entry describing a day in your life. How do you feel? What are your symptoms? What are your thoughts? How do you manage day-to-day activities? What therapy or treatment do you need to have?
- Prepare a proposal requesting government funding of $500 000. Create a poster or PowerPoint presentation about the disorder, and justify why you should receive the funding. How would you use the funding to improve the lives of those with this disorder?
- Find an article in the media relating to an experience of a specific mental illness. What can you learn about the mental illness from this article? Present your findings to the class.

BRAIN BOOSTERS

YOUR LIFESTYLE CAN DIRECTLY INFLUENCE HOW WELL YOUR BRAIN WORKS FOR YOU. DO YOU FIND IT DIFFICULT TO DRAG YOURSELF OUT OF BED ON A SCHOOL MORNING, OR DO YOU HAVE TROUBLE STAYING AWAKE IN CLASS?

How often have you been unable to think clearly after eating particular foods? Diet, exercise, use of stimulants, patterns of sleep, and even the technology we use all impact upon how well our brain works for us.

BRAIN CARE

Carefully consider the following questions.

- Have you been unable to concentrate and think clearly after eating certain foods?
- Have you spent the entire day fighting the urge to shut your eyes?
- Have you felt the need to drink water but ignored it?
- Do you think about doing exercise, but just can't be bothered ... it's easier being a couch potato!
- Do you text, email or network with friends on the computer or play computer games right up until going to bed?
- Do you drink caffeine drinks to keep awake and get you through the day?
- Do you keep pressing the snooze button on the alarm because you don't want to wake up?

If you answered 'yes' to any of these, chances are you have not been looking after your brain properly! In this chapter, you will find how to avoid these behaviours and, instead, how to give your brain functioning a boost!

EXERCISE

Exercise is a powerful way to improve how your brain functions. A period of exercise can improve the brain's ability to think clearly, concentrate and learn. Physical activity makes blood pump around the body more efficiently, improving the delivery of oxygen and nutrients to the brain's hard-working nerve cells. Neurons require energy in the form of oxygen and glucose, and the more readily available these are, the better these special cells can function.

Exercise also increases the release of 'feel-good' chemicals such as serotonin and dopamine, which can improve mood and reduce stress. Regular exercise can even be a powerful factor in reducing depression.

Many adolescents find that their lives are full of social activities, part-time work commitments, school and homework. Exercise can become a casualty in a busy schedule because it seems as if there is no time to fit it in. However, making exercise a priority is important for maintaining a healthy lifestyle and can be a way to ensure that time spent in class and on homework is much more effective. Daily exercise is the best form of exercise. It may be organised sport, bike-riding, walking to school or physical activity at lunchtime.

The importance of exercise has also been supported by research with mice. It was found that mice in cages with running wheels for exercise and toys for mental stimulation showed improvements in learning and memory, compared to mice in cages without wheels or toys (Harburger et al, 2007). This means that exercise and mental stimulation appear to be important factors in reinforcing memory in mice. These results can be used to make general inferences about the role of exercise and mental stimulation in improving learning and memory in humans.

CASE STUDY

Benefits of exercise

Jason is an outdoor enthusiast and a self-confessed exercise addict. Cycling through mountain terrain, ice-climbing glaciers, kayaking fast mountain streams, swimming choppy ocean swells and running long distances are all regular weekend activities for him. He is almost always training for a marathon or endurance event of some sort! Jason owns a car, but rarely uses it. He chooses instead to cycle to work and to social outings.

When asked about the positive impact of exercise for him, Jason made the following comments:

'Time takes on a different quality for a period after exercise … it goes faster!'

'Processing information is easier after exercise. I feel much more alert.'

'I think more laterally during exercise—it is a great time to problem-solve.'

'I don't enjoy not being able to exercise! Exercise is a regular part of each work day, plus weekends and holidays.'

6.1 INVESTIGATE

Does exercise affect mood?

1 Keep an exercise journal (based on Table 6.1) for one week to find out whether exercise has an influence over your mood. Rate your mood both before and after exercise on a scale of 1 to 10: '1' being a very low mood and '10' being a very high mood.

2 Analyse your data.

- Was your mood influenced in any way by exercise? Explain your answer with reference to your results.
- Did any particular type of exercise have a greater impact upon your mood?
- Did any particular time frame spent exercising have a greater impact upon your mood?
- Did any particular rating of exercise (mild, medium or strenuous) have a greater impact upon your mood?
- Is a period of one week a sufficient length of time to make conclusions about the effect of exercise on mood for you? Explain.
- What other factors may have influenced your ratings of mood that were unrelated to exercise?

3 Based upon your findings, what general conclusions can you make about the effect of exercise on your mood?

TABLE 6.1» Exercise journal

Day	Type of exercise	Rating of exercise: mild, medium, strenuous	Time spent exercising	Rating of mood before exercise	Rating of mood after exercise
Monday					
Tuesday					
Wednesday					
Thursday					
Friday					
Saturday					
Sunday					

Interview: the impact of exercise on well-being

4 Find someone you know who enjoys exercise and believes it has a positive impact on the functioning of their brain. Write some questions about the person's experience with exercise and the effects it has on day-to-day lifestyle. Include the following topics in your interview:

- the nature of the exercise
- how often and when exercise is undertaken
- the positive effects of exercise on lifestyle
- the effects on concentration, memory and learning during the day
- the effect felt when exercise is skipped.

Note: Ensure you fully brief the person about the purpose of the interview before you begin, to ensure they are comfortable sharing the information with you.

REVIEW 6.1

1 List the benefits of exercise.

2 How does exercise specifically benefit our neurons, and why is this important?

3 What do experiments with mice suggest about the role of exercise and mental stimulation?

4 What inferences can be made from the findings of experiments with mice about the role of exercise and mental stimulation in humans?

SLEEP

Are any of the following familiar scenarios for you?

- I struggle to get out of bed each morning on a school day.
- I often feel the need to fall asleep in class during the day.
- I often have trouble concentrating in class, especially at the start of the day and after lunch.

Adolescents commonly suffer from **sleep deprivation**. Teenagers have a biological need for approximately 9¼ hours sleep per night for effective learning and for healthy brain development. However, a hectic schedule of school, homework, part-time jobs, social activities and family commitments leaves many teenagers with too little time to sleep. In addition to this, during adolescence the body experiences a shift in sleep–wake cycles, leading to behaviour that is seen as typical of teenagers: that is, preferring to go to bed late (on average around 11 pm) and, therefore, to wake up later. A sleep time of 11 pm and a wake-up time of 7 am, for example, will leave a teenager at least 1¼ hours short of the optimal amount of 9¼ hours of sleep. Over the period of one week, this adds up to a sleep debt of at least five hours. If this happens, teenagers can be chronically sleep-deprived— which might explain the lack of enthusiasm many show in having to get up on a school morning!

According to sleep researchers Wolfson and Carskadon (1998), adolescents also release the 'sleep hormone' **melatonin** later in the evening than adults and young children. This makes it difficult for teenagers to go to sleep at an earlier time. The research supports the idea that teenagers are not necessarily being difficult about going to bed earlier; it is, in fact, a biological factor of adolescence over which teenagers have no control.

The consequences of sleep deprivation in teenagers can be serious. An adolescent lacking sleep will experience a greatly reduced ability to concentrate, problem-solve, remember and learn. This, in turn, can lead to poorer performance at school. Insufficient sleep can also lead to poor health and behavioural problems, and can be a risk factor in teenage anxiety and depression.

Better sleep: tips for teenagers

During the day

- Get outside, preferably early in the morning (but lunchtime will do).
- Get some exercise each day (finish your exercise at least three hours before bedtime—elevated body temperature is a barrier to sleep).
- Avoid napping.
- Avoid caffeine (coffee, tea, soft drinks, chocolate), nicotine and other stimulants after noon.

Around bedtime

- Aim for 8½ to 9¼ hours sleep a night.
- Choose a bedtime that works for you, and go to bed around this time each day.
- Avoid alcohol—although it makes you sleepy, it shortens and disrupts sleep.
- Avoid overstimulation later in the evening. Intense study, computer games, arguing or heated discussions are incompatible with sleep.
- Create a good sleeping space that is dark, comfortable, cool, quiet and uncontactable, which means no mobile phone and no Internet.
- Develop a soothing pre-sleep routine to train the body into a relaxed state for bed (try a hot bath or a quiet read, chamomile tea or a relaxation technique in the hour before bed).
- Avoid bright light in the evening. Screens, especially computer screens at close range, tell the body clock that it is not yet dark.
- If you have any worries or concerns at bedtime, write them down for consideration in the morning.
- If you're not asleep 20 minutes after lights out, get up and do something quiet until you feel tired.

In the morning

- Open the blinds or turn on lights as soon as you get up. The body clock benefits from a light reminder that the day has started.

Catch-up sleep

- Weekend sleep-ins are OK, but don't get up more than two to three hours later than your usual awakening time or it could disrupt your body clock.

Tips provided by Associate Professor Greg Murray of Swinburne University of Technology

6.2 INVESTIGATE

Media response: 'Better sleep is associated with improved academic success'

Read the article 'Better sleep is associated with improved academic success' and answer the following questions.

1 According to this article, what type of sleep produces a better academic performance?

2 Who was the key investigator in this study?

3 Describe the characteristics of the subjects involved in this study.

4 What type of data was collected from subjects?

5 What link was found between higher maths and English scores and sleep?

6 According to Cousins, what are poor sleep and poor sleep habits associated with?

7 What conclusions were made by researchers?

Better sleep is associated with improved academic success

Getting more high-quality sleep is associated with better academic performance. The positive relationship is especially relevant to performance in maths.

According to principal investigator Jennifer C. Cousins, PhD, postdoctoral fellow at the University of Pittsburgh Medical Center, it was surprising that although more and better sleep produced overall improvements, different types of sleep measures were related to different types of functioning.

'Sleep deficits cause problems for adolescents, but students differ in their personal resources and in how chaotic their sleep–wake schedules are,' said Cousins. 'The more regular and predictable their sleep is, the better they are likely to do when confronted with short-term sleep deficits. Therefore, participants with better sleep overall may be affected differently in a sleep condition compared to those who have a more varying sleep/wake schedule.'

The study involved data from 56 adolescents (34 female) between the ages of 14 and 18 years who had complaints of daytime sleepiness and/or insufficient sleep at night. Participants reported their subject grades and overall academic standing. Sleep was measured objectively with actigraphy and subjectively through sleep diaries. Higher maths scores were related to less night awakenings, less time spent in bed, higher sleep efficiency and great sleep quality; there was also a trend for decreased sleep onset latency (SOL). Higher scores in English were associated with less night time awakenings. Increased SOL during the weekends was related to worse academic performance.

According to Cousins, poor sleep and poor sleep habits are associated with substance use, emotional problems, cognitive problems and a general decline in daily functioning.

Authors of the study state that results provide overwhelming evidence of the importance of sleep during a period of development that is critical in adolescents and highlight the importance of the development of sleep intervention programs for students in order to improve existing problems with sleep and daily functioning.

Based on a presentation by Jennifer C. Cousins PhD to 23rd Annual Meeting of the Associated Professional Sleep Society in June 2009

FIG 6.1» Teenagers have a biological need for 9¼ hours of sleep every night.

The symptoms of sleep deprivation in teenagers include:

- tiredness
- aggressive behaviour
- social withdrawal
- low energy
- hyperactivity
- clumsy behaviour
- learning problems
- reduced attention, memory and learning
- decreased academic performance
- decreased production of growth hormone
- poor memory.

Many schools in the United States begin classes early in the day (around 7.15 am). As a result of research into adolescent sleep patterns (Wolfson and Carskadon, 1998), some schools changed their starting times to around 8.30 am. The results of data collected by these schools over three years showed improvement in the rate of student attendance, better student health, improvements in student behaviour, and more alert students (Wahlstrom, 2002).

Wolfson and Carskadon (1998) surveyed more than 3000 United States secondary school students and found that those who received lower grades (C's, D's and F's) got about 25 minutes less sleep and went to bed about 40 minutes later than those students who scored A's and B's.

Another United States research study found a link between poor school performance and sleep disorders. Gozal (1998) found that children whose breathing problems caused poor sleep quality actually improved their school performance when their breathing problems were treated and the quality of their sleep improved.

Australian psychologist and sleep researcher Dr Sarah Blunden has found that up to 40 per cent of Australian children experience some form of sleep disorder, leading to insufficient and poor-quality sleep. Dr Blunden is actively involved in educating the community about the value of healthy sleep patterns for children. To help reduce sleep disruption, she suggests exposure to sunlight first thing in the morning as this will help to suppress the sleep hormone melatonin, helping a person feel more awake. Exercise in the morning also helps to wake us up. Conversely, minimising exposure to light and avoiding exercise before we go to bed will help us get to sleep more easily.

Sleep is necessary for brain repair and for consolidating things we have learnt or experienced during the day. To enable the best conditions for learning, it is important to have sufficient sleep of a good quality. Sleep debt is inevitable at times, due to the many commitments adolescents have. However, you can help reduce the 'debt' by sleeping more on subsequent nights. If you don't 'catch up', your brain—and therefore your concentration and learning capacity—will suffer.

6.3 INVESTIGATE

Should school start later?

1. Refer to the article Better sleep: tips for teenagers. List five ways in which teenagers can get a better sleep and briefly explain why.
2. Should school start later? What is your opinion—yes, no or unsure? Write a few sentences to support your point of view.

6.4 INVESTIGATE

How good are your sleep habits?

1 Keep a sleep diary (see Table 6.2) and record your sleeping behaviour over the next week.

- Calculate your average number of hours' sleep per night. How does this compare to the average of 9¼ hours recommended for teenagers?
- What overall observations can you make about your sleep throughout this week? Did any patterns emerge?
- What factors may have prevented you from getting a good night's sleep? Consider the conditions in your bedroom and in the immediate environment, such as light and noise, as well as personal factors such as your thoughts and emotions.
- Comment on your level of alertness and performance at school during the day. Do you think it was affected by your sleeping pattern? Explain.

TABLE 6.2» Sleep diary format

Features	Monday
Hours of sleep	8 hours
Activities undertaken within two hours before bedtime	Homework; chatting to friends online; watching TV
Dreams?	Yes
Wakeful periods?	Awake from 2–3 am
Sleep rating 1= poor 10= excellent	6

Sleep tips for teenagers

2 Use the information you have learnt about sleep to create a guide to what teenagers and parents should know about sleep. The guide can be in the form of a brochure, poster, PowerPoint presentation or a talk. Choose one of the following as a focus for the guide:

- what parents should know about teenage sleeping habits and good sleep tips for their teenage children
- what tips teenagers should know about the importance of sleep.

WWW» Useful sites to visit to find out more about sleep.

An interview about sleep problems

3 Interview someone you know who has difficulty sleeping to find out about their sleep patterns and the effect it has on their day-to-day lifestyle. Topics to cover in your interview include:

- the nature of their sleeping problems
- what time do they go to bed
- what time do they wake up,
- average hours' sleep per night
- the effects on concentration, memory and learning during the day.

Note: Make sure you fully brief the person on the purpose of the interview before you begin, to ensure they are comfortable sharing the information with you.

REVIEW 6.2

1. What is the average number of hours of sleep required each night for teenagers?
2. What is the role of melatonin in sleep, and how does it affect the sleep cycles of teenagers?
3. List five symptoms of sleep deprivation in teenagers.
4. List five 'better sleep' tips for teenagers. For each, explain how this tip can be helpful.
5. Why did some schools in the United States move their starting times to later in the morning? What were the benefits of this?
6. Sleep disorders are relatively common in children. What effects can this have on a child's sleep quality?
7. Why is sleep necessary?
8. What is a 'sleep debt'?

TECHNOLOGY ... THE GOOD, THE BAD AND THE UGLY

It is difficult to imagine life without the Internet, mobile phones, iPods and computer games. We rely on technology for entertainment, information and communication.

There are many different opinions on the impact of technology on our lives and our brains. The reality is that most people find the electronic and multimedia environment exciting, rewarding, fast-paced and entertaining. The new technology feeds the reward centres of the brain and has us seeking more and more.

The merits and dangers of computer games have been discussed in the media a great deal. In August 2008, the computer game Grand Theft Auto IV was removed from sale in Thailand after an 18-year-old man allegedly committed murder in an attempt to recreate a scene from the game. While incidents such as these are very disturbing, most people who play computer games do not commit acts of violence. A great deal of research has been conducted on the effect of electronic games on behaviour, but there is little evidence of a clear link between playing violent games and aggressive behaviour.

Some criticism levelled at computer game manufacturers has focused on the inactivity it encourages in children. In recent years, games involving physical activity, such as Nintendo's Wii Fit and Guitar Hero, have challenged these ideas. However, although these games might increase energy expenditure compared to normal electronic games, they are no substitute for real physical activity. The Australian Department of Health and Ageing suggests that teenagers should participate in 60 minutes of moderate-to-vigorous exercise and spend less than two hours using electronic media per day.

A key issue is that of balance. Ideally, children should have a range of interests and activities that enable them to develop into fully rounded adults. As long as there is balance in the child's life and one activity does not interfere with their ability to be part of the family, their education , health and well-being, then a 6-year-old spending a period of time playing a computer game (preferably with a parent) is fine (Carr-Gregg 2008).

Good electronic games can provide many positive benefits for players. Electronic games can be powerful

FIG 6.2>> Are computer games powerful educational tools or are they increasing violence in young people?

tools for improving problem-solving and scientific thinking skills as well as improving hand–eye coordination, depth perception and even attention span.

It is even possible that some of today's good gamers might be the top surgeons of the future. Many games require players to react quickly and demonstrate precision. In a study conducted with 33 surgeons at New York's Beth Israel Medical Centre, surgeons who played computer games were compared with those that didn't. When given a surgery simulation, those who regularly played games made 37 per cent fewer mistakes and completed tasks 27 per cent times faster than those who did not play the games. Factors such as age, training and surgical experience appeared to have no significant effect on performance (Rosser et al. 2007). Surgeons of the future may therefore find themselves training for surgery by practising on computer games!

Some online games also require collaboration with other players to succeed, encouraging gamers to work together. This is a form of social interaction, even though it does not take the place of face-to-face social interaction.

However, a lack of real social interaction can lead to inexperience in reading social cues and body language. This can lead to misreading the facial expressions of others and difficulties in communicating. Face-to-face social interaction is therefore to be strongly encouraged during childhood and adolescence to enable the normal development of social skills.

Late night conversations on the mobile might not be a great idea if we want a good night's sleep. Studies suggest that mobile phone signals alter our brain waves. This, in turn, interrupts our sleep patterns if we use a mobile phone near bedtime.

In a study conducted at Swinburne University of Technology's Brain Science Institute, researchers attached a mobile phone to the heads of 120 participants. A sudden rise in brain waves typical of an awake state was shown, especially in the region of the brain directly near the phone (Croft et al. 2007). In another study conducted by a group of sleep researchers in England, participants took twice as long to get to sleep after being exposed for 30 minutes to mobile phone signals in talk mode (Hung et al. 2007).

did you know?

- Exposure to the light screens of mobile phones and computers at night can prevent our brain from going into sleep mode. It can stimulate our alpha (awake) waves instead of delta (sleep) waves. Texting, computer games and watching television at close range for up to two hours before bed can reduce our readiness for sleep and affect our quality of sleep. Bright digital clocks next to the bed can also influence our brainwaves and therefore our sleep patterns.
- There appears to be a gender difference in the effect electronic games have. These games activate the pleasure or reward centres in men more than they do in women! Men are also more likely than women to report feeling addicted to electronic games (Hoeft et al. 2008).

REVIEW 6.3

1. How much do you rely on technology? List all of the ways you use technology in a typical day.
2. Technology motivates us to seek more and more because it activates the _____ of the brain.
3. List some specific skills that can be learnt or practised as a result of playing electronic games.
4. What do studies about mobile phones suggest about their effect on sleep?
5. True or false? Mobile phone signals are thought to have an effect on brainwave patterns.
6. Are computer games dangerous to users? Some people say 'yes'. Why do they have this view?
7. What positive benefits could come from computer games?
8. What sort of computer games create social interaction? Is this good or bad and why?

FIG 6.3» Using a computer within two hours of going to sleep can affect the quality of sleep.

6.5 INVESTIGATE

Food for thought

Write a reflection or contribute to a class discussion about the following ideas from two prominent researchers.

- Dr Gary Small is a Professor of Neuroscience and Human Behaviour in California. He is concerned that the digital age places too little emphasis on important social skills such as reading facial expressions and body language. This, in turn, leads to social awkwardness and misinterpretation of nonverbal messages in young people.
- Professor Susan Greenfield is a neurophysiologist who has concerns for the future of our technology-focused society. She believes that the desire for today's youth to be surrounded by technology for work and play is altering the way our minds operate, and questions the impact this will have on the minds of future generations. Professor Greenfield is concerned that technology is teaching us to be focused on the thrill of the moment, creating ever-decreasing concentration spans in today's youth.

DIET

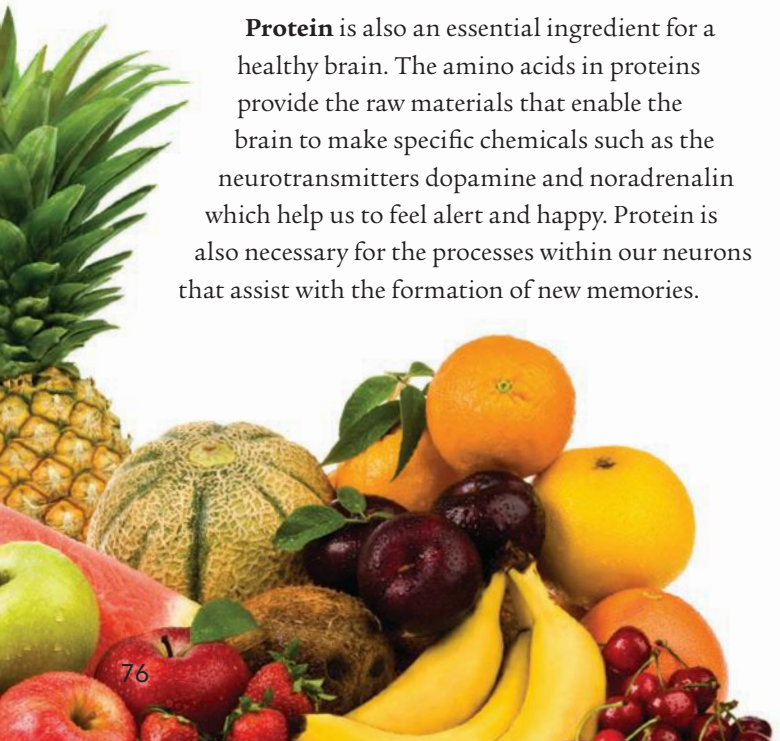
The brain needs fuel just like the rest of your body. Its ability to carry out all its functions is very dependent upon the quality of the fuel provided.

At least 20 per cent of our food intake is directly utilised by our brain. The type of food we eat can have a direct effect on our mood, sleep patterns and ability to think and concentrate. Good nutrition helps to protect the brain against toxins. It can also improve mental function and assist in the formation of memories. We should be careful to provide the type of fuel that will ensure our brain functions to its best ability.

When our diet does not meet our energy requirements, we experience changes in the way our brain functions. When hungry, we can lack motivation and energy, and experience a lower capacity for thinking and problem-solving. For this reason, skipping breakfast can directly impact upon our brain's ability to function in the classroom. Being hungry can also affect our mood and the ability to fight infection, making us more likely to get sick.

It is important to include fats in our diet, as **fats** are an essential part of our neuron structure. The best fats for our brain are omega-3 fats, which are commonly found in fish, nuts and seeds. However, many diets today are high in 'bad' or saturated fats. These are the ones associated with animal fats and with fast foods, and are thought to have detrimental effects on our memory and learning when consumed in high amounts. The best diet will be well balanced and include plenty of low cholesterol, low saturated foods.

Protein is also an essential ingredient for a healthy brain. The amino acids in proteins provide the raw materials that enable the brain to make specific chemicals such as the neurotransmitters dopamine and noradrenalin which help us to feel alert and happy. Protein is also necessary for the processes within our neurons that assist with the formation of new memories.



Glucose is required by the brain to provide neurons with the energy to build and repair cells, and to enable neurons to communicate with each other. When your concentration starts to fade, a snack might be the brain booster that you need! Low glycaemic index (GI) foods, such as apples, dried apricots, carrots, peanuts and baked beans, will enable the bloodstream to keep up a steady supply of glucose to the brain. High-GI foods, such as sugar sweets, will quickly raise the glucose available to the brain, then rapidly drop again, leaving the neurons without a constant supply of energy. High-GI foods can cause a quick burst of energy but leave you feeling tired and unable to concentrate once the glucose level drops again.

Fruit and vegetables are also considered good brain foods. They are high in **anti-oxidants**, which are thought to protect the brain against particles that damage brain cells. A diet high in anti-oxidants can help learning and memory. Fruit and vegetables are also high in vitamins, which are essential for many of the chemical processes that occur in the brain.

TABLE 6.3» Brain-boosting foods

Nutrient	What it does for the brain	Examples of brain food
Protein	Amino acids in protein are reassembled by the brain to make the chemicals it requires to function; protein is involved in constructing memories.	Fish, nuts, seeds, eggs, turkey, dairy products, chicken
Fat	Omega-3 fats help make cell membranes and build myelin sheaths around nerve cell axons.	Fish (such as salmon, tuna and sardines), nuts, seeds
Glucose/	Low-GI foods create a steady supply of energy for neurons to function.	Apples, spaghetti, dried apricots, baked beans, oatmeal, oranges, carrots, peanuts, cherries, whole-grain breads and pastas, brown rice
Anti-oxidants	Protect the brain against damage.	Blueberries, green tea, prunes, raisins, spinach, broccoli, dark grapes, blackcurrant juice, dark chocolate
Vitamins	Required for chemical processes in the brain.	Dairy products, turkey, fresh fruit and vegetables

Some foods are super brain-boosters because they are high in the nutrients that help the brain to function most effectively. These include: salmon, tuna, sardines, walnuts, blueberries, broccoli, eggs, bananas, yoghurt, low-fat cheese and milk, turkey, green tea, whole-wheat products (such as multi-grain bread), spinach and other dark green vegetables, strawberries, avocados and dark chocolate too!

We also need to drink plenty of water for our brain to function. The brain is 80 per cent water, and just a slight drop in content within our brain results in headaches, feeling lethargic and difficulty concentrating. Regularly drinking water is an important habit to get into. Although many foods and drinks contain water, these need to be processed by the body to extract the water before the brain can use it. Therefore, pure water is the best way to supply the brain with what it needs.

It also appears that some foods can help you sleep, while others might keep you awake counting sheep. Sleep researcher Dr Charli Sargent from the University of South Australia has found that eating foods high in the amino acid tryptophan can help put you to sleep. Tryptophan can be found in warm milk, which might explain the old remedy of a warm milk drink before bed. Turkey, yoghurt and cheese also contain tryptophan. It is possible that the tryptophan in turkey might explain the need for a snooze after eating Christmas lunch!

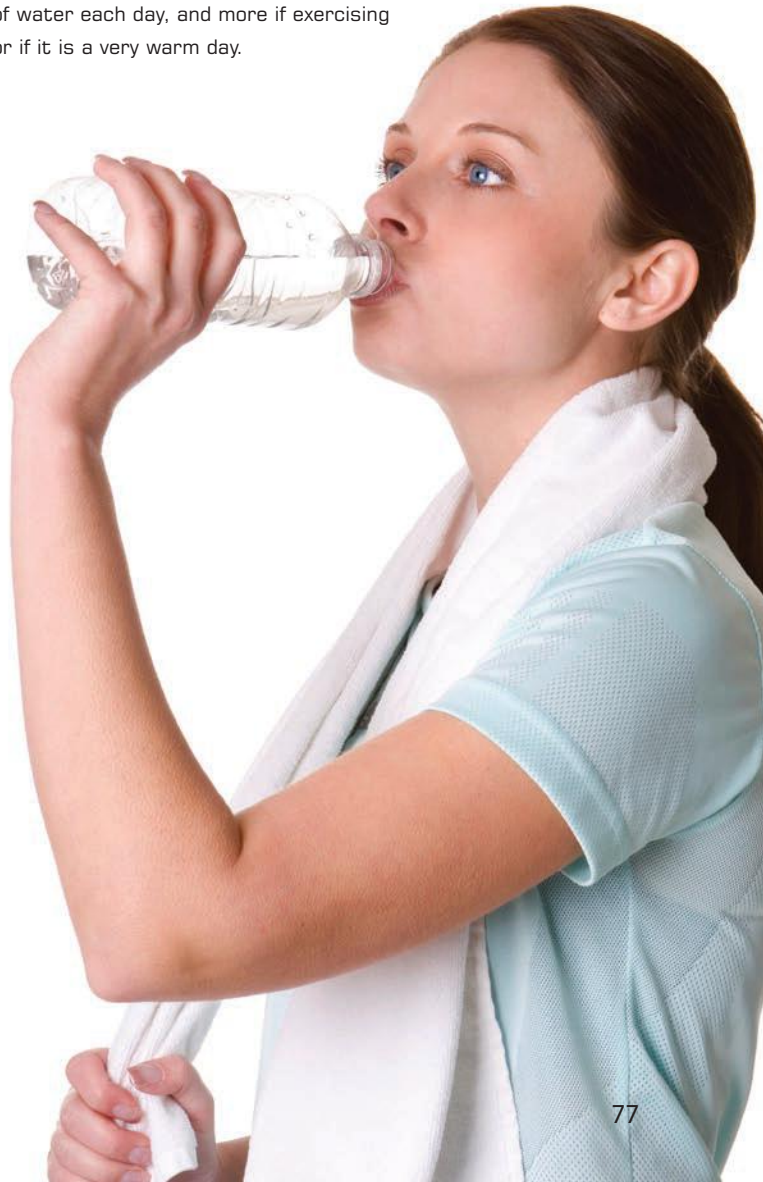
REVIEW 6.4

1. What proportion of our food intake is directly utilised by the brain?
2. Explain why good nutrition is important for the brain.
3. Explain why skipping breakfast is not a good idea.
4. What effect does a diet high in animal fats have on the brain?
5. What role does protein play in the brain's functioning? Give an example of foods that supply protein to our brain cells.
6. Why are low-GI foods better than high-GI foods for the brain and for concentration?
7. What role do anti-oxidants play in ensuring a healthy brain? Give an example of foods rich in anti-oxidants.
8. Why is water important to your body and especially to your brain?
9. Which foods may help you sleep and which foods may keep you awake? Why do they have these effects?

did you know?

- It is vital that babies get sufficient fat in their diet to assist in the growth and development of their nervous system. Neurons require fat to create myelin around their axons, and this assists in transmitting messages from neuron to neuron. Breast milk, which is 50 per cent fat, assists in providing the necessary fat.
- Populations that traditionally have a diet high in omega-3 fatty acids are less likely to develop disorders of the brain and spinal cord.
- Rats fed a diet high in saturated fats (such as those found in many fast foods) performed poorly on tasks testing learning and memory.
- Humans living on a diet high in saturated fats are at a higher risk of dementia.

FIG 6.4› Teenagers need to drink 8–10 cups of water each day, and more if exercising or if it is a very warm day.



6.6 INVESTIGATE

Food for thought

1. Eric Jensen, a well-known author and researcher in the field of psychology, made the following statement: 'Usually the first indication of a nutritional deficiency is a decline in mental functioning.' Explain what he means by this statement. Support your answer with information from this chapter.
2. Breakfast is an essential meal for the day, particularly for students heading to school to learn. What type of foods could be used to create a brain-boosting breakfast that is high in protein, healthy fats, vitamins and anti-oxidants? Explain your choice of foods.
3. Analyse your own diet. How many brain-boosting foods do you eat? Make a list of the foods you eat over a week. Highlight the foods you consider would be brain-boosting foods. What proportion of your diet includes food that is good for your brain?
4. Create a menu for the Brain Food Café. It must:
   - provide a well-balanced diet for breakfast, lunch and dinner
   - include brain-boosting foods
   - be interesting to eat.

   How would you market or promote your menu for the Brain Food Café? What factors do you think would both attract customers and educate them about foods that will improve their brain function?

MUSIC AND MEDITATION

Music can have many positive effects on the brain—just listening to a particular song or music can lift your mood. Music can activate the brain's reward centre, leaving you feeling happy and relaxed. It can also improve thought processes, boost performance and enhance reading and memory skills. Music is also used to treat anxiety and insomnia, lower blood pressure, soothe patients suffering dementia and relax babies.

According to researchers at the Center for Music Research at Florida State University, lullabies played to premature infants in an intensive care unit resulted in more rapid weight gain and a quicker discharge from hospital, compared to babies not exposed to the music (Standley 1998).

Music training can also create changes in our brain. In a study conducted by Gaser and Schlaug (2003) the motor, auditory, visual, spatial cortexes were larger in professional musicians compared to non-musicians.

A well-publicised study by researchers at the University of California in 1993 suggested that listening to Mozart could boost cognitive performance—the 'Mozart effect'. While the idea remains popular with some people, the study has been widely criticised. Meditation also has positive effects on the brain. People who meditate regularly have been found to have better immune systems, and report feeling positive more often. The practice has also been associated with effective treatment for pain, insomnia, depression and anxiety disorders.

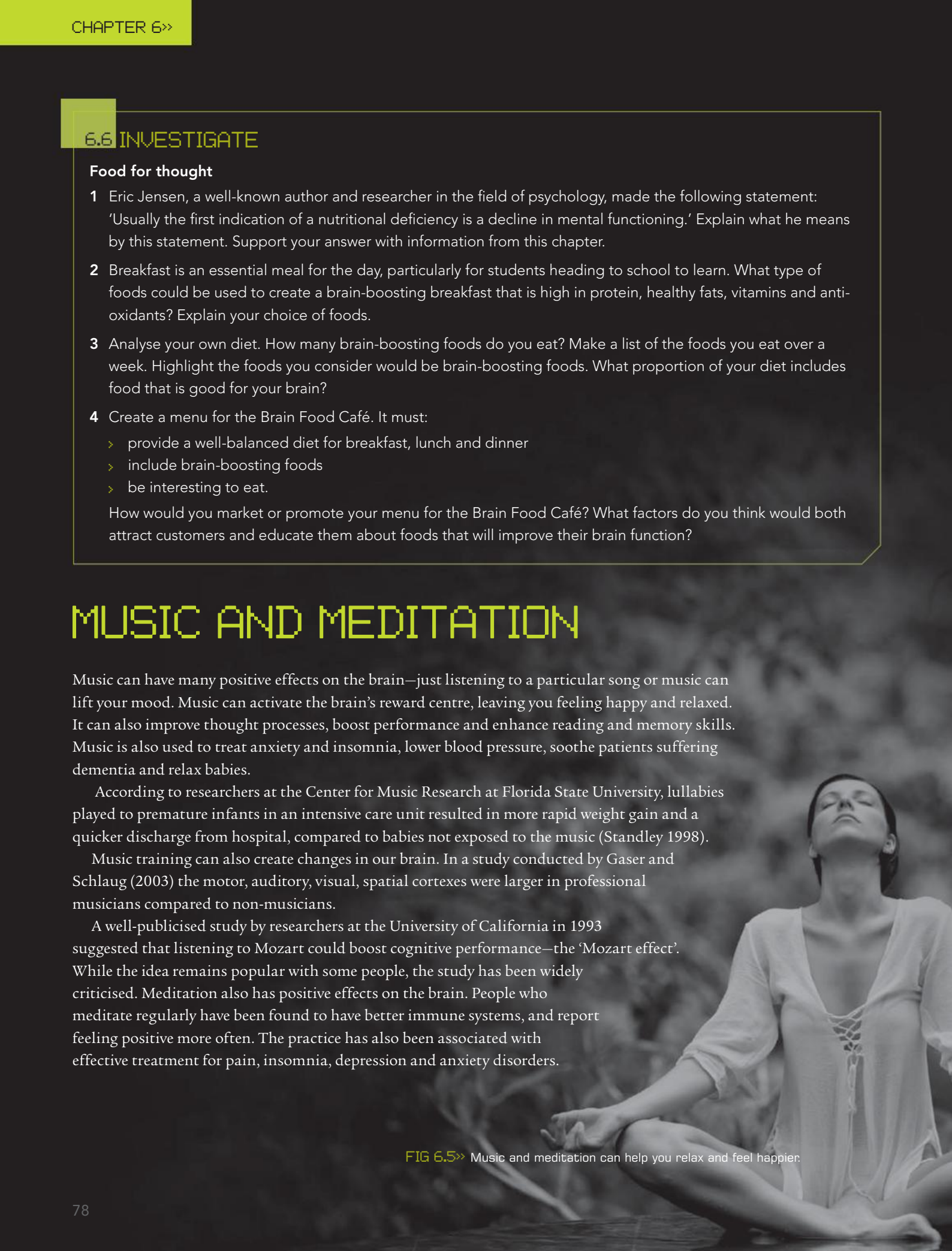


FIG 6.5» Music and meditation can help you relax and feel happier.

CASE STUDY

Benefits of learning music the Suzuki way

The Suzuki method combines teaching music with an overall philosophy of personal development. It encourages learning music by listening and memory, but also recognises the importance of sharing learning with others.

Dr Suzuki called his method of teaching the 'mother-tongue approach', because it was based on the principles of language acquisition in children. Just as all children easily learn to speak their native language, Dr Suzuki believed that all children could learn music, if the same process involved in language learning was applied.

The Suzuki method emphasises:

- beginning at an early age (3–4 years)
- frequent listening to music (immersion in music)
- learning to play by ear before learning to read music
- repetition and step-by-step mastery
- parental involvement
- a nurturing learning environment
- using well-trained teachers
- regular group performance and frequent public performance.

6.7 INVESTIGATE

Music and mood

1 Think of a song or a piece of music that leaves you feeling happy and answer the following questions.

- What is the song or music?
- Describe the effect it has on your mood and your behaviour.
- Describe the times you might actively search for this type of music.

2 Think of a song or piece of music that leaves you feeling frustrated or in a low mood.

- What is the song or music?
- What effect does it have on your mood and your behaviour?
- Why does this music have this effect on you?

Design an activity: Effects of music or meditation

3 Design an activity that tests one of the following research questions.

- Can relaxation or meditation reduce heart rate?
- Can music increase heart rate?
- Can increased arousal as a result of listening to motivating music improve athletic performance?
- Can relaxation or meditation improve performance on a problem-solving task?

a Propose a hypothesis to predict the outcome of your research question.

b Design a step-by-step method that tests your research question and hypothesis.

c Consider how you will measure your results.

d Who will your subjects be? How many do you need to fairly test your hypothesis?

e Carry out your experiment. What did your results show? Was your hypothesis supported, or not?

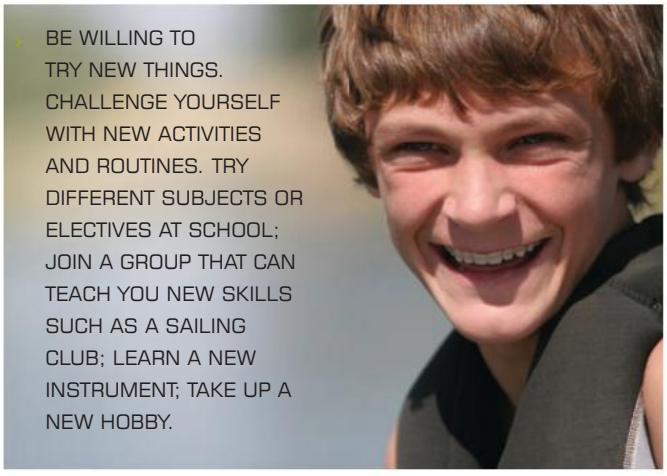
f Were there any other factors that may have unfairly influenced your results?

g What conclusions can you make based upon your results?

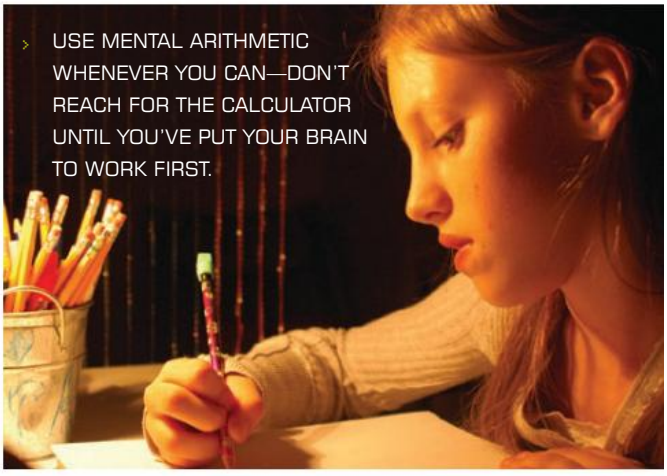
OTHER BRAIN-BOOSTING IDEAS

The brain needs to be exercised, just as your body does. Thinking and making the brain work keeps it in shape. Any unused parts of our brain will gradually stop working, so the old phrase of 'use it or lose it' is very true. Keeping the brain challenged with new activities and skills might also wake up parts of your brain that you don't use very much.

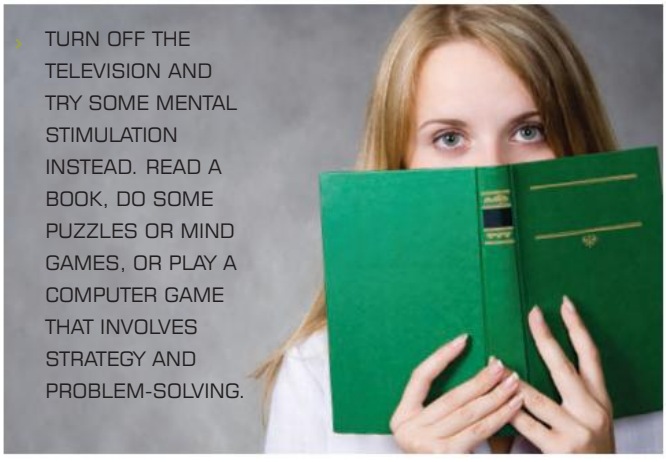
The following brain-boosting activities are useful ideas about how to keep your brain healthy and active. Mental decline in a typical human brain begins at about 40 years of age, so get started on these brain activities now to insure against declining abilities as you get older!



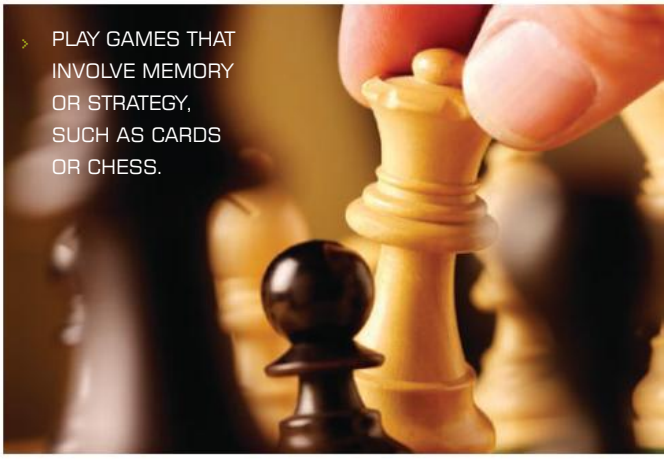
BE WILLING TO TRY NEW THINGS. CHALLENGE YOURSELF WITH NEW ACTIVITIES AND ROUTINES. TRY DIFFERENT SUBJECTS OR ELECTIVES AT SCHOOL; JOIN A GROUP THAT CAN TEACH YOU NEW SKILLS SUCH AS A SAILING CLUB; LEARN A NEW INSTRUMENT; TAKE UP A NEW HOBBY.



USE MENTAL ARITHMETIC WHENEVER YOU CAN—DON'T REACH FOR THE CALCULATOR UNTIL YOU'VE PUT YOUR BRAIN TO WORK FIRST.



TURN OFF THE TELEVISION AND TRY SOME MENTAL STIMULATION INSTEAD. READ A BOOK, DO SOME PUZZLES OR MIND GAMES, OR PLAY A COMPUTER GAME THAT INVOLVES STRATEGY AND PROBLEM-SOLVING.



PLAY GAMES THAT INVOLVE MEMORY OR STRATEGY, SUCH AS CARDS OR CHESS.

6.8 INVESTIGATE

Brain stuff for teenagers

Use the information in this chapter to create a 'brain stuff' presentation aimed at teenagers. Your presentation may take the form of a brochure, a poster, a PowerPoint or an oral presentation. Include any information and ideas about the brain and how to keep it functioning well that you believe all teenagers should know about.

REVIEW 6.5

1. Describe some of the benefits that music can provide.
2. What are some of the benefits of meditation?
3. What is meant by the term 'use it or lose it' in relation to the brain?
4. In what ways can challenging your brain be good for it?
5. List two (or more) ways in which you have 'boosted' your brain's capacity in the past week.

CHAPTER SUMMARY

- Our lifestyle has a significant impact on how well our brain functions. Diet, exercise, sleep patterns and technology all affect our brain health in both the short and the long term.
- Exercise improves the brain's ability to think clearly, concentrate, learn and remember. By increasing the supply of oxygen and nutrients to the neurons, brain function is enhanced.
- Adolescents commonly suffer from sleep deprivation. Despite a need for 9¼ hours' sleep per night, lifestyles and commitments often mean a significant sleep debt is accumulated.
- Insufficient and poor-quality sleep impacts upon our brain's function during the day. It directly affects the ability to concentrate, problem-solve, remember and learn.
- Sleep deprivation in teenagers can cause many symptoms such as aggressive behaviour, social withdrawal, learning problems, poor memory and low energy.
- Simple steps can be followed to help improve our quality of sleep, such as good bedtime routines, avoiding overstimulation and bright lights at bedtime, exercising during the day, and avoiding caffeine in the afternoon.
- It is difficult to imagine life without technology. Our desire for entertainment, information and constant communication may have both benefits and negative side-effects for our brain.
- The digital age is feeding our brain's reward centres through excitement, entertainment and fast-changing activity.
- Mobile phones may reduce our ability to go to sleep and the quality of our sleep.
- Good nutrition is important for a healthy brain. A balanced diet high in protein, omega-3 fats, low GI foods, anti-oxidants, vitamins and water is essential for short-term and long-term brain health.
- Music and meditation activate the brain's reward centres, improving thought processes.
- Exercising and challenging the brain helps to keep it in shape.

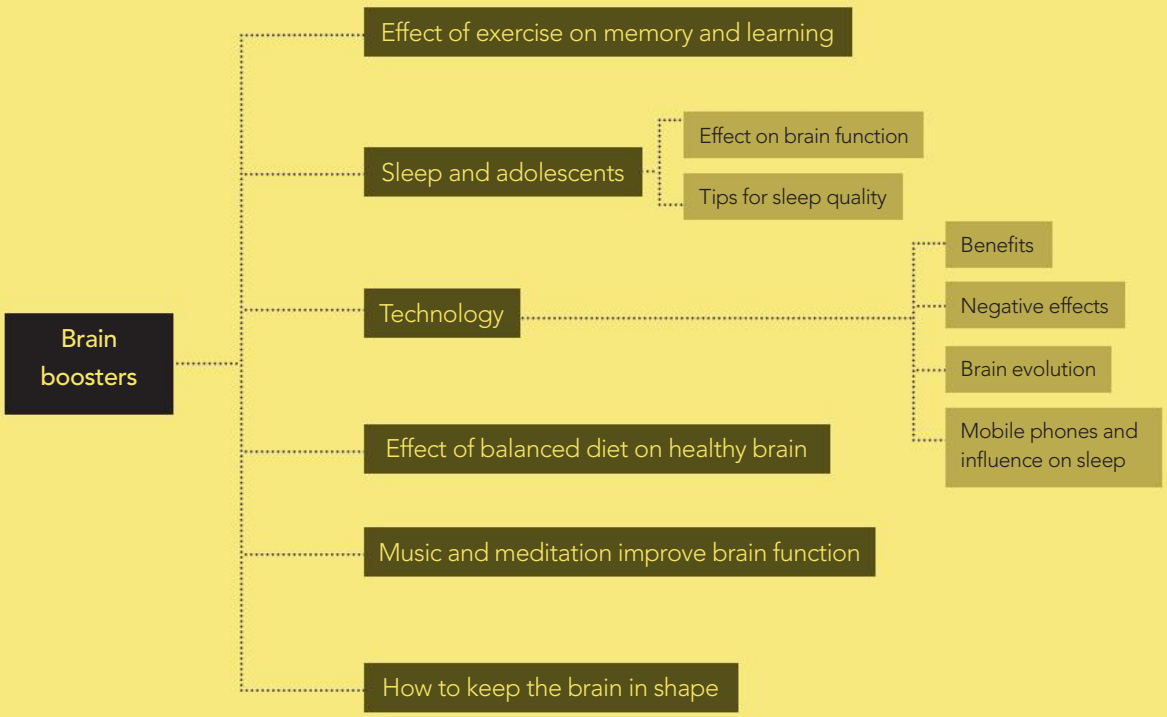


FIG 6.6›› Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 One of the key benefits of exercise is that it provides our brain with:
   - **a** oxygen and glucose
   - **b** 'feel good' chemicals such as serotonin
   - **c** improved blood supply
   - **d** all of the above.

2 Experiments with mice have suggested that improved memory and learning can be achieved with:
   - **a** running wheels for exercise
   - **b** toys for mental stimulation
   - **c** equipment for both exercise and mental stimulation
   - **d** a relaxing environment.

3 The biological time clock in teenagers differs from that of younger children or adults in that:
   - **a** it has no particular time set for teenagers to go to sleep and wake up
   - **b** it is programmed for sleep later in the night
   - **c** it is programmed for waking up earlier in the morning
   - **d** it causes teenagers to feel tired all the time.

4 The chemical responsible for causing us to feel sleepy is called:
   - **a** serotonin
   - **b** glucose
   - **c** dopamine
   - **d** melatonin.

5 Technology is thought to have both positive and negative impacts on society. Negative effects include:
   - **a** inactivity and a decreased focus on exercise
   - **b** a reduced opportunity to socialise face to face and interpret body language
   - **c** the rapid processing of data which reduces the ability to concentrate on one task
   - **d** all of the above.

6 Research comparing the skills of surgeons who played computer games with surgeons who did not play computer games showed that:
   - **a** surgeons who played computer games had a greater chance of making mistakes during surgery
   - **b** surgeons who played games were faster and less accurate during surgery
   - **c** surgeons who played games were faster and more accurate during surgery
   - **d** there was no significant difference between the two groups.

7 Studies on the effects of mobile phones on sleep showed that:
   - **a** mobile phones had no effect on the quality of sleep
   - **b** mobile phones affected the brainwaves and sleep patterns of teenagers only
   - **c** mobile phones activated the brainwaves associated with wakefulness rather than sleep
   - **d** mobile phones activated the brainwaves associated with sleep rather than wakefulness.

8 Which of the following statements accurately reflects the association between diet and the brain?
   - **a** The brain's neurons use only the healthy food in our diet to enable it to function.
   - **b** A good diet can have a direct effect on our mood, sleep patterns and our ability to learn.
   - **c** Very little of our food intake is used directly by our brain.
   - **d** There is no relationship between the brain and diet.

9 Omega-3 fats are important for our brain because they:
   - **a** are required for the structure of healthy neurons
   - **b** create specific brain chemicals or neurotransmitters
   - **c** are involved in the formation of memories
   - **d** help to protect our brain against harmful substances.

10 Listening to music has been found to have the following effect on our brain:
- **a** It reduces learning performance and memory capacity.
- **b** It eases anxiety and reduces insomnia.
- **c** It makes it difficult to concentrate on reading.
- **d** It increases blood pressure.

11 What is meant by 'sleep debt' and why might it occur among teenagers?

12 What are some of the symptoms of sleep deprivation?

13 Describe some activities that can create problems for going to sleep.

14 'Technology is thought to be rewiring our brains differently because of the "plastic" nature of the brain.' Explain what this statement means.

15 Describe some of the benefits associated with playing electronic games.

16 What are the types of brainwaves associated with going to sleep?

17 What effects can exposure to screens such as on computers and mobile phones, prior to going to bed, have on our brain? Explain with reference to alpha and delta brainwaves.

18 Explain why a healthy brain diet must include 'good' fats, protein, glucose, anti-oxidants and water.

19 Describe how the term 'use it or lose it' relates to the brain's function.

Extend Yourself

20 Research one or more of the following questions and report your findings back to the class:
- How do drugs such as alcohol, marijuana and nicotine affect the brain's function?
- What is going on in your brain when you experience a headache?
- What are the different types of headache, and what can cause them?
- How does the brain use protein and fat from your diet?
- What is the world record for staying awake?
- What effect does not sleeping for long periods have on our brain?
- Why is solitary isolation in a dark cell an effective means of punishment or torture?
- Why is exposure to constant light an effective means of punishment or torture?

21 At the beginning of this chapter, there were a number of questions posed that highlighted behaviours that reflect poor brain care. For each of the following scenarios, use the information you have learned in this chapter to explain:
- **a** why each of these behaviours reflects poor brain care
- **b** what behaviour is more helpful in boosting the brain's function.

Scenarios:
- You are unable to think clearly or concentrate after eating certain foods.
- You spend the entire day fighting the urge to shut your eyes.
- You feel the urge to drink water, but just can't be bothered doing it.
- You think about doing some exercise but never get around to it—being a couch potato is much more appealing!
- You text, email or network with friends, or play computer games right up until going to bed.
- You drink caffeine drinks to keep awake and get you through the day.
- You keep pressing the snooze button on the alarm in the morning because you just don't want to wake up.

DREAMING

MANY PEOPLE CONSIDER DREAMING TO BE PERSONAL AND PRIVATE IN NATURE—SOMETHING THAT NEEDS TO BE CENSORED BEFORE IT IS SHARED. SOME BELIEVE THAT DREAMS ARE MEANINGLESS; OTHERS BELIEVE THAT DREAMS OFFER AN INSIGHT INTO THE MIND.

Do dreams have meaning? Keep reading to find out …

DREAMING: THE BASICS

'You will never believe the dream I had last night,' Jules told Ahmed. 'It was amazing. One moment I was surfing the biggest wave at the beach. The next moment, I landed in the middle of the Melbourne Cricket Ground on AFL Grand Final day. I was handed the cup and the crowd went wild. Do you think this means great things are about to happen to me?'

'Nah,' said Ahmed. 'It was probably just something you ate before going to bed.'

Dreaming is an intriguing part of our lives and dreams have been the subject of interpretation throughout history. Many questions have been asked, such as:

- Do dreams offer spiritual guidance?
- Can dreams transform our life and guide us to greater wholeness and well-being?
- Why do we dream?

7.1 INVESTIGATE

How much sleep did you have last night?

1 Think about your sleep last night and answer the following questions.
   - When did you go to bed?
   - How long did you sleep for last night?
   - Did you wake up during the night?
   - When did you wake up in the morning to start the day?
   - Did you dream?
   - If you did dream, did you dream in colour?
   - If you did dream, who was the main character in your dream?

2 Compare your answers with other members of the class. What are the most common answers? Refer to your answers and the class results throughout this chapter.

Increase your dream recall

1 You are more likely to remember a dream if you wake during or immediately after you dream. Try the following activity to increase your dream recall.

   Set the alarm clock for about 4½ hours after you have gone to bed. When the alarm sounds, try to note the thoughts and images that are in your head.

Dreams are very personal and private experiences. While sleep researchers can determine when you are dreaming, they cannot determine what you are dreaming about unless you tell them. In this section we will discuss when and why we dream and common themes we usually dream about.

DOES EVERYBODY DREAM?

Everybody dreams. On average, a person dreams four to five times a night. Even people who say they never dream actually do—they probably dream as often as other people, although they might not remember it.

Can you recall the dreams you had last night? It is unlikely that you can recall all of them—over 95 per cent of dreams are forgotten. Some people are **low dream recallers**—that is, they tend to recall few dreams, while others (**high dream recallers**) recall dreams more easily. Low recallers tend to wake up slowly and experience, on waking, more electrical shifts of activity between brain hemispheres than do high recallers.

WHEN DO DREAMS OCCUR?

Dreams can occur at any time during sleep, although about 90 per cent of dreaming occurs during rapid eye movement (REM) sleep. Throughout sleep, we shift between non-rapid eye movement (NREM) and REM sleep. On average, we go through a cycle of NREM and REM every 90 minutes. The amount of time spent in REM sleep increases as the night progresses.

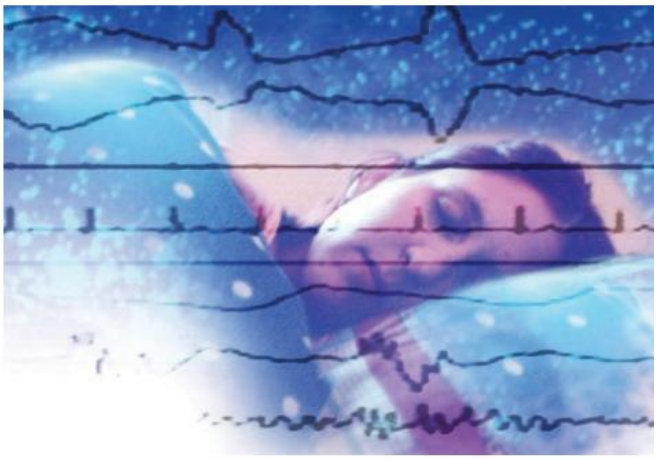


FIG 7.1» In a sleep laboratory, brainwave activity and other physiological responses are recorded during sleep.

7.2 INVESTIGATE

Common dream actions

1 What do you think are the most common actions in dreams? Rank the following dream actions from most common to least common:
   - arguing
   - thinking
   - walking, jumping and running
   - sitting
   - watching
   - talking
   - flying
   - floating
   - falling.
2 Survey four other people in the classroom and compare your rankings.
3 Read on to find out the most and least common dream actions.

REM sleep

As the name suggests, **rapid eye movement (REM)** sleep is a period of sleep when your eyes move rapidly, for short bursts of time. Electrical activity of the eye muscles is very high. During REM sleep, there is more going on in the body, though, than just eye movements. Heart and breathing rate fluctuate, voluntary muscles, especially those below the neck, are very relaxed, and brainwave activity, as measured by electroencephalogram (EEG) recordings, is increased. The EEG pattern of small, fast brainwaves is similar to one in which a person is awake and thinking.

Ninety per cent of dreaming occurs during REM sleep. Dreams during REM sleep tend to follow a storyline (even if it appears bizarre at times) and the dreamer often feels as if they are experiencing a different world. REM dreams are the ones most likely to be remembered.

There are a number of interesting facts about REM dreams:

- REM dreams can be mundane or dramatic and bizarre.
- REM dreams often incorporate personal experiences from the previous day or week.
- Nightmares tend to occur in REM sleep.
- In dreams, negative emotions are more prevalent than positive emotions.
- About 88 per cent of people dream in colour, although not all dreams are in colour. For some, dreams only occur in one or two colours.
- The dreamer is usually at the centre of the dream's storyline. In about 95 per cent of cases, other characters appearing in our dreams are family and friends of the dreamer—not monsters or people out to get us!
- Females tend to dream of males and females equally. Males, however, dream of other males about 65 per cent of the time, which is more often than they dream of females (about 35 per cent of the time).
- Male dreams tend to be more aggressive in content than female dreams.
- The action in male dreams often occurs outdoors, while female dreams are more likely to take place indoors.
- What is happening in our external environment can be incorporated into our dreams. For example, have you ever dreamt of an alarm clock ringing, only to realise when you woke up that your alarm clock was actually ringing?
- The most common actions in dreams include running, jumping, sitting and talking. Other common dream actions are flying, floating and falling.

Our cultural background, life experiences, and current concerns shape dream content. Therefore, you would expect that the typical dreams in different cultures would differ as social rules, expectations and fears vary between cultures. Table 7.1 highlights the similarities and differences in typical dreams for Chinese, Canadian and German participants (Yu 2008). Look carefully at the rankings. Which rankings differ by more than 10 ranks? In your opinion, how would Australian data differ?

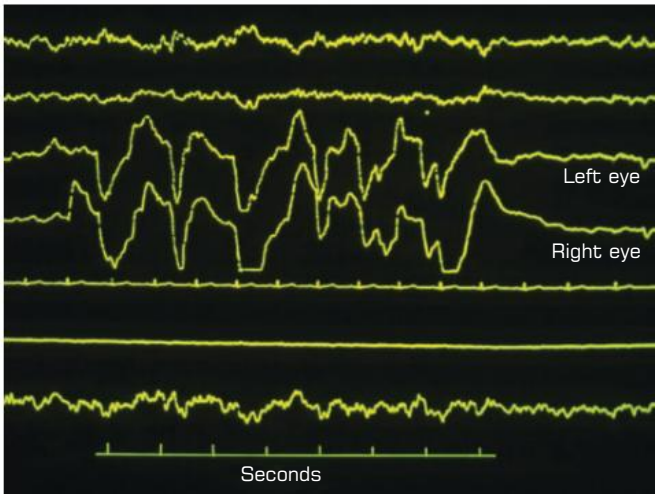


FIG 7.2» During REM sleep, electrical activity of the eye muscles is very high.

TABLE 7.1» Typical dreams for Chinese, Canadian and German participants

	Rank		
Typical dream	Chinese	Canadian	German
School, teachers, studying	1	4	1
Being chased or pursued, not physically injured	2	1	2
Falling	3	3	4
Arriving too late (e.g. missing a train)	4	5	5
Failing an examination	5	11	8
A person now alive as dead	6	8	6
Trying again and again to do something	7	7	23
Flying or soaring through the air	8	9	7
Being frozen with fright	9	13	10
Sexual experiences	10	2	3
Eating delicious food	11	23	14
Being on the verge of falling	12	6	9
Being a child again	13	15	22
Physically attacked (beaten, stabbed, raped)	14	12	12
Having magical powers (other than flying or floating through the air)	15	27	32
A person now dead as alive	16	14	11
Vividly sensing a presence in the room	21	10	33
Swimming	23	18	15
Being nude	38	19	13

7.3 INVESTIGATE

Dream diary

1 For the next five days, keep a pen and paper next to your bed. Upon waking, write down as many dreams as you can remember. For each night, answer the following questions:

- **a** On a scale of 1 to 5, with '1' being very anxious/negative and '5' being very calm/positive, how did you feel when you went to bed last night?
- **b** On a scale of 1 to 5, with '1' being very anxious/negative and '5' being very calm/positive, how did you feel when you woke up this morning?
- **c** How long did you sleep for?
- **d** How many times did you wake during the night?
- **e** How many dreams can you recall, even if only partially?
- **f** Can you relate your dreams to the previous day's experiences?
- **g** Were you the main character in your dreams?
- **h** Were there any other characters in your dreams?
- **i** If yes, were they family or friends?
- **j** Were they male or female?
- **k** Were any of your dreams in colour? If yes, how many colours can you recall?
- **l** Did your dreams include taste, touch or smell sensation?

2 Collate your results and give averages for each of the questions above.

3 How do your results compare to a typical night's sleep and dreaming episodes as outlined in this text? Did you notice aspects about your dreams that you previously had not noticed?

4 Were there any problems with collecting the results? Were there any other limitations with this activity?

NREM sleep

NREM (non-rapid eye movement) sleep is almost the reverse of REM sleep. The EEG records large, slow and regular brainwaves. Heart rate and breathing are regular and slower than REM sleep and the eyes only move slowly and muscles are less relaxed.

NREM dreams are less frequent (around 10 per cent) and are more difficult to remember than REM dreams. NREM dreams tend to be more similar to waking thought patterns. Compared to REM dreams, they tend to be brief, less intense and have little storyline. People who are lighter sleepers and more anxious are more likely to dream in NREM sleep than other people. Have you ever felt as if you have been awake all night thinking about a problem? The chances are that you did sleep and some of this thinking occurred during a NREM dream.

7.4 INVESTIGATE

When do you wake up?

Have you ever noticed that it is harder to wake up at some times of the morning than others? For example, you wake before the alarm goes off, feeling quite alert. However, as you don't need to get up yet, you drift off to sleep again. Thirty minutes later you are jerked awake by the sound of the alarm clock. This time, however, you feel sluggish and tired on waking, in spite of the extra 30 minutes of sleep.

Throughout the night, we often wake up briefly at the end of a NREM/REM cycle, which occurs about every 90 minutes. We are unlikely to remember waking, especially when we are young. However, it is easier to get out of bed in the morning if our wake-up time coincides with the end of a 90 minute NREM/REM cycle.

Tonight write down the time you go to bed. Then, if you wake up during the night, jot down the time. Also, jot down the time you wake in the morning. Was it difficult to wake up?

The following night, set a time to go to bed. Make sure that a series of 90 minute cycles will bring you to your chosen waking time, for example, go to bed at 10.00 p.m. wake at 7.00 a.m. Best to make it earlier than later—we don't want you sleep-deprived at school!

REVIEW 7.1

1 Does everybody dream? How can we tell?
2 What is a 'low dream recaller' and a 'high dream recaller'?
3 What differences in brain activity have been found between a low dream recaller and a high dream recaller? How quickly does each type of recaller tend to wake up?
4 What is the usual length of a REM/NREM cycle?
5 What happens to our bodies during REM and NREM sleep? Complete the following table:

	REM	NREM
Eye movement		
Brainwave activity		
Heart rate		
Breathing rate		
Voluntary muscles		

6 Answer *REM* or *NREM* to each of the following questions.
   a When does most dreaming take place?
   b Which dreams tend to follow a storyline?
   c Which dreams tend to last for a shorter time?
   d Which dreams are more likely to be remembered?
   e When are nightmares more likely to occur?

FIG 7.3» Are you ready to get out of bed when your alarm clock goes off?

DO DREAMS HAVE MEANING?

Throughout history dreams have been the subject of interpretation. Do they provide a meeting place; offer prophecies and wisdom; have magical powers; or inspire creativity? Can dreams transform our lives and guide us to greater wholeness and well-being? In Australian culture, many people consider dreams to be personal and private in nature—things that may need to be censored before they are shared. Other people believe that dreams are meaningless. Some cultures encourage the sharing of dreams.

Do dreams have meaning and, if so, do they need to be analysed? In the following section, three different approaches to dreams and their meaning are discussed:

- Sigmund Freud's **psychoanalytic dream theory** (yes, dreams have meaning)
- The **problem-solving theory** (dreams have meaning but don't need to be analysed)
- Hobson and McCarley's **activation-synthesis theory** (no, dreams do not have meaning).

PSYCHOANALYTIC DREAM THEORY

According to Sigmund Freud (1900), dreams do have meaning. In Freud's psychoanalytic dream theory, the storyline of a dream is known as the **manifest content**. The storyline contains dream symbols that can offer insights into our underlying wishes and thoughts. The dream's hidden meaning is known as the **latent content**.

For example, you have a dream that you are flying across the sky. The manifest content is the storyline—you are flying through the sky. The latent content is the hidden meaning of the dream: that you feel trapped in your daily life and want to be free.

Freud believed that most of our wishes, desires and fantasies are hidden in our unconscious mind, where we are unaware of them, and are typically sexual and aggressive in nature. The purpose of dreams is to express those wishes, desires and fantasies we could not express in everyday life. By dreaming of them in a symbolic form, we reduce our anxiety levels—this is known as **wish fulfilment**.

According to Freud, some dream symbols are unique to an individual while others are universal, recognised and used by most people.

TABLE 7.2» Freud's dream symbols and what they represent

Symbol	What it represents
Screwdrivers, sticks, trees, umbrellas, most weapons, trains, neckties	Male genitals
Caves, jars, ships, chests, bottles, doors, pockets, hats	Female genitals
Small animals	Children
Kings and queens	Parents
Water	Birth
A journey	Death
Nakedness	Uniforms

Freud's work has been influential in the study of the nature of dreaming. His psychoanalytic dream theory has, however, received much criticism for the following reasons:

- it has little scientific empirical (based on observation or experiment) support
- it is too negative, sexual and aggressive in nature
- it is unclear why the meaning of the dream has to be disguised.

Today, the significance of Freud's work is still evident. Most contemporary psychoanalysts take a more positive approach and consider the latent content of dreams to be a window into a person's wishes and concerns, which are not necessarily forbidden sexual or aggressive desires in nature.

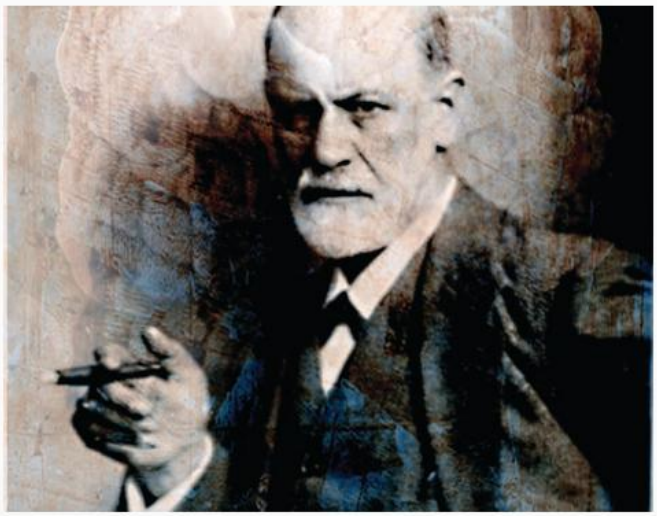


FIG 7.4» According to Sigmund Freud dreams do have meaning.

PROBLEM-SOLVING THEORY

Have you ever been faced with a tough decision and said 'I'll sleep on it!'? The problem-solving theory suggests that often this can be a good idea.

According to the problem-solving theory, dreams have a purpose and help solve problems. When we dream, we sort out problems experienced during our waking life. While our dreams can have meanings, they are not deeply hidden as Freud's theory suggests. For example, if you are feeling overwhelmed with your workload, you may dream of being 'snowed under', buried or trapped. In the problem-solving approach, paying attention to dreams is unnecessary because dreams automatically deal with a person's emotional problems and help solve other problems.

Cartwright studied people in sleep laboratories who were monitored through the night and woken when dreaming (Cartwright et al. 1998). She found that people feeling concerned, worried or sad (such as you may feel in the lead-up to examinations) followed a similar pattern in their dreams.

At the start of the night, they would have a short dream that exhibited negative feelings (for example, a dream where they are trying to travel somewhere but keep missing the bus). The second dream would have a more complicated storyline but would also be negative in tone.

By the third dream, however, the storyline and its associated emotions became positive. By the fourth, and often the last dream for the night, the dreams had become even more positive, with storylines that indicated the dreamer 'taking charge' of a situation.

Cartwright also found that those people who are 'good' dreamers (that is, people whose dreams have well-developed storylines that are often remembered) are likely to overcome emotional difficulties more quickly than people who are not good dreamers.

7.5 INVESTIGATE

You'll feel better in the morning

The problem-solving theory supports the notion that 'you'll feel better in the morning'. Look back at Investigate 7.4. On any occasions when you reported feeling anxious/negative on going to bed, did you feel more calm/positive in the morning?

FIG 7.5» 'I'll sleep on it' is best not employed as a problem-solving technique during classtime.

7.6 INVESTIGATE

Media response: 'Better performance after a dreaming nap'

Read the article 'Better performance after a dreaming nap' and answer the following questions.

1 The word association test in the article involved being given multiple groups of three words (such as cookie, heart, sixteen) and then asked to find a fourth word linked to all three (such as sweet).
   - **a** At what time of day did the participants sit the first test? The second test?
   - **b** Did performance on the word association test improve for all the participants?
   - **c** Under which condition did the participants show the most improvement?

2 What do the results suggest about the importance of REM sleep? How could REM sleep be linked with creativity?

3 Which theory of dreaming does Mednick's study support?

4 Outline one method that Mednick could have used to determine if the participants were in REM or NREM sleep.

Better performance after a dreaming nap

By Nicholas Bakalar

Have to solve a problem? Try taking a nap.

But it has to be the right kind of nap—one that includes rapid eye movement, or REM, sleep, the kind that includes dreams.

Researchers led by Sara C. Mednick, an assistant professor of psychiatry at the University of California, San Diego, gave 77 volunteers word-association tests under three before-and-after conditions: spending a day without a nap, napping without REM sleep and napping with REM sleep. Just spending the day away from the problem improved performance; people who stayed awake did a little better on the 5 p.m. session than they had done on the 9 a.m. test. Taking a nap without REM sleep also led to slightly better results. But a nap that included REM sleep resulted in nearly a 40 percent improvement over the pre-nap performance.

The study, published June 8 in The Proceedings of the National Academy of Sciences, found that those who had REM sleep took longer naps than those who napped without REM, but there was no correlation between total sleep time and improved performance. Only REM sleep helped.

'Dreams are fanciful,' Dr. Mednick said. 'They incorporate strange ideas that you would never have put together in waking life. In REM sleep, it becomes more likely that ideas might come together in a solution.'

Source: New York Times, 23 June 2009

ACTIVATION-SYNTHESIS THEORY

According to the Hobson and McCarley activation-synthesis theory, dreams are meaningless and should not be subjected to interpretation. During REM sleep, neurons are randomly activated from the brain stem. This random activation sends signals to other parts of the brain. Our brain attempts to understand and interpret these signals, using past experiences, memories and knowledge. In doing so, our brain often puts these experiences, memories and knowledge together into bizarre and disjointed dreams that make little sense.

There is some empirical evidence to support the activation-synthesis theory. Random neuron activity appears to exist. For example, activity in the balance areas of the brain may be incorporated into the dream storyline as flying. This is not always the case, however; not all activity gets interpreted and put in the storyline. Critics claim that the activation-synthesis theory overestimates the bizarreness of dreams (not all dreams are bizarre and unusual) and fails to explain the presence of dreams in NREM sleep.

REVIEW 7.2

1 According to Freud, what is the significance of dream symbols?
2 Outline some of the criticism that Freud's theory of dreaming has attracted.
3 According to the problem-solving theory, what is the purpose of dreaming?
4 According to the problem-solving theory, what is meant by the term 'good' dreamer and how does this relate to coping with emotional problems?
5 What happens to the brain's neurons during REM sleep? How is this linked to Hobson and McCarley's activation-synthesis hypothesis?
6 How does the activation-synthesis theory account for having bizarre dreams?
7 Outline some of the criticism that the activation-synthesis hypothesis has received.

FIG 7.6» Daydreaming in class is not usually well received by the teacher.

OTHER FORMS OF DREAMING

LUCID DREAMS

Imagine that you are asleep and you gradually realise that you are dreaming. You do not want to wake—you want to stay dreaming. The dream continues and you find yourself able to control your dream.

This is known as **lucid dreaming**. Being able to control your dreams can be an enlightening and empowering experience. For example, a nightmare of you being chased by a lion can be turned into you chasing the lion!

Lucid dreaming is very common for some people, while for others it is rare. However, you can train yourself to be aware of when you are dreaming and to take control of your dreams.

There are a number of lucid dreaming machines available for purchase. These devices are worn like an eye mask. Beeping sounds and flashing lights are activated when REM sleep is detected. Sleepers train themselves to recognise the beeps and flashing lights as a sign that they can begin controlling their dreams.

LaBerge, one of the leading researchers in this area, has developed a method to increase the likelihood of lucid dreaming. Check out LaBerge's Lucidity Institute on the web. WWW»

DAYDREAMS

We have all experienced daydreams (perhaps even while sitting in a classroom!). **Daydreams** are a normal state of consciousness and occur when we pay attention to our own thoughts and ignore the external world. Daydreams are visualised thoughts that are usually positive. We spend anywhere from a third to a half of our waking life daydreaming.

Daydreams serve many purposes including:

- imagining pleasurable fantasies
- helping us make decisions and solve problems
- planning effectively for future actions or conversations
- reliving past actions or conversations
- overcoming boredom
- enhancing creativity
- controlling undesirable habits
- offering an insight into our personality, motives and concerns.

7.7 INVESTIGATE

Lucid dreaming machines

Lucid dreaming machines help train sleepers to control their dreams.

1. Why might someone be interested in purchasing such a device?
2. Would you like to know when you are in REM sleep? Would you like to know when someone else sleeping in your room is in REM sleep?
3. Discuss in small groups the benefits and disadvantages of purchasing such a device.

SLEEP LABORATORIES AND DREAMS

The nature of our dreams fascinates many people. Research in sleep laboratories monitors brainwave activity and other physiological processes. Participants can be woken and asked to recall dreams before they forget them. Data can be matched up with how the participant was feeling before going to sleep and with physiological recordings. This can tell us a great deal about dreaming.

There are limitations, however, to this type of research.

- For the research to be valuable, participants must be honest about the content of their dreams. Given the private nature of dreams, participants may censor parts of their dreams. There is no way to verify whether or not the person is telling the truth.
- Participants in sleep laboratories tend not to have really emotional dreams. In fact, nightmares rarely occur.
- Dreams may not be recorded accurately. The participant may not be able to describe the dream accurately and the researcher may make errors in recording these descriptions.
- Participants tend to have their sleep interrupted, for example being woken while in REM sleep to report their dreams. Subsequent dreams may be affected by these sleep disturbances.
- Participants sleep in an unfamiliar environment with wires and other apparatus attached to their bodies. This may interfere with their normal sleep patterns and their dreams.

This area of research is becoming more complex with brain-scan imaging. The latest technology will advance our knowledge and understanding of what happens within our brain when we dream, although interpreting dreams will still be difficult—dreamers will still need to accurately record their dreams.

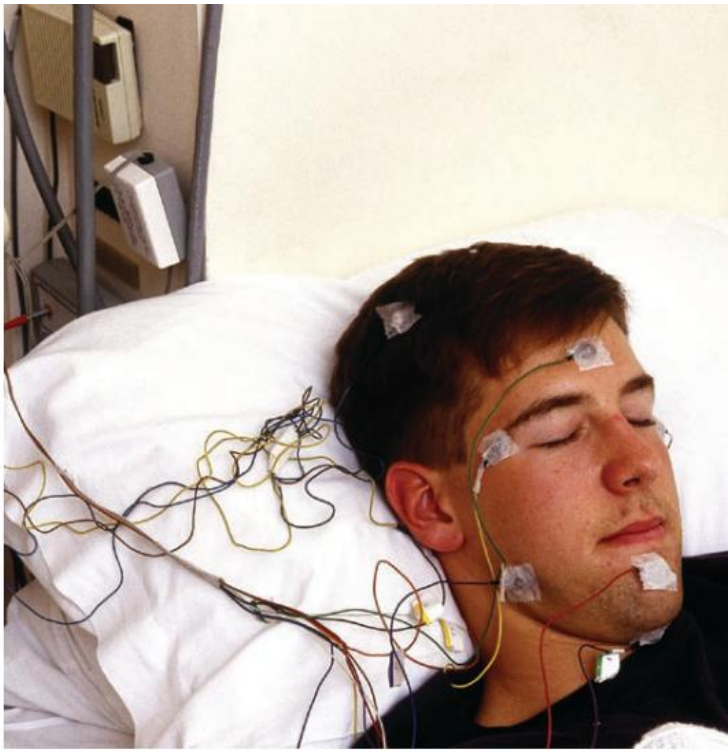


FIG 7.7» Research in sleep laboratories has provided much insight into dreaming.

REVIEW 7.3

1. What is lucid dreaming?
2. What are the potential benefits of lucid dreaming?
3. Are lucid dreams likely to occur in REM or NREM sleep? Explain your answer.
4. How much waking time is typically spent daydreaming?
5. What are the potential benefits of daydreaming?

7.8 INVESTIGATE

Please help Stefan

Stefan is studying psychology in school. He has been asked to complete a dream diary over the next week. The trouble is Stefan believes he never dreams. Help Stefan overcome this problem. Explain why he may not remember dreaming. Discuss techniques that Stefan can use to help record his dreams.

CHAPTER SUMMARY

- Dreaming is an intriguing part of our lives that has been the subject of interpretation throughout history. Our culture largely considers dreams to be personal and private in nature and, as such, may need to be censored before being shared. Other cultures openly share their dreams and believe they are of great significance.
- On average, a person dreams four to five times a night, although it is unlikely that we can recall all our dreams. Some people are low recallers, tending to wake slowly and experience more electrical shifts of activity between brain hemispheres than high recallers upon waking.
- Dreams can occur at any time during sleep, in both rapid eye movement (REM) sleep and non-rapid eye movement (NREM) sleep.
- Most dreaming (around 90 per cent) occurs during REM sleep. REM dreams tend to follow a storyline (even if it appears bizarre) and dreamers often feel as if they are experiencing a different world. REM dreams are more likely to be remembered than NREM dreams.
- Around 10 per cent of dreaming occurs during NREM sleep. These NREM dreams are more difficult to remember than REM dreams. The dreams tend to be brief, less intense and have little storyline, and are more like regular thinking processes. People who are lighter sleepers and more anxious are more likely to dream in NREM sleep than other people.
- According to Freud (1900), dreams have meaning. The storyline of a dream uses dream symbols that can offer insights into our underlying wishes and thoughts. Dreaming of these wishes and thoughts, many of which are aggressive and sexual in nature, can relieve anxiety.
- According to Cartwright's problem-solving theory, we dream to sort out problems experienced when awake. Dreams have a purpose; they help solve problems and overcome negative feelings.
- The Hobson and McCarley activation-synthesis hypothesis holds that dreams are meaningless and should not be subjected to interpretation. During REM sleep, neurons are randomly activated from the brain stem. This random activation is then relayed to other parts of the brain. Our brain attempts to understand and interpret these signals by using past experiences and knowledge. As a result, bizarre and disjointed dreams that make little sense are often created.
- A lucid dream is one that you can consciously control when you become aware that you are dreaming. Daydreams are a common occurrence and have many functions, including relieving boredom and helping in problem-solving.
- Sleep laboratories monitor a participant's brainwave activity and other physiological processes. These can be matched with the participant's recall of the dreams and their thoughts and feelings before and after the dream. There are limitations, including the fact that dreams still need to be accurately and truthfully recalled by the dreamer.

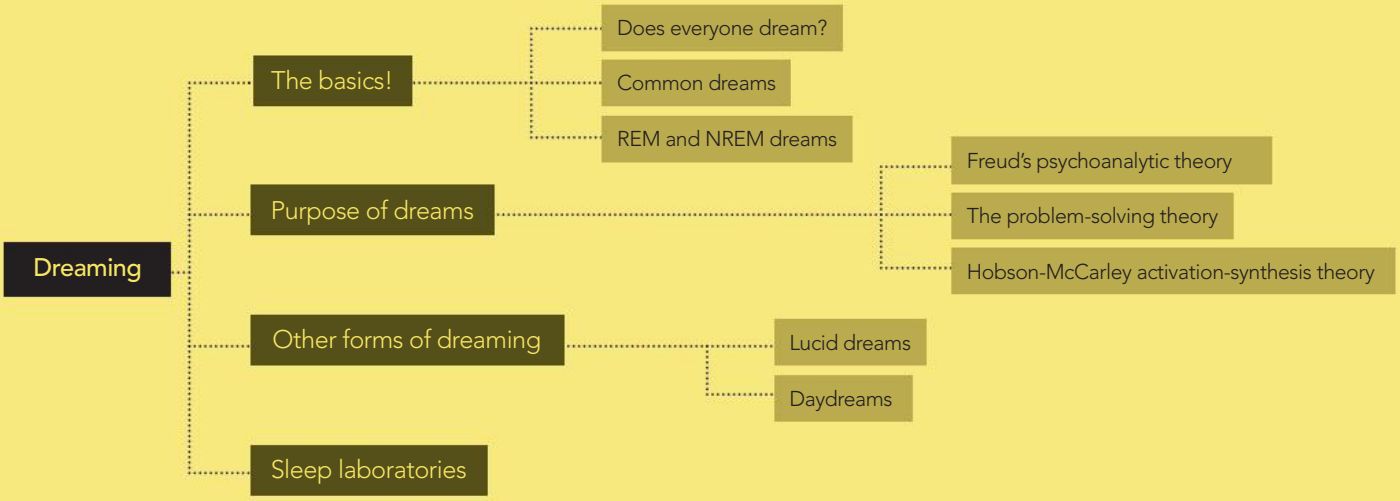


FIG 7.8>> Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 When compared to NREM dreams, REM dreams are:
   - **a** more vivid
   - **b** shorter in length
   - **c** less likely to follow a storyline
   - **d** more difficult to remember on waking.

2 During NREM:
   - **a** heart rate fluctuates
   - **b** muscles are deeply relaxed
   - **c** breathing is calm and relaxed
   - **d** brainwaves, as measured on an EEG, are small and fast.

3 One cycle of NREM/REM sleep usually lasts for:
   - **a** 9 minutes
   - **b** 60 minutes
   - **c** 90 minutes
   - **d** 8 hours.

4 According to the activation-synthesis theory, dreams:
   - **a** are a conscious interpretation of random brainwave activity
   - **b** offer a window into a person's wishes and desires
   - **c** allow a person to solve problems while sleeping
   - **d** mainly occur in NREM sleep.

5 According to Freud, wish fulfilment is:
   - **a** the storyline of the dream
   - **b** random brain activity during REM sleep
   - **c** carrying out a desire that has been dreamt about
   - **d** the symbolic expression of our wishes and desires in our dreams.

6 When does most dreaming occur?

7 What are the most common activities in dreams?

8 Is there a difference between the content of male and female dreams? If yes, what are they?

9 According to Hobson and McCarley's activation-synthesis theory on dreaming, what do the terms activation and synthesis mean?

10 According to the problem-solving theory, why might a negative mood or feeling of anxiety improve after a night's sleep?

11 Would you volunteer for sleep laboratory research on dreaming? Why/why not?

12 Does each of the following theories of dreaming account for the bizarre nature of dreams? Explain your answer.
   - **a** Sigmund Freud's psychoanalytic dream interpretation
   - **b** Rosalind Cartwright's problem-solving theory
   - **c** Hobson and McCarley's activation-synthesis theory

Extend yourself

13 Go online to dreamstudies.org and select a recent study on dreaming. Report back to the class.

14 Investigate another dream theory, for example:
   - social dreaming
   - reverse learning theory
   - reprogramming theory.

15 Build a dreamcatcher and find out about its significance in Native American culture.

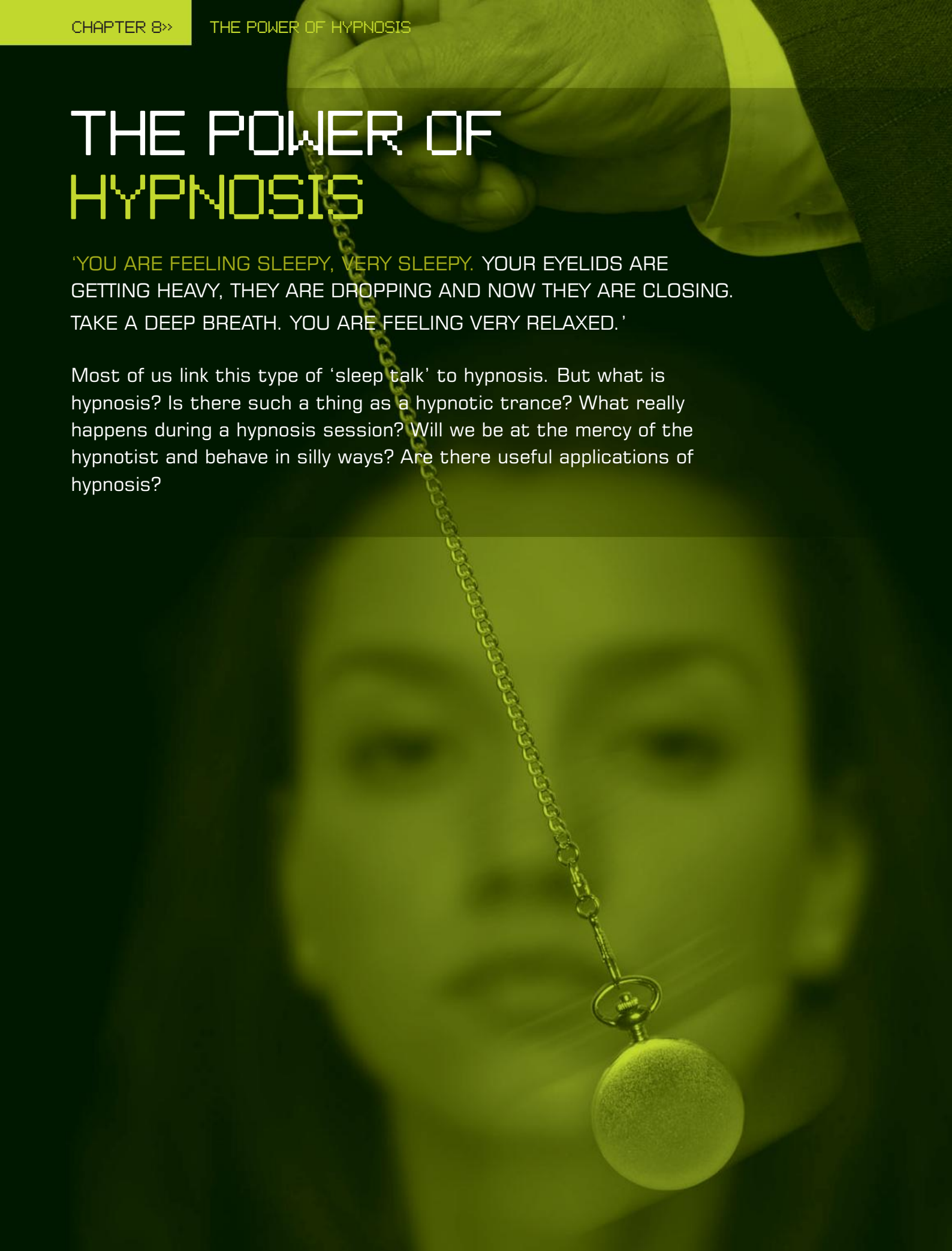
16 What is the difference between nightmares and night terrors?

17 Does sleep talking reveal what you are dreaming about? Are sleepwalkers merely acting out their dreams?

THE POWER OF HYPNOSIS

'YOU ARE FEELING SLEEPY, VERY SLEEPY. YOUR EYELIDS ARE GETTING HEAVY, THEY ARE DROPPING AND NOW THEY ARE CLOSING. TAKE A DEEP BREATH. YOU ARE FEELING VERY RELAXED.'

Most of us link this type of 'sleep talk' to hypnosis. But what is hypnosis? Is there such a thing as a hypnotic trance? What really happens during a hypnosis session? Will we be at the mercy of the hypnotist and behave in silly ways? Are there useful applications of hypnosis?



WHAT IS HYPNOSIS?

Many questions surround the nature of hypnosis and its potential benefits. There is debate about whether hypnosis is a distinct state of consciousness (a hypnotic trance) or just a result of people's expectations. In other words, do people tend to follow the instructions or suggestions just because they believe in hypnosis and expect it to work? Our definition of **hypnosis** is that it is a special condition of increased suggestibility that a person may experience after being given instructions that suggest they will enter this condition.

Hypnosis has been used as a tool to help medical conditions since the late 1700s and for psychological interventions since the early 1900s. Today, it is commonly used to help people overcome bad habits such as smoking or nail-biting, for pain relief and even to lose weight. It is used in the treatment of other psychological and physiological problems, including dealing with stress and headaches. A qualified person who uses hypnosis to help clients with such problems is called a *hypnotherapist*. Hypnosis, however, is also used for entertainment purposes, such as people being hypnotised on stage and asked to perform humorous or embarrassing acts. The perception of hypnosis leading to a loss of control and dignity is, perhaps, why many people fear undergoing hypnosis.

8.1 INVESTIGATE

True or false?

Read the following statements and answer true or false. (Answers can be found on page 106.)

1. Everyone is capable of being hypnotised.
2. A person falls into a deep sleep when they are hypnotised.
3. If asked to raise their right arm, a hypnotised person is likely to say that their right arm raised itself involuntarily (automatically).
4. The main use of hypnosis is for entertainment purposes.
5. Hypnosis is able to relieve pain in situations such as dental work.
6. Hypnosis will allow a person to remember accurate details of a forgotten event.
7. A person will not remember about the hypnosis session afterwards.
8. There is such a thing as a hypnotic trance.

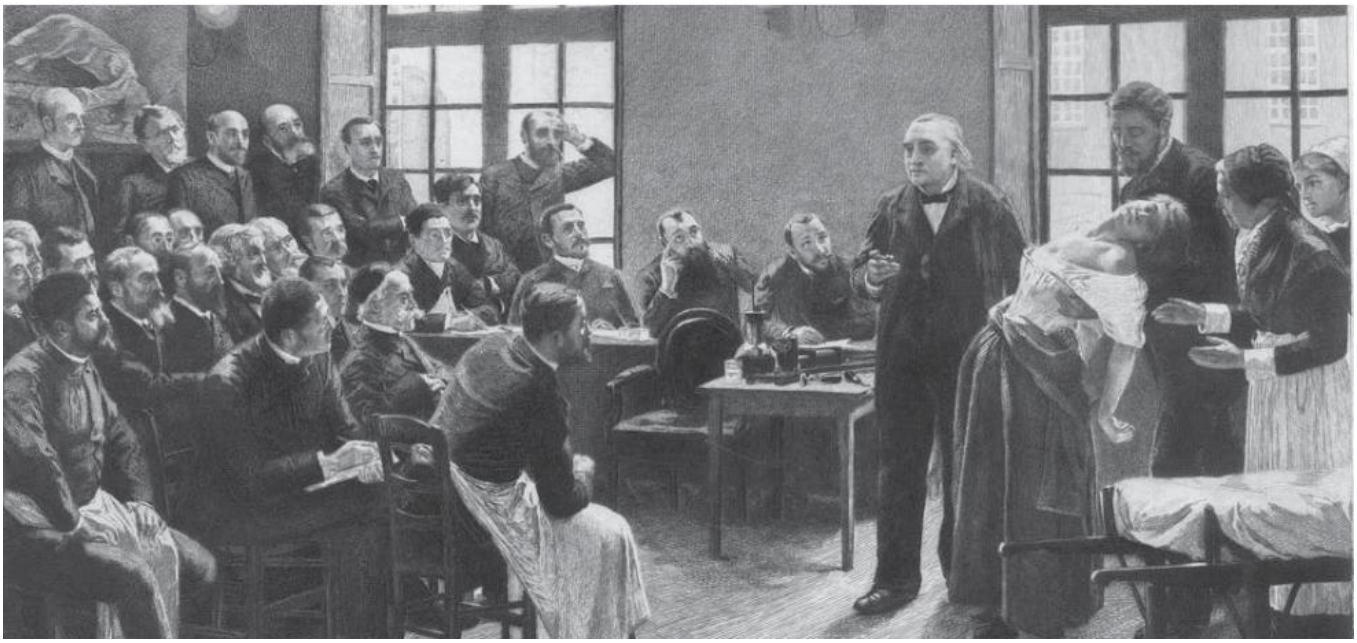


FIG 8.1» French neurologist Doctor Jean Martin Charcot (1825–1893) lecturing on hypnotism to a class of medical students. Charcot introduced the use of a pendulum for subjects to focus on although it is not necessary for hypnosis and is not commonly used.

WHO CAN BE HYPNOTISED?

Not everybody can be hypnotised, which is one reason why hypnosis attracts much debate. Only 15 per cent of the population is extremely susceptible to hypnosis. Another 10 per cent is highly resistant and everyone else falls somewhere between the two extremes.

People who are extremely susceptible:

- tend to be able to form vivid visual images in their mind
- tend to be able to become completely focused on an activity and ignore distractions
- can be dependent on others (susceptible to traditional hypnosis) or compulsive (susceptible to self-hypnosis)
- believe and expect hypnosis to work.

Have you ever been in a daydream or totally engrossed in music or a book, where you lose sense of time and move into the imagined other world? Then hypnosis is something you may have already experienced. You do not need someone to hypnotise you. Self-hypnosis is also possible, either through channels such as hypnosis tapes or just by being totally absorbed in what you are doing.

8.2 INVESTIGATE

Can you be hypnotised?

Do you think that you could be hypnotised? Answer the following yes or no questions:

- Do you tend to have vivid and frequent fantasies?
- Can you easily think up detailed visual images?
- Can you become highly absorbed in an activity, such as watching television, reading, daydreaming or school work, to the exclusion of everything else around you?
- Do you often depend on or seek directions from others?
- Do you consider yourself to be compulsive?
- Do you often seek compliments from others?
- Do you believe in hypnosis and its power to overcome problems?
- Do you expect to follow instructions by the hypnotherapist when under hypnosis?

The more 'yes' responses, the more likely it is that you are able to be hypnotised.

CHARACTERISTICS OF A HYPNOTISED PERSON

When a person is hypnotised, they tend to display a number of particular characteristics.

Open to suggestion

Imagine that you really want to swallow. Your mouth is filling up with saliva and, despite trying not to swallow; you cannot wait to gulp all the excess saliva. You just need to swallow. You really want to swallow and your mouth is almost overflowing with saliva. When undergoing hypnosis, you are more likely to be open to suggestion. You are more likely to follow instructions with little resistance, even when the instructions seem unusual or impossible.

Did you just swallow? Odds are that you did; probably when the topic changed from imagining that you want to swallow to discussing being open to suggestion. This is a typical example of what it means to be open to suggestion. Suggestibility can explain a number of experiences under hypnosis:

- **Post-hypnotic amnesia**. Post-hypnotic amnesia is when the hypnotised person is instructed to forget what happened during the session on 'awakening'. When hypnotised again, the person can usually recall the session. Some believe post-hypnotic amnesia occurs simply because the person who has undergone hypnosis believes and expects it to occur.
- **Post-hypnotic suggestion**. During the hypnosis session, the hypnotised person may be instructed how to respond in a certain situation when they 'awaken'. For example, they may be told to fall sleep whenever they hear the word 'sleep'. If a client is trying to quit smoking, he or she may be told that cigarettes taste foul. After the session, the client may hate the taste of cigarettes and quit smoking.

You may have seen the use of post-hypnotic suggestions used in films or on television. For instance, a person may be told to 'quack' at the sound of a certain word. Indeed, they do just that and make a fool of themselves. Such misuse of hypnosis in popular culture has added to the poor understanding of hypnosis. It can make people afraid of hypnosis and stop them from understanding its potential value.

Quiet and still

Hypnotised people usually sit quietly, focusing on the voice of the hypnotist. They are very relaxed. However, a state of relaxation is not always necessary; people can be hypnotised when they are performing vigorous activities, such as riding fast on a stationary bike.

Focused attention

Being quiet and still allows a person to concentrate on one thing at a time. The person focuses on the voice of the hypnotist and becomes less aware of other external and internal happenings, especially when guided to do so by the hypnotist. For example, a person under hypnosis can become less aware of other voices, or less aware of pain.

Planning and decision making suspended

The hypnotised person seems to stop critically evaluating the situation. This means they are no longer thinking deeply about what is being said to them. Deciding whether what is being said is true or even possible can be difficult. The hypnotised person can also stop planning or thinking about the consequences of their actions. Making important decisions can be impossible. While under hypnosis, planning and decision-making is in the control of the hypnotist.

Go online to the Mind Motivations website. WWW>> Try the Mind Motivations Spiral Test—the results may give you insight as to whether or not you can be hypnotised.

8.3 INVESTIGATE

Meditation

Meditation exercises, such as the one below, encourage a relaxed state (as per hypnosis). It can help you become calmer and your thoughts become clearer. Follow the instructions for the meditation exercise, then answer the questions about your experience.

The meditation exercise

Make yourself comfortable, either at your desk or on the floor.

Read the following instructions first, record them and play them back or get someone (perhaps your teacher) to read them to you.

- Sit quietly for about a minute, concentrating on your breathing. Breathe in slowly through your nose. Let your lungs fill up with air and then slowly breathe out through your mouth. Breathe in and out another 10 times, allowing yourself to relax and unwind.
- Visualise your muscles relaxing. Notice how quickly your body relaxes from the top of your head to the tips of your toes. Breathe in and out another three times.
- Imagine you are in a quiet place. Take your time to look around this place. What does it look like? Where is it? What does it smell like? What colours dominate the landscape?
- Imagine there is a track. Walk along this track. What type of track is it? Is it bumpy, smooth, wide or narrow?
- Imagine that you can hear water. Walk along your track to the water. What sort of body of water is it? What noise is it making? Describe the landscape—what does it look like, feel like and smell like?
- You notice something on the ground at your feet. Slowly bend down to look at this object. You start to become smaller and smaller and are now the same size as the object on the ground. What does it look like? Note the texture on the object.
- You start getting bigger and bigger. Pick up the object on the ground and carry it back along the path to your quiet place.
- Breathe in and out another five times. Slowly open your eyes.

Reflection

1. Compare your experiences with other members of the class.
2. Were you able to relax during this activity?
3. Describe your quiet place. Did other people have a similar quiet place?
4. What type of path did you walk down? What was the body of water? What was the object that you picked up?

FIG 8.2» The hypnotherapist has suggested to this person that he has a balloon tied to his left hand and that his right hand is very heavy. The person's left arm has raised and right arm lowered accordingly.

THE STANFORD HYPNOTIC SUGGESTIBILITY SCALE

The Stanford Hypnotic Suggestibility Scale is the most common scale used to measure how deeply a person is hypnotised. It lists 12 suggestions, of increasing complexity and difficulty, to be given by a hypnotist to a participant. If the participant follows a suggestion, it indicates that that particular level of hypnosis has been reached.

TABLE 8.1» Examples of some of the levels from the Stanford Hypnotic Suggestibility Scale

Level	Suggestion	Behaviour if this level is achieved
1: Arm lowering	Participants sit with their right arm outstretched. They are told their arm is getting heavy and to slowly lower it.	Participants slowly lower arm.
3: Mosquito hallucinations	Participants are told that an annoying mosquito is buzzing around.	Participants report hearing the mosquito and try to swat or shoo it away.
4: Taste hallucinations	Participants eat something sour or bitter (e.g. an onion) and are told it is sweet (or vice versa).	Participants respond as if the food is sweet even if it is not.
7: Age regression	Participants are told to imagine being at school at a certain age.	Participants' handwriting changes according to the imagined age.
9: Loss of smell (amnosia) to ammonia	Participants are told that they cannot smell household ammonia.	Participants cannot smell ammonia.
12: Post-hypnotic amnesia	Participants are told that they will not be able to recall a certain event that occurred during hypnosis unless given a specific signal.	Some items are not recalled afterwards until participants are told that they can now remember everything.

REVIEW 8.1

1 What percentage of the population is highly resistant to hypnosis?
2 Would you expect a person who is extremely susceptible to hypnosis to be able to work in a noisy environment? Explain your answer.
3 What is meant by the term 'suggestibility'? How does this relate to 'post-hypnotic amnesia' and 'post-hypnotic suggestions'?
4 What can happen to a person's planning ability during hypnosis?
5 What is the purpose of the Stanford Hypnotic Suggestibility Scale?

APPLICATIONS OF HYPNOSIS

Does hypnosis work? This may seem a simple question but there is no simple answer. Probably the best answer is 'hypnosis can work and it can be very effective'. While a small percentage of people cannot be hypnotised, for others the benefits can be massive.

USES AND TREATMENTS

Hypnosis is an exciting area of research with an increasing number of reports of its effectiveness in a number of physical and psychological areas being published each year. Positive self-talk is associated with hypnosis which assists both physiological and psychological problems.

Pain control

Imagine this scenario. Dave has been seriously injured in wartime. He is in agony. His leg is bleeding profusely and he overhears one surgeon telling another that he will bleed to death if his leg is not operated on immediately. He is in a makeshift hospital tent in a land far away from home. The anaesthetic supplies have run out and there is no possibility of extra supplies arriving in time.

A nurse leans over Dave and tells him that he will be fine. Her voice is very calm and reassuring. Dave tunes in to her voice as she says, 'You are a bit nervous but you are with the best medical team.' He finds himself listening intently to her voice and believing her suggestions.

The nurse continues, 'You are relaxed. You will feel a little bit of pressure in your leg.' Dave believes that he is feeling just a little bit more pressure. And, indeed, that is all he feels. He continues listening to the nurse as the surgeon saws off his leg. Afterwards, Dave thanks the nurse for her support and finds that he has survived a life-threatening situation and serious surgery thanks to hypnosis.

This scenario is not just imaginary. There have been actual cases of limb amputation occurring under hypnosis without the support of anaesthetic, particularly in war situations.

Hypnosis has been used successfully to replace anaesthesia and control pain in situations such as:

- childbirth
- major surgical procedures, including the amputation of a limb and abdominal surgery
- minor procedures, such as dental surgery.

It appears that the ability to tolerate pain under hypnosis is due to patients being able to dissociate (i.e., remove) themselves from the pain by intensely focusing on something else and not being aware of it.

CASE STUDY

Tamara Sharp

Tamara Sharp was talking to her friends in the schoolyard when she was shot from behind with a crossbow. The crossbow arrow went completely through her left lung. Despite blood pouring from her chest wound, 16-year-old Tamara was able to keep calm by putting herself in a self-induced trance. Not only did the self-hypnosis keep Tamara calm, it also helped keep pain at bay until medical help could arrive. Tamara believes her 10 years of jujitsu training helped her to use her mind to control her body and save her life.

Tamara's incident highlights how people can learn to self-induce hypnosis and control their thoughts and bodily responses. It is very similar to meditation. When a person is hypnotised, they focus entirely on a voice or an item and remain quiet and still. Tamara was able to ignore the pain and danger of the situation by focusing elsewhere and keeping very calm and still.

FIG 8.3» Tamara Sharp, now recovered from her injuries

Treatment of warts and stress skin diseases

There are a striking number of reports about the effectiveness of hypnosis in treating warts. Hypnosis has led to warts disappearing without medical intervention. It is believed that hypnosis can assist the immune system to fight this viral disease, although exactly how this occurs is uncertain. Hypnosis can also be effective in treating skin diseases caused by stress.

Breaking bad habits

Many people have had success with breaking bad habits, such as smoking, nail-biting and overeating, by using hypnosis. In many cases, the bad habit is replaced by a healthier habit.

People wanting to quit smoking, in particular, will often respond to hypnosis, provided that *all* the reasons for wanting to smoke have been referred to under hypnosis; otherwise the person will conclude, when unable to give it up, that they didn't really want to!

Hypnosis can remove the smoker's awareness of any withdrawal symptoms, provided that the person genuinely wants to stop smoking. It appears that hypnosis allows the smoker to stop being conscious of any resistance to stopping the addiction.

Weight loss

Hypnosis can help a person stop experiencing the usual craving associated with dieting or emotional eating. It has also been linked to helping people overcome the eating disorder bulimia nervosa.

Other areas

Hypnosis has been useful in a number of other areas:

- treating stress, phobias and fears
- treating headaches and asthma
- training, particularly in practising complex moves that need to become automatic such as diving or skydiving and military and operational training. For example, a skydiving team may, under hypnosis, rehearse the patterns they plan to create in the sky. This encourages them to focus on the range of complex moves without getting distracted by other things.
- clinical therapy especially where regression (imagining yourself when you were younger) and role play may assist in recalling and dealing with a traumatic event
- reducing the symptoms of dementia.

CASE STUDY

Richard's story

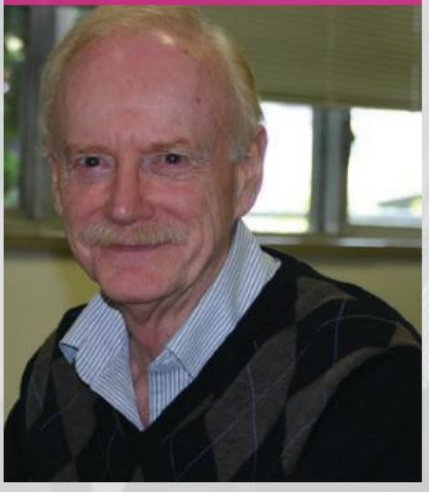


FIG 8.4» Richard.

From the age of 16, I smoked over two packs of cigarettes a day for the next 20 years. It was very fashionable to smoke in the 1970s, but even then I knew it was affecting my health badly, and I made many fruitless attempts to give up. The strategies I used were almost all behavioural ones, such as using the money saved to go on holidays, but no reward could beat the pleasure of the next cigarette! It took the birth of my daughter to really force the issue. I went to a hypnotherapist on the advice of a really weak-willed friend who had (amazingly) given up smoking straight after hypnotherapy. I was easily hypnotisable, and stopped smoking after one session. I did relapse after a year, but one further session fixed me for good, and I've never touched a cigarette since. I understand that the technique rests on focused attention, so that self-statements ('I really want to give up, and am going to stop completely') are really meaningful. I used self-hypnosis from time-to-time after seeing the hypnotherapist so I would stay really focused, but very soon the habit of not smoking took over. I just needed that extra help to get me to focus and act on my deep-down wish to give up.

MEMORY

Can hypnosis improve your memory of past events? This is a controversial area with no consensus among researchers. Some research has indicated that hypnosis can lead to enhanced recall of memories while other research indicated that it can lead to distorted memories.

In 1976, a bus driver and the 26 schoolchildren who were his passengers were kidnapped from a bus in Chowchilla, California. They were held at gunpoint by the kidnappers and buried in a van within a quarry. Hours later, they managed to escape. Afterwards, under hypnosis, the driver was able to provide comprehensive details of the crime, including the kidnappers' licence plate number. This ultimately led to the arrest and conviction of the kidnappers.

Later in the 1970s, a $US 2.7 million armoured car robbery occurred in Boston, Massachusetts. Under hypnosis, a witness was able to recall with confidence the licence plate number of the getaway vehicle. Subsequently, however, this was found to be the licence plate number of the president of Harvard University who was able to prove he had nothing to do with the robbery. There was no doubt that this was the wrong number and it was later found that the witness worked at Harvard University and had often seen the president's car.

It appears that while hypnosis may enhance memories it is unreliable. People under hypnosis are highly suggestible, which makes it unwise to rely on 'recovered memories' without corroborating evidence. If the hypnotist uses a misleading question or mentions additional or even conflicting information, memories can be altered or new memories constructed. A person can later firmly believe that this false information is indeed true.

When hypnosis is applied to criminal investigations claims by hypnotised people must be treated with caution. These new or enhanced memories are often unreliable and further evidence is needed.

REVIEW 8.2

1 In terms of focused attention, why can hypnosis successfully control pain?

2 Can hypnosis help a person break a bad habit if they genuinely want to break the habit? Explain.

3 Explain why skydivers performing tricks might benefit from hypnosis.

4 Why may memories obtained under hypnosis be unreliable?

FIG 8.5» Midair suspension—a spectacular stage show trick. This has been used in hypnosis stage shows in an attempt to demonstrate great strength obtained under hypnosis. However, you do not need to be hypnotised to perform this trick as Simon and Gemma demonstrate!

8.4 INVESTIGATE

Self-hypnosis

If possible, find a CD that uses the technique of self-hypnosis (including positive self-talk) and bring it to class.

1 Read the instructions on the CD.
   - **a** What is the length of time for each session? How often are you meant to listen to it?
   - **b** What are the potential benefits?
   - **c** Do you think this CD will suit everyone who wants these potential benefits? Explain your answer.

2 Sit quietly in class and listen to a suitable section of the CD.
   - **a** What instructions were used to guide you into hypnosis?
   - **b** What instructions were given to help teach you to relax?
   - **c** Can you relate aspects of the CD to what we have already covered in this chapter?

STAGE HYPNOSIS—REAL OR FAKE?

What really happens at a hypnotic stage show? Is it merely staged or is it real? If you were called on to participate in a hypnosis stage show, do you think you would follow the hypnotist's instructions? Do you think you would perform acts against your will? Do you think you would embarrass yourself?

Entertainers such as Martin St James in Australia use hypnosis to make a living. They seem to be able to easily make people behave foolishly, such as clucking like a chicken. Entertainers such as these have added to the mystery and misconceptions that surround hypnosis, but it is important to keep in mind several factors that are at play in stage shows featuring hypnosis.

1. Stage hypnotists are not psychologists. They do not have the comprehensive training and qualifications to work as a psychologist or medical physician.
2. Trickery is possibly involved. There have been accounts where trickery has been exposed. This can be in the form of 'planting' members in the audience and other forms of deception.
3. There is careful selection of audience members. Not all people can be hypnotised and therefore members of the audience need to be carefully selected as participants. The audience is often monitored and members are selected before the show begins. Those who display a higher level of suggestibility are selected.
4. Participants are playing the social role. It has been suggested that people hypnotised on stage are playing a social role. They have seen hypnosis acts on stage or in the popular media (such as on television or in the movies) and know how they are expected to behave. They believe that they will be unable to resist the suggestions by the hypnotist when hypnotised. The audience is also expecting that the person will carry out the suggestions. This type of social influence can be called the role-playing (non-state) theory.
5. Studies have shown that people perform unlikely and uncharacteristic acts when asked by a person with authority. They are merely following orders and do not need to be hypnotised. The stage hypnotist would be seen as an authority figure in this case.
6. Other studies have demonstrated that hypnotised people are not more likely to perform uncharacteristic acts than when not hypnotised. People are not more likely to follow instructions when hypnotised compared to when they are not hypnotised. They are not at the mercy of the hypnotist: they will not follow every instruction, especially when they do not want to.

FIG 8.6» An audience member at a stage show is hypnotised into thinking he is playing guitar in a rock band.

ETHICS

Many serious ethical concerns are raised due to the hypnotist being able to control a person's behaviour. Some people have been extremely angry or upset following a stint on stage. How would you feel if you followed orders and were 'forced' to eat an onion?

8.5 INVESTIGATE

Ethics and hypnotism

1. If possible, watch a documentary or a stage show on hypnotism in class.
2. Discuss the ethical considerations for using hypnosis for:
   - **a** entertainment reasons
   - **b** therapy and medical use.

DEBATE ABOUT HYPNOSIS

Is hypnosis real? Is being hypnotised different from being asleep or awake? Hypnosis is an area of psychology that attracts much debate among psychologists and these questions are at the centre of the arguments.

Some psychologists believe a hypnotic state does exist. This means that they believe there is such a thing as a hypnotic trance and is known as the **state theory**. Others view hypnosis as a situation in which a person merely is being influenced by the social setting, rather than being in an altered state of consciousness. This is known as the **role-playing** or **non-state theory**. They believe that hypnosis is not a different state from waking (alert and relaxed) and sleep states—the person is simply responding to the suggestions.

Many psychologists and medical doctors believe hypnosis can help overcome physical and psychological problems.

Even most role-playing (non-state) theorists admit that hypnosis can have remarkable effects. If people believe in hypnosis, labelling a treatment 'hypnosis' may increase its placebo effect: they will believe that the treatment will work and will be more likely to experience positive outcomes.

8.6 INVESTIGATE

Media response: 'Aussie hypnotist puts UK club on winning streak'

Read the article 'Aussie hypnotist puts UK club on winning streak' and answer the questions.

1 Why did the Ipswich team employ a hypnotist?

2 When a person is hypnotised, they are open to suggestions. In this case, what suggestions have been given to the Ipswich players?

3 How has the Ipswich team performed since the two mass hypnosis sessions?

4 How do Collingwood's suggestions relate to positive self-talk?

5 a How can the team's improved performance relate to the belief that hypnosis is real?

b Does the team's improvement demonstrate that hypnosis is real? Could there be other reasons for the improved performance?

Aussie hypnotist puts UK club on winning streak

Meet the Australian hypnotist hired by an English Championship side to improve its performance—with startling results.

Since Ipswich Town engaged Perth-based Rick Collingwood, the struggling team has not lost in its past four outings.

Collingwood was recruited at the start of December after team officials heard about group hypnosis sessions he was holding in the UK.

He held two mass hypnotisms on the team at their training ground. 'They all go into a room together and go down into a trance,' Collingwood explained.

'Basically under direct suggestion they're told they'll perform better, they'll kick harder and more accurately. It enhances their natural capacities. It's just about maximising the inner potential they have already.'

He has also prepared a special hour-long CD for players to put on as they go to sleep each night.

Source: Daily Telegraph, 21 January 2009

8.7 INVESTIGATE

The hypnosis debate

1 Form teams to debate one of the following questions. You need to gather evidence (in the form of theories, case studies or research) to support your side of the argument.

- Does a hypnotic state exist?
- Can hypnosis treat medical and psychological conditions?
- Can hypnosis aid memory recall?
- Should stage shows that involve hypnosis be banned?

However, research about hypnosis and the treatment of medical and psychological problems has attracted criticism. Some psychologists argue the findings are based on poor scientific research methods, for example small sample sizes, lack of control groups and collection of invalid data in some studies.

Research in whether a hypnotic state exists is getting more technical. Brain recordings, such as electroencephalograph (EEG) and functional magnetic resonance imaging (*f*MRI), are being used to determine what occurs in the brain during hypnosis. Table 8.2 outlines some of the findings from brain recordings.

Research into this field is still inconclusive but it is an undeniable fact that hypnosis, whether real or not, has helped many people overcome serious physical and psychological problems.

8.8 INVESTIGATE

Please help Molly

Molly is a Year 10 student who has difficulty taking written tests. Her teachers often comment that her poor test results do not reflect her true understanding of the course material. Molly says that she panics and her brain 'freezes' when she walks into the test room. Her parents report that she often sits for hours concentrating on her work and her teachers comment that she can answer all the written questions at other times. Molly's psychologist suggests hypnosis to overcome this difficulty. However, Molly is scared of using hypnosis. Please write a short letter to Molly explaining what hypnosis is, why it may help and why she should not be scared.

TABLE 8.2» Evidence from brain recordings

Findings	Evidence for state theory	Evidence for role-playing (non-state) theory
EEGs, taken while under hypnosis, display more of a certain type of brain-wave (known as theta-waves).	These brain-waves are unusual when a person is awake or in a deep or dream sleep. Therefore, it shows that a hypnotic state exists.	These brainwaves can occur when a person is sitting quietly deeply concentrating on something. They are not unique to hypnosis.
Brain scans, under hypnosis, report an increase of activity in a certain part of the brain (the anterior cingulate cortex or ACC).	Activity in this area of the brain occurs when the brain receives conflicting information. For example, under hypnosis a person may report feeling no pain although another part of their brain reports extreme pain. Therefore, a conflict exists and a hypnotic state is different from being awake or asleep.	Similar ACC activity can occur among people not under hypnosis when they are asked to imagine or view things that contradict each other. This includes imagining yourself and an experience when you were younger rather than thinking of the present. Another example is when a person is asked to read colour words when the word is written in a different colour (e.g. red, yellow, blue).

REVIEW 8.3

1 What tricks can occur during a hypnosis stage show?
2 Why might hypnosis stage shows be considered unethical?
3 Outline the role-playing theory. How does this theory explain what happens to participants during hypnosis stage shows?
4 What is the role of the anterior cingulate cortex (ACC)? Why would you expect this to be active during hypnosis?

Answers to 8.1 Investigate: false, false, true, false, true, false (although there is some evidence that it has happened), false (unless given a hypnotic suggestion to forget that the hypnosis took place), debatable (true and/or false).

CHAPTER SUMMARY

- The term 'hypnosis' was coined from the Greek work for sleep, *hypnos*. Hypnosis, however, is not actually sleep. Today, hypnosis is commonly used in the treatment of some psychological and physiological problems. It is a powerful tool that can produce life-changing benefits.
- Misconceptions about hypnosis are often reinforced in popular media. For instance, the way in which hypnosis is used for entertainment purposes may be a reason why some people fear undergoing hypnosis.
- Not everybody can be hypnotised. Only 15 per cent of the population is extremely susceptible to hypnosis. Another 10 per cent is highly resistant and everyone else falls somewhere between the two extremes.
- People who are extremely susceptible to hypnosis tend to be able to: form vivid visual images; become completely focused on an activity and ignore distractions; be dependent on others; and be compulsive (often able to self-induce hypnosis). People who are susceptible to hypnosis also tend to believe and expect hypnosis to work.
- When a person is hypnotised, they tend to display the following characteristics: they are open to suggestion; they sit quietly and still; they focus entirely on the hypnotist's voice (or any item used as a focus by the hypnotist); they stop planning and making decisions.
- The Stanford Hypnotic Suggestibility Scale is the most commonly used scale that measures how deeply a person is hypnotised. It lists a number of suggestions of increasing complexity and difficulty. If a person follows the suggestion given by the hypnotist, they are said to have reached that level.
- Hypnosis has successfully assisted with: pain relief; the removal of warts and treatment of some skin diseases; breaking of habits; stress-related problems; learning and executing complex moves; and clinical therapy.
- The use of hypnosis to enhance or recover lost memories is controversial. It may have clinical therapy applications but memories 'recovered' under hypnosis can be unreliable.
- Stage hypnotists often use stage tricks and carefully select their participants on the basis of their presumed suggestibility. Stage shows highlight ethical issues with the use of hypnosis.
- Role-playing theorists believe that hypnosis is not an actual state of mind. People are merely playing a social role because of their belief that hypnosis exists and they will be unable to resist the hypnotist's suggestions. There is evidence that people selected to participate in hypnosis stage shows are those who, for a variety of reasons, would be inclined to follow instructions anyway.
- State theorists believe hypnosis is an actual state of consciousness. It is a different state from being asleep or awake as hypnosis exhibits its own special characteristics.
- Evidence from brain scans is now being used to determine what occurs in the brain during hypnosis.

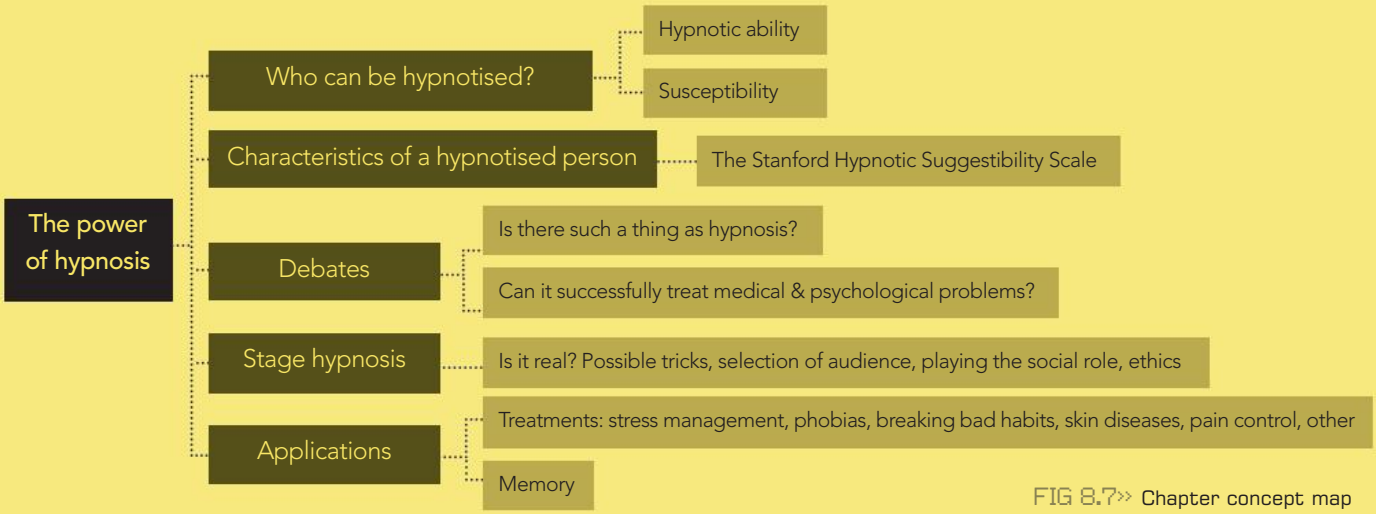


FIG 8.7» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 Hypnosis is:
   - **a** a stage of sleep
   - **b** a condition of increased openness to suggestions
   - **c** a trick commonly used to manipulate and embarrass people
   - **d** a method to increase awareness of all the events occurring around us and within our body.

2 A person undergoing hypnosis usually:
   - **a** feels more pain
   - **b** feels very relaxed
   - **c** has visual hallucinations
   - **d** has difficulty focusing their attention on the hypnotherapist's voice.

3 Entertainers who use hypnosis during their stage shows choose as their participants people who normally show:
   - **a** a lower than average level of suggestibility
   - **b** a lower than average level of intelligence
   - **c** a higher than average level of suggestibility
   - **d** a higher than average level of intelligence.

4 Approximately what percentage of the population cannot be formally hypnotised?
   - **a** 5 per cent.
   - **b** 10 per cent.
   - **c** 50 per cent.
   - **d** 90 per cent.

5 Critics of hypnosis claim that any effects displayed are simply due to the person:
   - **a** being highly motivated to respond to the hypnotist's suggestions
   - **b** being unmotivated to respond to the hypnotist's suggestions
   - **c** not believing in hypnosis
   - **d** not being able to remember the hypnosis experience.

6 EEG recordings during hypnosis:
   - **a** are the same as those during dream sleep
   - **b** are the same as those during deep sleep
   - **c** display less theta waves than normal when awake
   - **d** display more theta waves than normal when awake.

7 What is the definition of 'hypnosis' used in this textbook? Why is the term 'hypnosis' difficult to define?

8 Describe the typical characteristics of a person who is extremely susceptible to hypnosis.

9 What characteristics are displayed when a person is hypnotised?

10 Explain what the term 'open to suggestion' means.

11 What is the difference between a 'post-hypnotic suggestion' and 'post-hypnotic amnesia'?

12 Planning and decision-making are suspended while under hypnosis. What does this mean?

13 How do the levels on the Stanford Hypnotic Suggestibility Scale differ?

14 Under hypnosis, is a person more likely to do silly and embarrassing acts that they wouldn't normally do? Why or why not?

15 What is positive-self talk and how is this related to hypnosis?

16 Hypnosis has been used successfully to treat psychological and physical problems. Outline three useful applications of hypnosis in these areas.

17 Should memories obtained under hypnosis be used in a court of law? Explain your answer.

18 What is the placebo effect and why has it been linked with treatments that use hypnosis?

19 What are the ethical issues that surround the use of hypnosis purely for entertainment?

20 What is the state theory of hypnosis? What is the role-playing or non-state theory of hypnosis?

21 Outline one piece of evidence collected from brain recordings that has been used to support the state theory. How has this evidence been used to argue against the state theory?

Extend yourself

22 Find out more about pain reduction through hypnosis.

23 Explore the Australian Society of Hypnosis website. Who can undergo training at the society? WWW»

WHY DO I FIND YOU ATTRACTIVE?

HAVE YOU EVER HAD A CRUSH ON SOMEONE? HAVE YOU EVER WONDERED WHY—ESPECIALLY LONG AFTER THE CRUSH HAS DISAPPEARED? DO YOU BELIEVE IN 'LOVE AT FIRST SIGHT'? WHAT ATTRACTED YOU TO YOUR CLOSEST FRIENDS? WHAT DREW YOU TOGETHER?

We are social people, and spending time with others is extremely important to us. This chapter considers the factors that draw us to seek out the company of people that we would like as friends.

WHAT IS ATTRACTION?

'I suspect the secret of personal attraction is locked up in our unique imperfections, flaws and frailties' (Hugh Mackay, Australian psychologist, social researcher and writer). 'Attraction is beyond our will or ideas, sometimes' (Juliette Binoche, French actress). 'Attraction is not a choice' (David DeAngelo, American entrepreneur and author).

Interpersonal attraction is the study of attraction between people. It considers the degree to which we like others. Love is the most intense form of attraction and includes other elements such as sexual desire and deep concern for each other.

What influences attraction at the beginning of a relationship? Here we will consider some factors that play a role in developing new friendships between two people: both platonic (friends) and romantic. These factors may apply in the formation of a wide range of relationships including choosing your close friends at school, your romantic partner and the friends you go out with on weekends. They also apply to both opposite and same sex relationships.

FIG 9.1» Nicole Kidman with Keith Urban (left) and Michael Clarke with Lara Bingle (right). What do you think initially attracted these well-known couples to each other?

9.1 INVESTIGATE

Who are you attracted to?

1 Think of four people that you have been attracted to at one time in your life. They could be very good friends at school or someone romantic.
   - What attracted you to them in the first place?
   - Do they share any similar characteristics?
   - Do they live close to you or share similar classes or have a locker nearby?
   - Do they have similar beliefs, attitudes and values to you?
   - Do they like you?

2 Review your answers once you have finished this chapter. Are your answers typical of the findings in previous research?

FIG 9.2» Good friends often share similar characteristics.

IMPORTANT FACTORS THAT INFLUENCE ATTRACTION

There are several key factors that influence interpersonal attraction—proximity, familiarity, similarity, physical attractiveness, psychological attractiveness, the reciprocity principle and biosocial explanations. These factors help explain the reasons why we choose to spend time and develop relationships with certain people.

PROXIMITY

Your best friend is likely to be someone who lives near you, works with you, is in the same club or team as you or sits next to you in class. They are likely to be someone who is physically near you.

Proximity means being physically or functionally close to someone. The smaller the distance between two people, either at school, work, home or some other place they visit regularly, the more likely they are to be attracted to each other.

Many research studies show the importance of proximity. Festinger et al. (1950) studied students who were staying in college apartments.

The students were assigned to their apartments; they did not choose where they lived themselves. The researchers then asked them, 'Which student in the estate do you see most of socially?'

They found that students were the friendliest with those living next door, slightly less friendly with those two doors away and least friendly with those at the end of the corridor. They also found that students who lived near a stairwell had more friends, including those on the next floor, than those living at the end of the corridor.

FIG 9.3» Neighbours often become good friends.

9.2 INVESTIGATE

Next door neighbour

1 Study the plan of the apartment in Figure 9.4. According to research, who is likely to be a friend of resident G.1? Resident G.3? Resident 1.2? Resident 1.5?

2 **a** Think about your neighbours. Is it likely for next door neighbours to become friends? What about if they share the same driveway? Compare this with neighbours further down the road (four houses away) and next door neighbours who have their driveway on the opposite side to your house.

b Carry out a quick survey within your class to find out if your answer is supported.

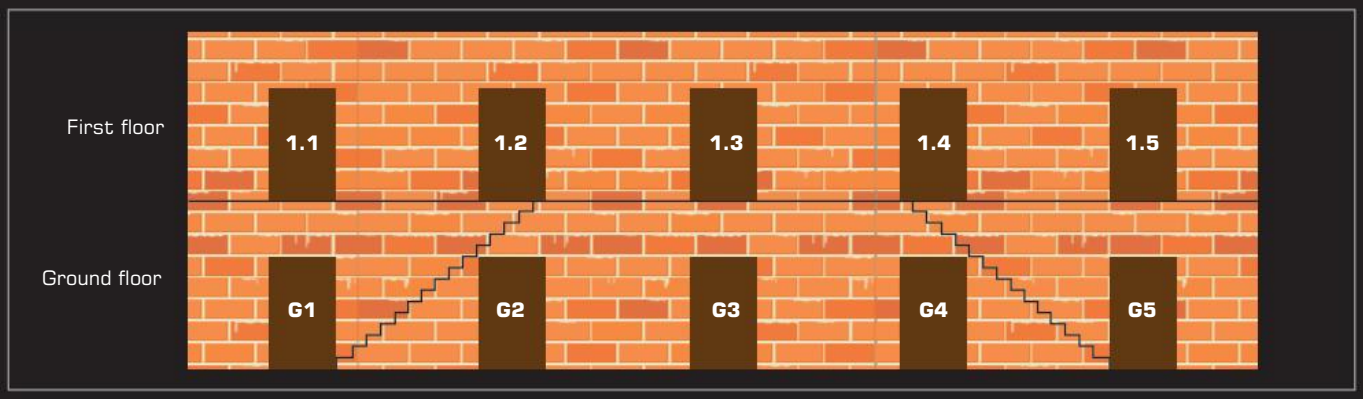


FIG 9.4» A plan of the college apartments used to study the effects of proximity (Festinger et al. 1950)

FAMILIARITY

Proximity is likely to lead to frequent interactions with someone. In turn, more frequent contact allows two people to know each other better and develop a relationship. In other words, closer proximity can lead to more encounters (**exposure**), which leads to **familiarity**. The more familiar we are with someone, the more likely we will feel attracted to them.

A study on police trainees supports familiarity (Segal 1974). The trainees were assigned to their apartments in alphabetical order. They were also seated alphabetically in their classrooms. After six weeks each trainee was asked to name their three closest friends in the police force. The trainees consistently chose people with surnames near their own in the alphabet. In fact, on average their friend was 4.5 letters away from them in the alphabet.

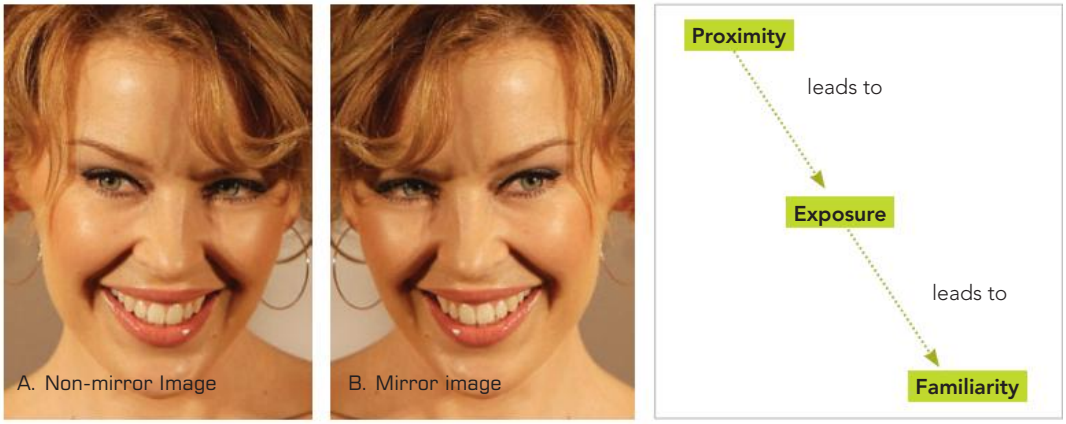


FIG 9.5» Australian singer Kylie Minogue is more likely to prefer her mirror image (image B) rather than image A based on familiarity. We are more likely to prefer image A. Which do you prefer? Why?

An interesting piece of research showed that familiarity can be extended to our own facial appearance (Mita et al. 1977). We prefer to look at mirror images of ourselves (the way we appear in the mirror) while our friends prefer the non-mirror image. We seem to like what we are familiar with.

Having frequent and relaxed encounters with someone and knowing something about their life seems to increase the likelihood of attraction. You need to be careful though. This doesn't mean that you should follow someone around if you want them to like you—you will make them feel uncomfortable. There are limits, and if you are not careful, such behaviour may become irritating, annoying or even boring. Don't invade their personal space!

9.3 INVESTIGATE

Mirror images

You can test this aspect of familiarity. Find a digital image of yourself. Reverse a copy of the image to create a mirror image and print both images.

1. Which image do you prefer?
2. Ask five members of your family and friends for their preference.
3. Is there a difference between your preference and that of your family and friends? Explain your results with reference to the factor of familiarity.

REVIEW 9.1

1. What does the term 'interpersonal attraction' mean?
2. In terms of proximity, why can close friendships develop online despite people being physically a long distance apart?
3. Outline a study that supports familiarity and attraction. Do you think there could be other factors involved? Explain your answer.
4. Why are we more likely to prefer a mirror-image picture of ourselves?

SIMILARITY

Are your friends *so* different from you? Does that *special someone* have similar interests to you? Do you share the same passion for a type of music or barrack for the same footy team?

Similarity could actually be the best prediction of attraction. Someone we perceive to be similar to us is more likely to support our beliefs, do the same activities, understand our needs and be easier to talk to. In agreeing with our beliefs, they provide support and confidence that our way of thinking is correct. This provides a boost to our self-esteem and reinforces our self-identity.

But what about those couples who seem to have nothing in common? Maybe you should look more closely. They may be similar in age, education, socio-economic level, personality, political beliefs and religion (one of the strongest factors). Perhaps they have seen each other enough to develop common interests. This is where proximity and similarity may overlap. You tend to live near those with a similar background, beliefs, attitudes and values.

In 1976, Hill studied college couples and found that they were likely to be similarly matched in religion, age, physical attractiveness, scores on aptitude tests, future plans and even height. Four years later he tested the same students and found that those couples who were more closely matched were more likely to still be together than those who were not.

We also appear to be attracted to people who laugh at the same jokes. We are attracted to those who laugh at our jokes or make us laugh. We tend to be more attracted to a stranger who has similar attitudes to us, and even more likely to find them attractive if they find the same joke funny.

These studies are not just limited to heterosexual couples or friendships. Men who are gay seem to be attracted to other men who have similar qualities to themselves. In one study (Boyden 1984), gay men who scored highly on stereotypical male traits were more attracted to males who were logical (a stereotypical male trait). Those who scored highly on stereotypical female traits preferred their partner to be more expressive (a stereotypical female trait).

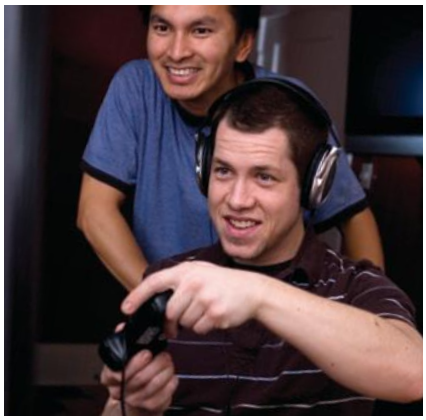


FIG 9.6›› Friends often share the same interests.

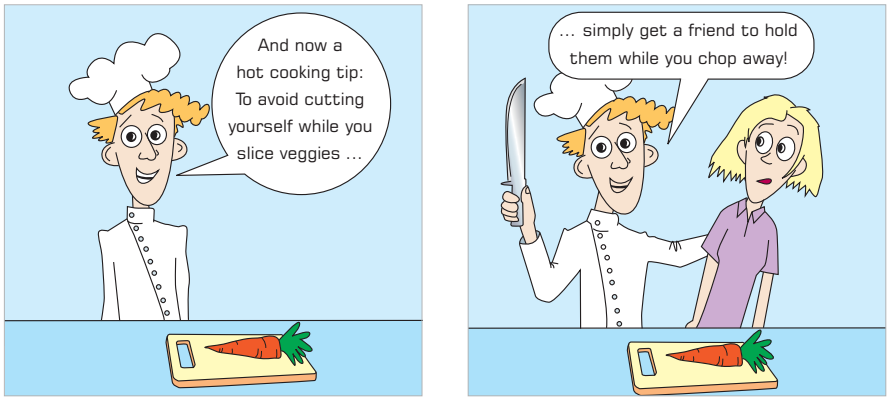


FIG 9.7›› How funny is this cartoon? We are more likely to be friends with people who share our sense of humour.

Another interesting finding relates to our actual name. According to the **Name Letter Effect**, we tend to gravitate towards people who have the same initials. Do any of your close friends' names start with the same initials? No wonder the authors of this textbook are good friends!

There is some conflicting argument, namely that we may dislike others who are *too* much like ourselves. Perhaps this is because we each like to view ourself as being one-of-a-kind: a wonderful, unique individual!

9.4 INVESTIGATE

What do you say?

Can you think of examples for the following two sayings?

a Birds of a feather flock together

b Opposites attract

Which saying do you think is more correct? Empirical research suggests that 'birds of a feather flock together' rather than that 'opposites attract'.

PHYSICAL ATTRACTIVENESS

9.5 INVESTIGATE

What makes a pretty face?

Think of a famous person who you consider to have an attractive face.

- What features make this person attractive? Eyes, nose, cheekbones, chin, eyebrows, shape of their face, ears, lips and so on?
- Do others agree with you? Carry out a survey.

Is the saying 'beauty is only skin deep' true? Do we consider good looks when we look for friendship, romance or both? We seem to be drawn to people who are physically attractive. Like it or not, physical attractiveness is very highly rated in our society.

To investigate the role of physical attraction, a 'get-acquainted' date was set up for a number of college students (Sprecher & Duck 1994). The researchers monitored the conversations and asked each participant about the date afterwards. They found that the main factor of romantic attraction was the physical attractiveness of the other person. To a lesser extent, females were more attracted when they enjoyed the conversation.

What makes a pretty face?

Exactly what makes a person physically attractive? This is a difficult question to answer as it appears to vary across cultures and over time. Also, not everybody agrees.

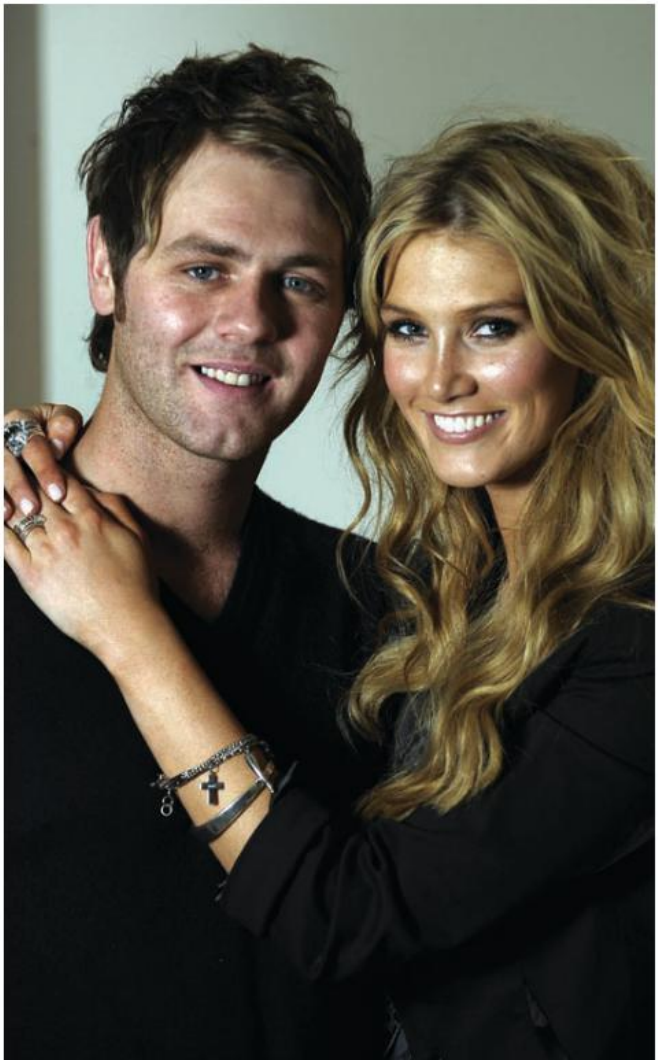


FIG 9.8» Brian McFadden and Delta Goodrem are both rated very highly on physical attractiveness scales.

Research suggests that most people prefer large eyes, a small nose and chin, and prominent cheekbones. When these features are actually measured, it appears that highly attractive faces are *more symmetrical* and *closer to average* within the culture than others (Langlois & Roggman 1994). This is similar across all cultures and accounts for differences found between male and female faces. In addition, in our culture, both males and females find an expressive face with a large smile attractive (Cunningham et al. 1990). Are you smiling now?

A study that investigated the appeal of facial scars reported interesting findings (Burriss et al. 2009). Heterosexual females were found to prefer males with scars for short-term relationships but equally preferred males with or without facial scars for long-term relationships. Heterosexual males showed no preference for either short- or long-term relationships. According to this study a scar is not unattractive. Females may even view scars as being attractive because they indicate health and bravery, at least in the short term!

You can view this study, partake in research, and investigate more research on facial attractiveness online. WWW

Remember that what one person finds attractive, the next probably won't. The ideal is in the eye of the beholder and there are many other influential factors at play.

9.6 INVESTIGATE

Beauty and attraction

Read the newspaper article by Deborah Smith. According to the article:

1 What role may genes play in attracting people to one another?

2 **a** List the facial features that are commonly associated with masculinity and femininity.

b Choose a famous person with the facial features of either masculinity or femininity. List the factors that led to your decision. Do you find the person physically attractive?

c Choose a famous person who you believe has an attractive face that does not have either masculine or feminine facial features. What makes their face attractive?

3 What other factors appear to be important for women when choosing potential partners?

Beauty: it's in the genes, but it helps to dress well

By Deborah Smith

BEAUTY really is more than skin deep. Whether a woman finds a man's face attractive can depend on his genes.

In particular, women like the look of men with diversity in their immune system genes, DNA tests on more than 70 Australian men have shown.

These men were judged to have more average facial features — not too big or not too small — a characteristic humans find appealing.

Hannie Lie, of the University of Western Australia, said her results supported the idea that standards of beauty are not arbitrary. Rather, our preferences in facial features — which are remarkably similar across all cultures — have evolved as a way of picking a high quality mate.

Men with genetically diverse immune system genes were likely to be healthier. "Genetic diversity is a form of genetic quality — the opposite of being inbred," she said.

And this was reflected in their faces.

The facial features that people around the world find most attractive are symmetry, averageness, femininity in women and masculinity in men.

Ms Lie and her colleagues tested the genetic diversity of 77 men and 77 women, looking right across their DNA code, as well as at a cluster of immune system genes known as the major histocompatibility complex, which helps fight off infections. The results are published in the journal Evolution.

But genes were not everything, Ms Lie said. Women choose partners on many factors, such as proximity in age and social background. "And men can do a lot of things to offset their lack of attractiveness, like dress well."

Adapted from the *Age, 27 September 2008, p. 11*

Matching hypothesis

But what about the majority of us? Are we attractive? Of course we are! Is there hope for romantic love? Indeed there is! The **matching hypothesis** proposes that we are more likely to be attracted to a partner who is of similar attractiveness to us.

A classic study that supports the matching hypothesis had participants rating the physical attractiveness of couples in photographs. The participants were shown photos of 'real' couples and other photos of 'random' pairs of people—people just photographed together for the purpose of the research. The 'real' couples were consistently found to be judged as more equal in attractiveness than the 'random' pairs. We seem to select people who are equal in attractiveness.

FIG 9.9» Concepts of physical beauty vary across different cultures.

Perception of physical beauty varies among different cultures. Physical features such as chipped teeth, body scars, tattoos and artificially elongated necks are considered attractive in some societies. Indeed, being thin is fashionable in our culture but not in others, including many Islamic cultures.

It is worth noting that some people are repulsed by physically attractive people because of their perceived vanity and self-obsession. In other words, they are viewed as being too precious about their looks and self-absorbed.

Attractive people are popular, though. Perhaps being liked by an attractive person means some positive characteristics could 'rub off' on that person. This is something you can debate in class and search online to find an answer. WWW»

When advertising for a friend in the newspaper, females are more likely to focus on physical aspects ('pretty', 'curvaceous', 'gorgeous') than are males ('handsome'). Males are more likely than females to advertise their social status and earning power and to seek a younger, attractive person (Dunbar 1995). This could provide evidence for the **complementary factor**, where one person seeks one thing from a relationship while the other seeks something else. People like to be with others whose needs, behaviours and resources complement their own. This provides a balance and some evidence that similarity may not always be important.

Love at first sight?

Can you find a suitable partner in just three minutes? Kurzban (2005) conducted speed-dating research with 10 526 participants who had taken part in a speed-dating service, one in which you meet 25 people in a session, each for just three minutes.

On what basis do you think each speed-dater judged their compatibility with each person? What qualities would you look for? Good looks, money, interesting job, social status, warm personality? The results were clear—most made a judgment on compatibility within the first three seconds. This

was well before they knew about the other person's sense of humour, interests or bank balance! Even though many participants could not sum up in words why they were attracted to a person, it seems that they knew almost instantaneously whether the person was for them or not. This finding highlights the importance of physical attraction, body language and making a good first impression—whether it be for a date, a job interview or an important meeting.

Does this research mean that love at first sight does exist? We still don't know. Speed-dating is not a typical way in which we interact. It may lead to a first or second date, but as far as long-term relationships are concerned, more research is needed.

FIG 9.10» Research on speed-dating found that most people make a judgment about the other person's compatibility within three seconds of meeting them.

9.7 INVESTIGATE

Play matchmaker

1. Based on the factors outlined so far, can you match two of the people in the 'personal ads' below? Give reasons for your match-ups.
2. Take careful note of the stereotypes that you use, especially regarding gender. It could be interesting to find out what you assume about a person from just a couple of sentences. Can you decide if each ad is written by a male or a female? Why/why not?

Seeking love and friendship

Inner-city professional (35 y.o.) seeks long-term relationship. Enjoys folk music, Italian food and crime novels.

Satellite city business executive wants to settle down with someone who loves animals, travel and reading.

I am passionate about life and **looking for adventure.** Are you honest and outgoing and a non-smoker?

Desperately lonely person looking for special someone for a warm and secure future. Must like kids and gardening.

Well-educated, family-orientated and romantic person seeking a lifetime friendship to share love of travel and cricket.

Shy person looking for a caring friend who enjoys good food, playing cards and watching old movies.

I'm **single and attractive** with a bubbling personality, seeking someone similar to enjoy life and good times.

30 y.o. person seeks a companion who enjoys good yarns and fishing. A boat would be an advantage.

Attractive self-employed 40-year-old seeking soul mate. You must enjoy Aussie rock music and have a sense of humour.

Single receptionist is looking for a fun-seeking partner. I am ambitious, vivacious and delicious. I enjoy painting, bike riding and yoga.

Suburban painter seeks a companion (25–35 y.o.) for friendship and perhaps more. Must enjoy musicals, the outdoors and football.

REVIEW 9.2

1. Why might we not like someone who is very similar to ourselves?
2. Besides having similar interests, what other similar factors may influence attraction?
3. Describe the facial features that most people find attractive.
4. What is the 'matching hypothesis'? Outline a study that supports this theory.
5. How does the 'complementary factor' relate to attraction?
6. Is there a link between facial scarring and attraction? Explain.
7. What research is available to suggest that speed-dating can be effective in forming short- or long-term relationships?

PSYCHOLOGICAL ATTRACTIVENESS

Do you look on the bright side of life? People are more likely to like those who display positive attitudes towards others and life in general than those who display negative attitudes.

According to this psychological factor, if you want someone to like you, be friendly, patient and listen. Keep positive and try to make your criticisms constructive.

9.8 INVESTIGATE

Warm and cold personalities

This activity is adapted from a classic study by Solomon Asch (1946). Asch considered how we form an impression of someone, especially with the information we receive first. In one study he looked at the difference the terms *warm* and *cold* would make on an impression. He found that 'warm' people were more likely to be considered popular, friendly and generous than 'cold' people. On the other hand, there was no difference between the terms *reliable* and *honest*.

List A	List B
intelligent	intelligent
skilful	skilful
industrious	industrious
warm	cold
determined	determined
cautious	cautious

Procedure

Following teacher instructions and ethical guidelines, find two participants. Test each participant one at a time.

1 For each participant, collect informed consent, and then read the following instructions:

I will read a list of words that describe a person. Please listen to them carefully and try to imagine the kind of person described. You will later be asked to fill in a checklist about this person. I will read the list slowly and will repeat it once.

2 Read List A slowly (one word per second) to the first participant and then repeat the list once.

3 Give the participant the checklist and a pen and say the following:

Here is a checklist of pairs of words. For the person described, circle one word from each pair that best describes the person.

Checklist:

- *generous or ungenerous*
- *popular or unpopular*
- *honest or dishonest*
- *reliable or unreliable*
- *sociable or unsociable*

4 Thank the participant for participating. Explain the experiment and the expected results.

5 Repeat for the second participant using List B.

Results

1 If available, pool the data with other members of your class.

2 Calculate the number of times the participants circled each adjective for List A and List B. Convert to percentages. Place in the table below:

Adjective	Class results %	
	List A	List B
generous		
popular		
honest		
reliable		
sociable		

Discussion

1 Based on the results, did you find any differences between List A and List B? Outline these differences.

2 Did your results support Asch's previous findings? If not, explain some possible reasons for this difference.

3 Were there any problems with this ERA that may have influenced the results (potential confounding variables)?

4 What is your conclusion from this study?

5 What implications do the findings have in terms of interpersonal attraction?

RECIPROCITY PRINCIPLE

Who are your closest friends? Most likely, the people you rank as your closest friends also consider you as one of their closest friends. If someone likes us, then we probably like them. This is known as the **reciprocity** principle. Interestingly, we tend to believe that someone likes us more if we like them. Therefore, liking encourages more liking and loving encourages loving.

Being around people who like us is good for our self-esteem. Reciprocity involves more thought processes than proximity and physical attractiveness. Thinking someone likes us is likely to lead to us liking them! Good sales representatives know about this factor and use it in their dealings with potential customers.

9.9 INVESTIGATE

Give a classmate a compliment

Turn to the students next to you in class and offer them genuine compliments. Then compliment two more students in the class that you normally do not sit next to.

1. How did it make you feel to give a compliment?
2. How did you feel when you received a compliment?
3. Can you relate this experience to the reciprocity principle? Explain your answer.

Gain–loss theory

An interesting theory is the **gain–loss theory** (Aronson & Linder 1965). Gain–loss theory states that we will like someone more if they originally didn't like us, but now they do. Conversely, if they originally liked us but then changed their mind, we will dislike them more than someone who didn't like us from the beginning.

To support the gain–loss theory, the researchers deliberately let participants overhear comments about themselves. When the comments were negative but then changed to positive, the participants rated the speaker more positively than if they just heard positive comments.

We must view a compliment offered to us as genuine. If we detect false flattery, then we are more likely to dislike the person. Maybe the saying 'flattery will get you nowhere' should be changed to 'false flattery will get you nowhere'.

BIOSOCIAL EXPLANATIONS

There are biological explanations for interpersonal attraction, with an emphasis on romantic attraction. Most are centred around biological sex differences, presume heterosexuality and focus on reproduction. For instance, some consider inbreeding issues—people tend not to be attracted to someone exactly the same (closely related) because there could be serious consequences for their children.

One recent study found that heterosexual males with blue eyes preferred blue-eyed females as partners (Laeng et al. 2007). Brown-eyed males and females with either blue or brown eyes showed no preference for eye colour in their partners. There could be a few reasons for these findings. One explanation is in evolutionary terms. Two blue-eyed parents can only have blue-eyed babies, whereas two brown-eyed parents or one parent of each colour can have both brown-eyed and blue-eyed babies. This is one way the male can feel confident that the child is his.

FIG 9.11» Prince Frederik and Princess Mary of Denmark first met in a crowded pub during the 2000 Olympic games in Sydney. Princess Mary, from Hobart, was working at a real estate agency at the time. Despite a world of difference between them, they were immediately attracted to each other. What factors of attraction do you think played a role at the start of this relationship?

Other interesting research in biological factors includes:

- the role of pheromones (bodily odours). We all secrete a unique, genetically determined body odour that influences attraction.
- parts of the brain, including the limbic system. The limbic system drives our emotions and therefore influences our feelings towards others.
- hormones such as oxytocin. There is evidence that oxytocin plays a major role in attraction, particularly in loving relationships.

Indeed, it seems that a mix of psychological, biological, cultural and social roles influences attraction between people.

IS FINDING A FRIEND REALLY THAT EASY?

An evaluation of the research

At first, the research does seem to suggest that we are a superficial lot. To look for a friend, we merely need to find a neighbour with a warm personality and similar interests who gives us compliments and is as attractive as we are!

There is much interest in attraction and how to find the perfect partner in our society. Indeed, it is a very popular research area and a topic that is relevant to everyone.

We live in a highly individualistic culture, and as a consequence most research has considered factors between just two heterosexual people with a view to marriage. Many studies look at two people in terms of romance and very short-term relationships, such as one or two dates. Some research is artificial, especially the older studies. Such a study lacks reality—it should be carried out in a real setting in everyday life. Many participants are in their late teens and early twenties, a time when they tend to overemphasise the importance of physical attractiveness and seek friends who are similar to reinforce their sense of identity.

Research methodology is changing and these days there is more research considering:

- practical implications in the natural world, with research in naturalistic settings rather than in artificial circumstances
- impacts of modern technology, such as Internet social networking pages, chat rooms and video links
- cultural aspects and differences
- relationships between friends (platonic relationships)—both same sex and opposite sex
- same-sex romantic relationships
- longer-term studies—more than just a glimpse (snapshot) at one time mainly with college students
- other factors such as third-party influences. For example, the role of family members and other friends.

This chapter focused on intial attraction. There are, however, many other factors that are important in maintaining long-lasting relationships.

9.10 INVESTIGATE

Please help Judy

Judy is about to move interstate and start at a new school. She is worried that she will not be able to make new friends.

Based on the findings in this chapter, offer Judy some advice to increase her chances of making new friends.

REVIEW 9.3

1. What qualities make a person psychologically attractive?
2. Use an example to explain the reciprocity principle.
3. Why must a compliment be genuine for the reciprocity principle to apply?
4. What is the 'gain–loss theory'? Use examples to explain your answer.
5. Outline one biological factor that may influence attraction.
6. Current research in the area of attraction is changing. There is an attempt to minimise the methodological concerns of the past. Identify criticisms of previous research methods that current researchers are trying to minimise and explain how they are attempting to do this.

CHAPTER SUMMARY

- *Interpersonal attraction* is the study of attraction between people. It considers the degree to which we like others. It relates to both platonic relationships (friendships) and romantic relationships. There are several key factors that influence interpersonal attraction including proximity, familiarity, similarity, physical attractiveness, psychological attractiveness, reciprocity and a number of biological factors.
- Proximity means being physically or functionally close to someone. The smaller the distance between two people, either at school, work, home or some other place they visit regularly (including online), the more likely they are to be attracted to each other.
- The more familiar a person is, the more likely we will feel attracted to them. This includes preferring to look at mirror images of ourselves (the way we appear in the mirror) while our friends prefer the more familiar non-mirror image.
- The more similar a person is to us, the more attracted we feel towards them. This includes similarities in interests, religion, socio-economic background, education, humour and age.
- Physical attraction may be important in the initial stages of a relationship and perhaps later on. Most people find faces that are *more symmetrical* and *closer to average* within their culture more attractive than others. The *matching hypothesis theory* proposes that we are more likely to be attracted to a partner who is of similar attractiveness to us.
- People who are psychologically attractive tend to be friendly, patient and good listeners. They tend to stay positive and their criticisms are constructive.
- We tend to find people more attractive if we think they like us (reciprocity). If someone likes us, then we probably like them.
- There are biological explanations for interpersonal attraction, with an emphasis on romantic attraction. Most are centred around biological sex differences, presume heterosexuality and focus on reproduction.
- Research methodology is changing and addressing the criticisms of most previous research. Changes include more research in naturalistic rather than artificial settings; taking into account cultural considerations; studying relationships between friends (platonic relationships), both same sex and opposite sex; studying same-sex romantic relationships; longer-term studies; and considering other factors such as third-party influences (e.g. the role of family members and other friends).

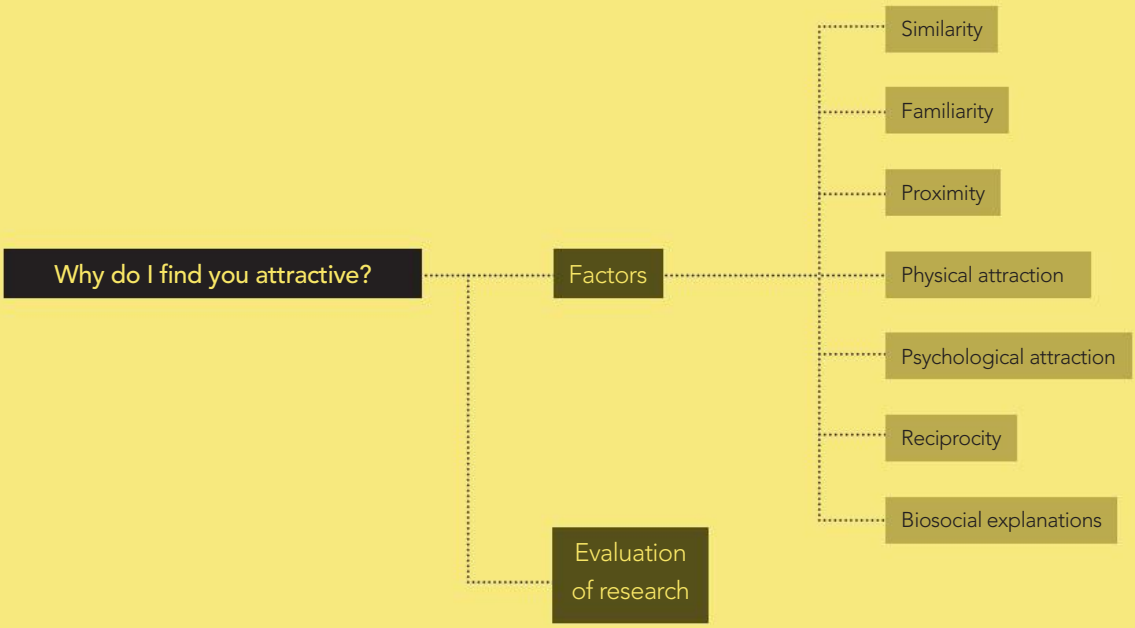


FIG 9.12›› Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 Interpersonal attraction is the basic reason for:
   - **a** most voluntary social relationships
   - **b** competition between rival corporations
   - **c** most involuntary work relationships
   - **d** cooperation between foreign countries.

2 We are generally attracted to people with whom we have frequent contact. Which factor of interpersonal attraction does this increased exposure initially relate to the most?
   - **a** similarity
   - **b** physical attractiveness
   - **c** familiarity
   - **d** reciprocity.

3 People with common backgrounds, attitudes and beliefs are often attracted to each other. This factor is known as:
   - **a** similarity
   - **b** physical attractiveness
   - **c** familiarity
   - **d** reciprocity.

4 Within a particular culture, an attractive face tends to have:
   - **a** very fine features
   - **b** larger than average features
   - **c** closer to average features
   - **d** unsymmetrical features.

5 We tend to like someone better when they don't like us at first but then do, compared with someone who likes us from the beginning. This is known as:
   - **a** matching hypothesis
   - **b** gain–loss theory
   - **c** reversible image factor
   - **d** similarity.

6 Why is proximity the major factor of interpersonal attraction?

7 Describe the matching hypothesis theory.

8 Explain why proximity and similarity tend to work together in influencing friendships.

9 Some people are now finding their ideal partner through online chat rooms. Indeed, many romances have begun despite the people involved being physically far apart. In this instance:
   - **a** Do proximity and similarity play a role in encouraging romantic relationships?
   - **b** What other reasons could lead to attraction? Explain your answer.
   - **c** Do you think there is value in using the Internet? Comment on the advantages and potential dangers.

10 List some of the people you are friends with. To what extent do proximity, familiarity, similarity, reciprocity, physical attractiveness and psychological attractiveness play a role in the strength of your friendship?

11 Interpersonal attraction is an important part of our lives.

- **a** What are some of the advantages in carrying out research on this topic?
- **b** Explain some of the limitations with this research, especially in terms of your life and culture.

12 Fill out the following table:

Interpersonal attraction						
Factor	Proximity	Familiarity	Similarity	Physical attractiveness	Psychological attractiveness	Reciprocity principle
Explanation						
Evidence (supporting research)						
Example (use one of your own)						

Extend yourself

13 If this topic interests you, try reading about the following psychological theories and concepts:

- Theories of romantic attraction: Sternberg's triangular theory of love and Hatfield's two types of love.
- Biosocial explanations for interpersonal attraction.

EMOTIONS EXPLAINED

CAN YOU IMAGINE WHAT LIFE WOULD BE LIKE IF YOU DIDN'T EXPERIENCE EMOTIONS? MOST LIKELY YOU CAN'T. WHAT WOULD IT BE LIKE WITHOUT HAPPINESS, ANGER OR EVEN FEAR? IMAGINE IT WAS YOUR BIRTHDAY AND SOMEONE GAVE YOU THE MOST WONDERFUL PRESENT. HOW COULD THE EXPERIENCE BE WONDERFUL WITHOUT THE FEELING OF SURPRISE AND JOY?

EMOTIONS MAKE PEOPLE HUMAN

Emotions are very much tied to our everyday experience. You could say that they are an essential part of our lives. They enable us to experience both the highs and the lows of life. Emotions are intertwined with motivation and mental health. Being overemotional or having difficulties experiencing emotions can lead to a range of problems, including social and relationship difficulties, lack of motivation and mental illness.

Something that at first appears to be a simple concept is actually part of what makes us very complex beings.

10.1 INVESTIGATE

How many emotions?

1. Make a list of as many emotions as you can.
2. Create categories for each emotion.
   - Are some emotions positive and others negative?
   - Are some emotions very similar?
   - Are there emotions within a category that vary in terms of intensity—from mild to intense (e.g. annoyance/anger/rage)?
   - How many categories did you create?
3. Discuss your finding with other members of the class.

FIG 10.1›› What emotion is shown on each face?

FIG 10.2›› An emotional high: Australian athlete Sally McLellan (centre), elated at winning the silver medal in the 100 m Hurdles at the 2008 Olympic Games

HOW MANY EMOTIONS?

I expect that your class identified a large number of emotions in 10.1 Investigate. Indeed, the list could seem endless. However, the categories you created most likely identified similar emotions. Plutchik's model is one popular theory that helps categorise the seemingly endless list of emotions.

PLUTCHIK'S PRIMARY EMOTIONS

Robert Plutchik (1994) has proposed one of several theories that address the question about the number of emotions. Plutchik's theory is an evolutionary theory. It is based on the premise that human emotions are largely innate (inborn) and that they evolved before thought.

Plutchik identifies eight **primary emotions**: fear, anger, joy, disgust, anticipation, surprise, sadness and acceptance. He believes that these primary emotions are the same for everyone—they are universal across all cultures. We are born with the ability to express these primary emotions.

But are there only eight emotions? Plutchik proposes that the range of emotions we experience is a result of blending or mixing primary emotions and thus creating secondary emotions. These secondary emotions are not universal—they can depend on learning and therefore can vary between cultures and individuals. Also, the level of intensity of a primary emotion can alter. Therefore, we can experience more than one primary emotion at a time and at different intensities. For example, terror and apprehension both involve the primary emotion of fear, just at different levels of intensity.

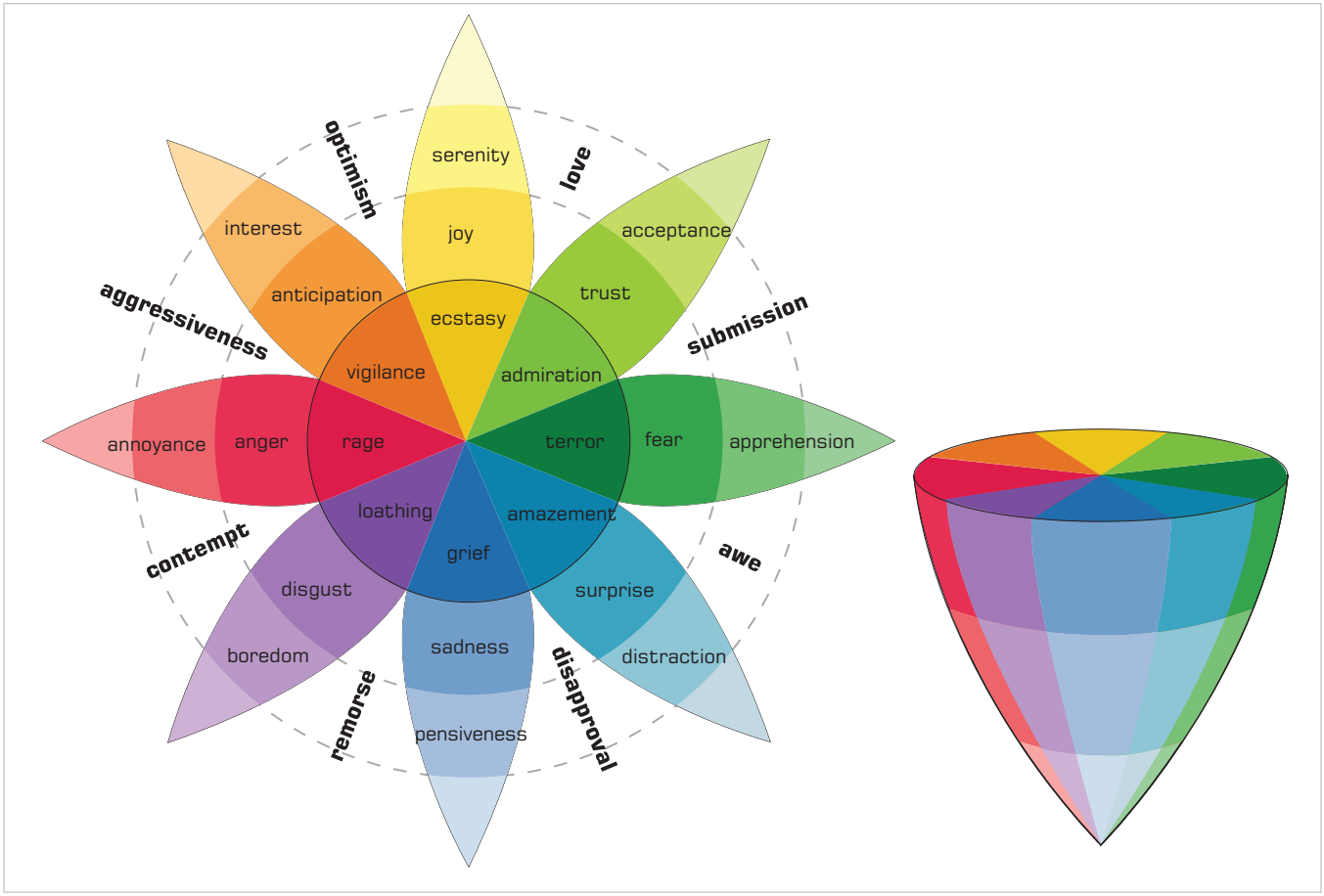


FIG 10.3» Plutchik's model identifies eight primary emotions. All others are a product of the level of intensity of the primary emotion (note the petals) and blending of the primary emotions into secondary emotions (white areas).

THE THREE COMPONENTS OF AN EMOTION

What are the parts of an emotion? It is generally accepted that there are *three* parts (components) to an emotion:

1. **subjective experience**—what we feel and label as an emotion (e.g. feeling ecstatic because your team won the grand final)
2. **expressive behaviour**—what others can see about what we are feeling (e.g. jumping up and down when the final siren sounded)
3. **physiological arousal within our body**—changes in heart rate, breathing rate, sweating and so on (e.g. your heart pounding when your team won the grand final). The extent to which these physiological changes occur, such as an increase in heart rate, is related to the intensity of the emotion. This physiological arousal is controlled by the autonomic (involuntary) nervous system.

REVIEW 10.1

1. List Plutchik's eight primary emotions.
2. According to Plutchik, what is a secondary emotion?
3. How does Plutchik explain emotions such as rage and annoyance?
4. Does Plutchik believe we are born with the ability to express primary emotions? What about secondary emotions?
5. What are the three parts to an emotion?
6. Think of an emotional situation you have experienced. Refer to this experience to explain the three components of an emotion.

10.2 INVESTIGATE

A happy time

It's time to reminisce about some previous emotional experiences. Please pick experiences that you are comfortable with and you must stop the activity if you become uncomfortable.

1. Think back over the previous year and relive a moment when you have been very happy.
   - **a** Describe what made you happy. What were your thoughts at the time?
   - **b** Describe the physical sensations you felt. How did you behave? How did your body respond? Were there any physiological changes to your body, such as increased heart rate or body sweat?
   - **c** Describe your behaviour. How did you express yourself?

   Probably just thinking about this happy time will cause a physiological change and some expressive behaviour (perhaps a smile and a giggle).
2. Now think of a time when you were very angry. How did your body respond?
   - **a** Describe what made you angry. What were your thoughts at the time?
   - **b** Describe the physical sensations you felt. How did you behave? How did your body respond? Were there any physiological changes to your body such as increased heart rate or body sweat?
   - **c** Describe your behaviour. How did you express yourself?

   Probably just thinking about this angry time will cause a physiological change and some expressive behaviour (perhaps a frown and a grunt).
3. Repeat the exercise for another intense emotion such as surprise, fear or sadness. Once again, were there any physiological changes in your body?
4. Think about your responses.
   - **a** Did your body respond the same way or differently for each type of emotion?
   - **b** Did your body alter its response depending on the intensity of the emotion? Explain.
   - **c** Do you think emotions have a physiological component? Explain.

THEORIES OF EMOTIONS

How can we explain the experience of an emotion?

Psychology is a very diverse subject and so are the theories of emotions. Included in this mix are the following commonly discussed cognitive theories:

1 James-Lange theory
2 Cannon-Bard theory
3 Schachter's two-factor theory

The use of an example is probably the best way to explain these theories. Lolita is scared of spiders. A spider has jumped onto her school bag and she is trembling.

COMMONSENSE VIEW

Before reading about the theories, most of us would take the commonsense view. That is, Lolita sees the spider, experiences fear (subjective experience) and then starts to shake (physiological arousal).

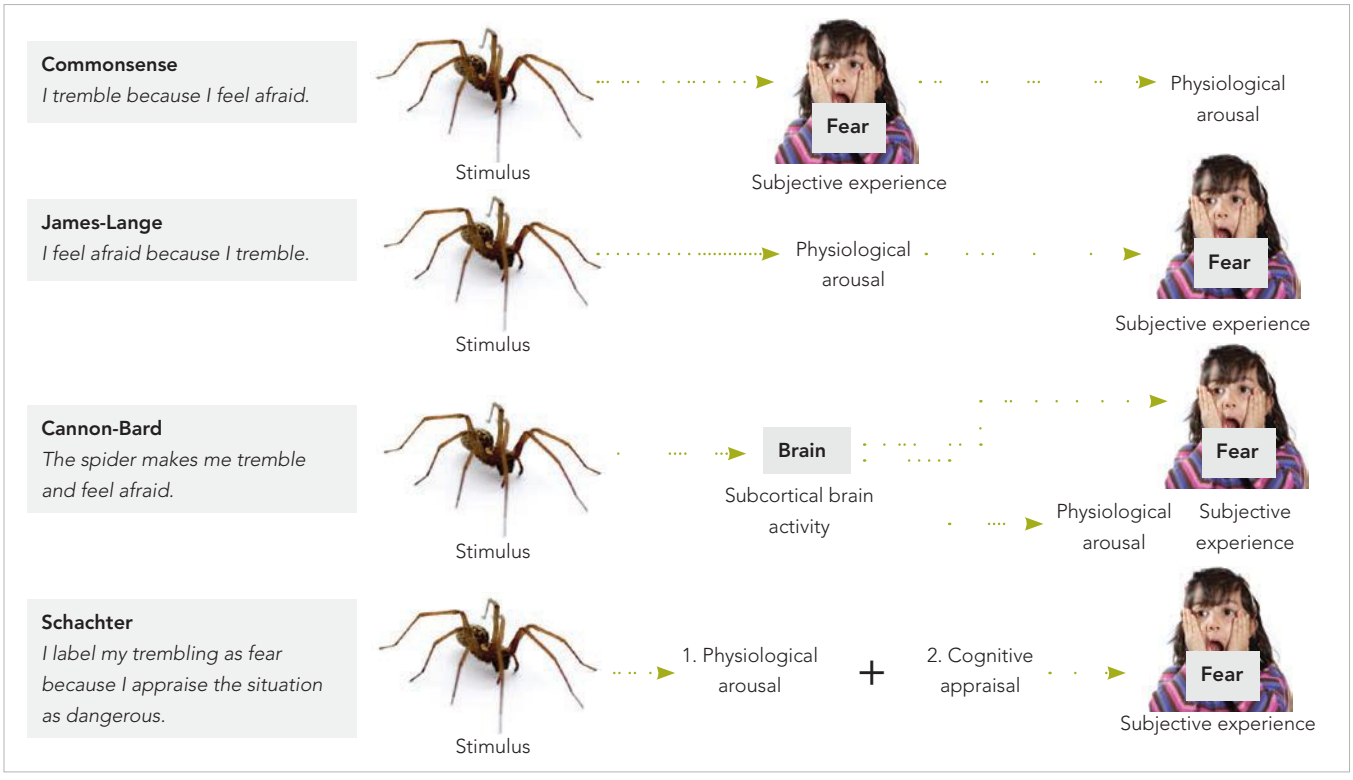


FIG 10.4» Theories of emotion. A summary of the three popular cognitive theories along with the commonsense view. Each attempts to explain Lolita's emotional experience on viewing the spider.

JAMES-LANGE THEORY

Awareness of physiological arousal causes emotions

The **James-Lange theory** proposes that physiological arousal occurs first. Lolita sees the spider, then physiological changes occur in her body. Lolita becomes aware of her body's arousal and then experiences fear.

In support of James-Lange theory are studies considering the facial feedback hypothesis. The **facial feedback hypothesis** predicts that changes in your facial expressions can produce emotional experiences to match these changes. In other words, smiling will make us happier, frowning will make us sadder and so on. The physiological changes will cause the subjective feeling.

Test it for yourself. Forcing yourself to smile may have some positive consequences.

Remember to use your whole face to smile, including your eyes, in order for this message to register in your brain and give you the 'buzz' of happiness!

FIG 10.5»
Laughter groups are now becoming more popular as people recognise the benefits of expressing positive emotions.

10.3 INVESTIGATE

Put on a happy face

1 Rate your current mood on a scale from 1 to 10.

Not at all happy 1 2 3 4 5 6 7 8 9 10 extremely happy

2 Put a pen between your teeth and give a big, hearty smile. Involve your whole face, including your eyes (fake smiles won't work). Hold that smile for the next 10 minutes.

3 Now rate your mood again, on a scale from 1 to 10.

Not at all happy 1 2 3 4 5 6 7 8 9 10 extremely happy

4 Did your results support the facial feedback hypothesis? Explain.

5 What implications could these findings have in your life? When would you like to improve your mood? What effect could frowning have on your mood?

CANNON-BARD THEORY

Physiological arousal and subjective experience occur at the same time

The **Cannon-Bard theory** offers another alternative theory. It states that once we become aware of the event (Lolita sees the spider), this information triggers both physiological arousal (trembling) and the subjective experience (fear) *at the same time*. The emotion is a result of noticing the spider, not noticing our physiological changes (as in James-Lange theory).

The Cannon-Bard theory of emotion has received some support. Some studies suggest that physiological changes are not necessary for an emotion to occur. People with severe spinal cord damage, for example, can experience the full range of emotions despite their bodies being unable to provide physiological feedback to the brain.

However, it is wrong to assume that physiological arousal has no influence on emotion—many other studies have shown that it plays an important role.

SCHACHTER'S TWO-FACTOR THEORY

How can you tell one emotion apart from another? Schachter went one step further and added an extra factor, a thinking factor known as 'cognitive appraisal'. While physiological arousal may be similar, an emotion cannot be felt until the situation is interpreted in an emotive way.

Let's pretend that Lolita's friend, Elijah, collects spiders. He walks into the room and sees the spider.

- Elijah's body starts trembling (physiological change).
- Elijah perceives this change and thinks about the situation (cognitive appraisal).
- Elijah realises that he is trembling because he identifies the spider as a rare species that is not in his collection.
- Therefore, he feels excited (emotion—the subjective experience).

Schachter's two-factor theory proposes that the emotions we experience are determined by the label we attach to the physiological changes we experience. We determine the label using external cues—what is going on in our external environment (outside our bodies). In other words, what we think about something will affect what sort of emotion we will experience.

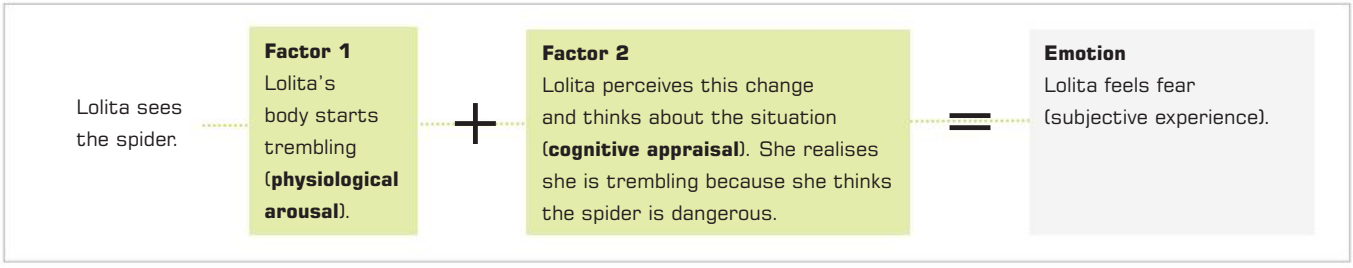


FIG 10.7» Schachter's two-factor theory proposes that emotions are determined by how we label physiological changes.

CASE STUDY

Falling in love on a suspension bridge

A classic experiment by Dutton and Aron (1974) supports Schachter's two-factor theory. An attractive female experimenter asked males (18 to 35 years old) to fill in a survey about the scenery as they crossed a bridge.

There were two experimental conditions. The experimenter asked males either on an extremely unstable and long *suspension* bridge or on a short *solid* wooden bridge. The suspension bridge was chosen because it is tricky to cross and would therefore increase physiological arousal (high arousal group). The solid bridge was easy and safe to cross and so physiological arousal would be minimal (low arousal group).

After completing the survey, the unsuspecting participants were invited to call the experimenter if they wanted more information about the research.

Those who were on the suspension bridge were expected to call the experimenter due to being more aroused than the solid bridge group.

In line with Schachter's two-factor theory, four times as many participants in the high arousal group (suspension bridge) phoned the experimenter to ask for a date than those in the low arousal group (solid bridge). They were also more likely to make up a story with sexual references.

The males on the suspension bridge (high arousal) appeared to have interpreted their increase in physiological arousal as sexual attraction rather than fear or anxiety.

10.4 INVESTIGATE

Romantic settings

Your teacher will need some time to prepare this activity. You need a dark and warm room, candles and chocolate (optional).

1. All students must find a partner before entering the classroom. You are allowed to talk only to your partner and you must talk in a low voice.
2. Upon entering the darkened room, sit opposite your partner and place a candle between the two of you.
3. Talk quietly to each other about whatever comes to mind for the next ten minutes. Eat your chocolate during this time.
4. Now relate this activity to Schachter's two-factor theory.
   - **a** Did you experience any physiological changes (e.g. increased heart rate, pupil dilation [enlargement], increased sweating)?
   - **b** In what situation would two people go out to a candlelight setting? Would you expect them to have a good time and have feelings for one another?
   - **c** If you experienced a physiological change and appraised the situation as being romantic, what emotion could you feel?
   - **d** How else could you have interpreted this situation? What other emotions could you have experienced?

REVIEW 10.2

Attempt to explain Elijah's experience using each theory of emotion.

FIG 10.6›› Candlelight dinner, roller-coaster ride and bushwalking. Can you relate these experiences to Schachter's two-factor theory and the beginning of romance? (Relate this experience to 10.4 Investigate.)

Our thinking can also affect our emotions when we interpret different events even when there is little physiological arousal. Imagine you are on the bus coming home from school. The traffic is unexpectedly heavy and moving very slowly. Your reasoning for the heavy traffic will determine what emotion you feel.

- You could decide that there are road works ahead and this is causing the delay. In this case you may feel somewhat *frustrated*.
- Alternatively, you could remember that a friend usually drives along this road at this time of day, and suddenly you become *anxious* that they may have been in a car accident. Your concern for their welfare affects your emotions.

Our expectations about an event can also affect our emotional experience. For instance, if we are told that a movie is very sad, we are more likely to feel sadder when we view it than if we are told that it isn't sad at all.

This clearly explains why people will experience widely differing emotional responses to the same stimulus or event. Someone who loves motorbike riding, for example, may feel positively excited even thinking about it, whereas a non-risk-taker may feel terrified at the thought alone!

Further to this, changing one's thoughts or beliefs can result in a dramatic change in the emotion and associated behaviours.

REVIEW 10.3

1. What is the James-Lange theory of emotion?
2. How does the facial feedback hypothesis support the James-Lange theory of emotion?
3. What is the Cannon-Bard theory of emotion?
4. Why doesn't the facial feedback hypothesis support the Cannon-Bard theory of emotion?
5. What does 'cognitive appraisal' of the situation mean?
6. Why is cognitive appraisal important in Schachter's two-factor theory?
7. Give an example of how our thoughts can influence emotions.

10.5 INVESTIGATE

Funny cartoons and expectations

Our expectations can influence our emotional experience. One study asked participants to rate cartoons on a scale from very funny to not funny (Wilson, Lisle, Kraft & Wetzel 1989). Students who were previously told the cartoons were funny tended to view them as being funnier than did participants who were told they were not funny at all.

1. Find at least four cartoons. Your teacher may pool all the cartoons together or source them for you.
2. Find two volunteer participants and carry out informed consent procedures.
3. For the first participant, give the following standardised instructions and rating form: *You will be asked to rate four cartoons that the psychology class considers to be very funny. Rate each cartoon in terms of how funny you think it is with 1 being 'not funny at all' and 5 being 'very funny'.*

	Not funny at all	Not very funny	Neutral	Funny	Very funny
Cartoon 1	1	2	3	4	5
Cartoon 2	1	2	3	4	5
Cartoon 3	1	2	3	4	5
Cartoon 4	1	2	3	4	5

4. Offer the cartoons, one at a time. Collect the rating scores. Debrief the participant.
5. Follow the same procedure with your second participant, except change the standardised instructions to the following: *You will be asked to rate four cartoons that the psychology class considers to be not funny at all. Rate each cartoon in terms of how funny you think it is.*
6. Pool the class results. Calculate the mean scores for rating between both groups.
7. Were there any differences between the two experimental groups?
8. Did your findings support previous findings by Wilson et al. (1989)? Explain.
9. What practical implications could these findings have in everyday life?

BRAIN STRUCTURES AND EMOTIONS

Physiological arousal is controlled by the autonomic nervous system, which is ultimately controlled by the brain. Within the brain there are other structures known to play a role in the experience of emotions.

THE CEREBRAL HEMISPHERES

As mentioned in earlier chapters, the cerebral cortex of the brain is divided into two hemispheres. For most people, the **right hemisphere** is more involved in recognising emotional situations and controlling the appropriate emotional response. While the **left hemisphere** is aware of the emotional situation, it is more involved in making plans often without allowing for the emotional situation.

TABLE 10.1›› The brain hemispheres and their role in emotions

Left hemisphere	Right hemisphere
Overall: Planning and rational thought	Overall: Recognising emotional situations and controlling the appropriate emotional responses
Left frontal lobe: Involved in planning and rational thought More active when given good news or thinking positive thoughts	Right frontal lobe: Producing facial expressions and tone of voice More active when given negative news or thinking negative thoughts
	Right parietal and temporal lobes: Recognising emotions in others
Damage to left motor area: May cause a catastrophic reaction	Damage to right motor area: May cause an indifference reaction

A person with damage to the motor area of the right hemisphere will have paralysis on the left-hand side of the body. However, they may be quite unmoved or indifferent about this situation and make plans regardless. The left hemisphere is now more involved. This is called an **indifference reaction**.

This can be quite different when the damage is in their left hemisphere's motor area. This would probably cause paralysis on their right-hand side and perhaps a severe emotional response such as severe anxiety or depression. The right hemisphere is now more involved. This is appropriately named a **catastrophic reaction**.

The *right* frontal lobe is more involved with producing facial expressions and tone of voice for the emotion while the *right* parietal and temporal lobes appear to be more involved with recognising other people's emotional reactions.

To conclude that the left hemisphere is completely non-emotional and operates independently is oversimplifying the issue. Both hemispheres are involved in the emotional experience. PET scans have shown that the *right* frontal lobe is more active than the left hemisphere when a person is asked to think negative thoughts or given negative news. The *left* frontal lobe is more active when given good news or asked to think positive thoughts (Tomarken & Davidson 1994). There are no simple conclusions: all parts of the brain can be involved in the experience of and response to an emotion. In addition everyone's brain is different and the parts of the brain that are involved may differ slightly from one person to the next.

did you know? In 1908, a woman with severe mental disturbances repeatedly tried to choke herself with her left hand. At the same time her right hand would try to pull her left hand away from her throat. She also engaged in other destructive behaviour, such as ripping up her bed sheets and clothes. However, she only ever did this with her left hand. This became known as the 'alien hand' syndrome. Her brain was studied when she died and it was found that her corpus callosum was severely damaged. Communication between the two hemispheres was disrupted. Her right hemisphere, controlling her left hand, responded in a catastrophic way while her left hemisphere, controlling her right hand, seemed indifferent to the situation and continued on without an emotional reaction. This reported case, while ocurring over 100 years ago, highlights the need for the right and left hemispheres to communicate.

THE HYPOTHALAMUS

The hypothalamus plays a central role in converting emotional messages from the cortex into autonomic and endocrine responses. This means it controls physiological arousal and hormonal reactions. The hypothalamus plays a role in causing or preventing aggressive behaviour.

LIMBIC SYSTEM

The **limbic system** contains a number of structures in the brain that interact and are probably involved in emotional experiences and behaviours. For example, the **amygdala**, small structures deep within the brain, are associated with strong emotions such as fear and aggressive behaviour. Up until the 1970s, removal or making lesions in the amygdala was one drastic method to reduce aggression in children and adults.

THE ADOLESCENT BRAIN

Ever heard of a parent complaining about their moody teenager?

Adolescence marks a time of great brain development. It is a time when the brain streamlines itself for more efficient communication between its different areas. This is especially true for two parts of the brain—the prefrontal cortex (part of the frontal lobes) and the amygdala (part of the limbic system). The prefrontal cortex plays a key role in planning and impulse control. The amygdala is important in reading other people's emotions and feeling emotions.

The trouble with the teenage brain, however, is that different parts of the brain tend to mature at different rates. The prefrontal cortex is usually the last to mature. The amygdala may play a stronger role in behaviour and therefore regulating emotions can be difficult. This means that teenagers are more prone to misinterpreting others' emotions, making risky decisions, experiencing mood swings and displaying aggressive behaviour. Add hormonal changes into the mix and adolescence can be a very interesting time.

We cannot blame teenage behaviour entirely on biology though. It certainly is not an excuse for anti-social behaviour. Environmental influences also play a key role. Upbringing, support from family and friends and the experience of stressful situations are also important. The interaction between environment and biology can make adolescence a turbulent time.

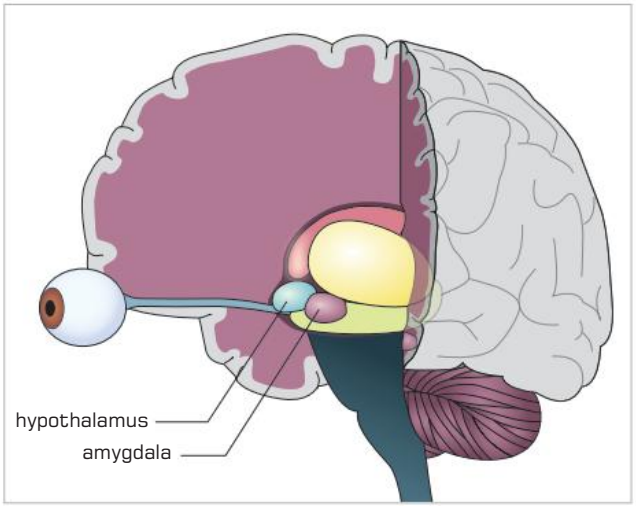


FIG 10.8» The hypothalamus and the limbic system, including the amygdala, play a central role in emotional experiences.

10.6 INVESTIGATE

Media investigation

Go online to the ABC website to find out more about the teenage brain. WWW»

Watch 'Teen brain' (*Catalyst*) and 'Moods' (*Whatever! The Science of Teens*, Episode 4) and listen to 'The modern teenager: myth or marvel?' (*All in the Mind*).

CASE STUDY

Charles Whitman

FIG 10.9» Charles Whitman

In 1966, Charles Whitman, a 25-year-old Texas student, committed horrendous crimes. He murdered his mother and wife and then went on a shooting spree from the observation tower of the University of Texas. Here he murdered a further 13 people and wounded 31 others. The police eventually shot and killed Whitman.

Whitman kept a journal and wrote a suicide note that provides some insight into his thinking. In the note he wrote:

'I do not really understand myself these days. I am supposed to be an average reasonable and intelligent young man. However, lately I have been a victim of many unusual and irrational thoughts ... After my death, I wish that an autopsy be performed on me to see if there was any physical disorder' (cited in Johnson 1972).

An autopsy was performed. A small brain tumour was found although its precise location was difficult to determine due to his fatal wounds. It appears that it may have been pressing on the amygdala, part of the limbic system that is associated with aggression.

It must be clear that this tumour offers no excuse for such chilling crimes. Whitman's upbringing, events leading up to the shootings (including increased headaches and aggression) and a visit to a psychiatrist where he revealed he felt the urge to 'start shooting people with a deer rifle' also offer insight. Indeed, there are many people who continue to struggle to come to terms with this disturbing event.

Tragically, Whitman's actions have been copied in other places around the world. References to his shooting rampage can be found in song lyrics and even on an episode of *The Simpsons*, 'Homer Loves Flanders', in which Ned has a dream that he kills Homer from the tower.

REVIEW 10.4

1. What is an 'indifference reaction'? Which part of the brain is likely to be damaged to cause an indifference reaction?
2. What is a 'catastrophic reaction'? Which part of the brain is likely to be damaged to cause a catastrophic reaction?
3. What is the role of the hypothalamus?
4. What strong emotions are associated with the amygdala?

CONCLUSION

Can you think of a song lyric that suggests emotions are tied to the heart? You probably can. Perhaps these feelings can be linked with the physiological arousal associated with a strong emotion (your heart pumps faster, heart rate increases). Or we can take the less romantic view and consider how physiological arousal, the autonomic nervous system and brain structures are linked to emotions, and also theorise about the number of emotions and the cognitive (thinking) elements?

Our subjective responses to experience can lead to varying emotions, which can in turn affect (that is, have an emotional impact on) future thoughts and behaviours. The affective, behavioural and cognitive components, while influencing one another, can be quite independent. Our subjective experience of an emotion is linked to the way our body physiologically responds and can have far-reaching implications in our lives. We will revisit emotions in chapters 11 and 17.

CHAPTER SUMMARY

- Emotions are very much tied to our everyday experience. They enable us to experience both the highs and the lows of life. Being overemotional or having difficulties experiencing emotions can both lead to a range of problems, including social and relationship implications, difficulties with motivation and mental illness.
- Plutchik has identified eight primary emotions: fear, anger, joy, disgust, anticipation, surprise, sadness and acceptance. These eight primary emotions can mix with each other to create secondary emotions. The primary emotions can also vary in intensity. For example, terror and apprehension both involve the primary emotion of fear, just at different levels of intensity.
- According to the James-Lange theory of emotion, physiological arousal occurs first and then our subjective feelings.
- The facial feedback hypothesis predicts that changes in facial expressions will produce matching emotional experiences. If a person smiles, then they are more likely to become happy. This supports the James-Lange theory that physiological changes must occur first.
- According to Schachter's two-factor theory, physiological arousal and cognitive appraisal of the situation occur simultaneously before the subjective feeling. An emotion cannot be felt until the situation is interpreted in an emotive way.
- Typically, the right hemisphere of the brain is more involved in recognising emotional situations and controlling appropriate emotional responses. The left hemisphere is more involved in planning without allowing for the emotional situation. Other parts of the brain play key roles in emotions, including the hypothalamus and the limbic system.

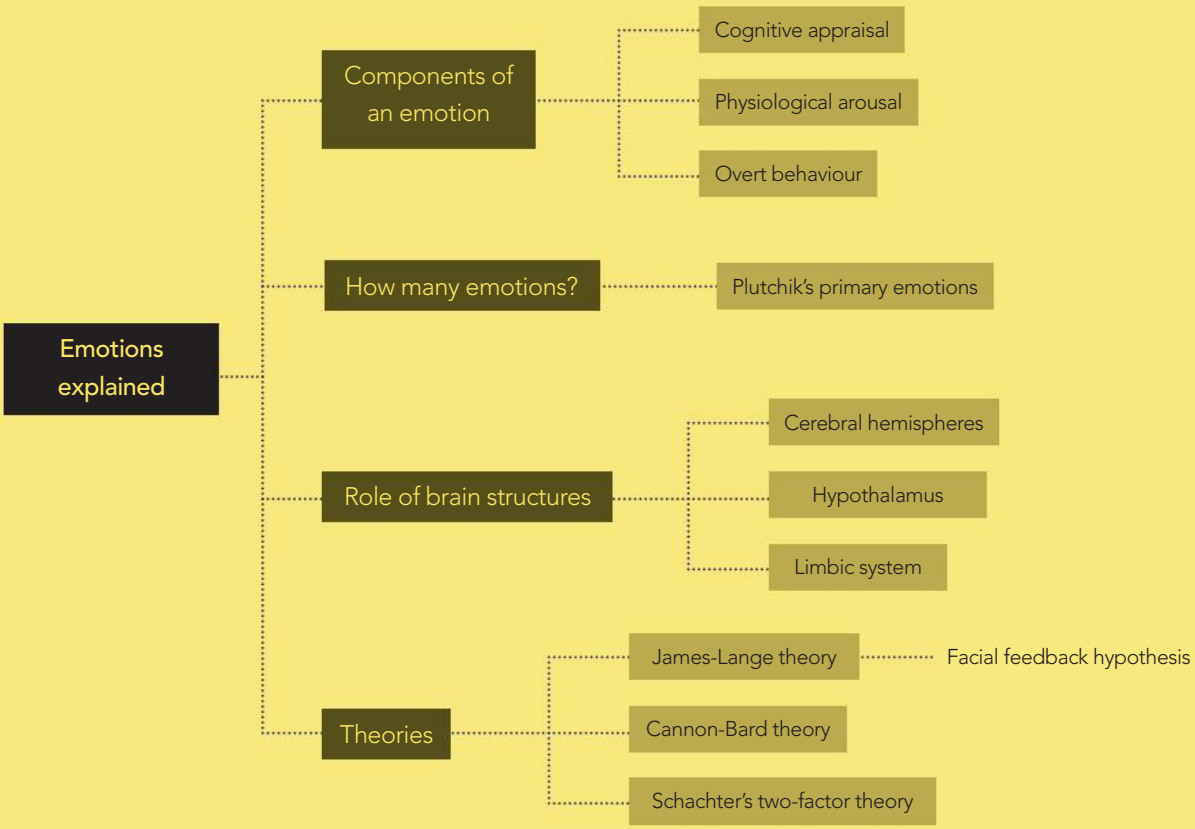


FIG 10.10» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 The _____ controls the physiological arousal associated with emotions.
- **a** autonomic nervous system
- **b** central nervous system
- **c** somatic nervous system
- **d** left hemisphere of the brain.

2 According to Plutchik, there are _____ primary emotions.
- **a** 6
- **b** 8
- **c** 10
- **d** 12

3 The facial feedback hypothesis provides evidence that:
- **a** cognitive appraisal is necessary for emotion
- **b** emotions can influence facial expressions
- **c** watching other people's facial expressions can influence our emotions
- **d** facial expressions can influence emotions.

4 The _____ is more involved in producing facial expressions that relate to an emotion.
- **a** right parietal lobe
- **b** left parietal lobe
- **c** right frontal lobe
- **d** left frontal lobe.

5 The amygdala is part of the limbic system that is strongly related to the expression of:
- **a** happiness
- **b** sadness
- **c** acceptance
- **d** fear

6 The _____ theory of emotion states that part of our brain triggers both the physiological and emotional experience at the same time.
- **a** Plutchik's
- **b** Cannon-Bard
- **c** James-Lange
- **d** Schachter's two-factor.

7 Describe the three components of an emotion.

8 Compare and contrast the James-Lange and Cannon-Bard theories of emotion.

9 What is the facial feedback hypothesis?

10 Outline evidence that supports Schachter's two-factor theory of emotion (such as the suspension bridge study).

11 According to Plutchik, what is the difference between primary and other emotions?

12 Sara went for a 5 km run. This increased her heart rate and breathing rate. However, immediately after her run, Sara did not feel any strong emotion despite this physiological arousal.
- **a** Explain how Schachter's two-factor theory can account for this lack of emotion at the end of Sara's run.
- **b** Explain why the James-Lange theory does *not* account for this lack of emotion.

13 How can expectations influence our emotional experience? Give an example.

14 Charlie has been in an accident and has extensive damage to the motor area of his left hemisphere.
- **a** Which side of his body is more likely to be paralysed?
- **b** Is it more likely that he will experience an indifference reaction or a catastrophic reaction in response to the seriousness of his injuries?

15 Pronounce the sound ee and then pronounce the sound oo. Saying ee over and over again has been linked to positive emotions while oo has been linked to negative emotions (Zajonc et al, 1989).
- **a** How do these findings relate to the facial feedback hypothesis?
- **b** Which theory of emotion do these findings support?
- **c** Design and conduct an experiment to test these findings.

Extend yourself

16 Find out about Schachter and Singer's (1962) well-known adrenaline experiment and how it supports Schachter's two-factor theory. Would the study meet current ethical standards? Discuss.

17 Go online to find out about laughter clubs. How popular are laughter groups in your area? What evidence suggests that laughing is beneficial?

BODY LANGUAGE AND EMOTIONS

HAVE YOU EVER MISINTERPRETED A MESSAGE FROM SOMEONE? HAS THIS GOT YOU INTO TROUBLE OR CAUSED SOME CONFUSION?

A MAJOR PART OF OUR LIVES IS SPENT COMMUNICATING WITH OTHERS. WE WANT OTHERS TO UNDERSTAND US AND WE WANT TO UNDERSTAND OTHERS.

GETTING THE MESSAGE RIGHT IS OF UTMOST IMPORTANCE. OUR MESSAGES ARE MIXED WITH EMOTIONAL CONTENT TO HELP EXPRESS OUR THOUGHTS AND FEELINGS. BODY LANGUAGE CUES CAN ACCOUNT FOR 60 PER CENT OR MORE OF THE MESSAGE.

In this chapter we will consider the way we express emotions through our verbal and non-verbal behaviour.

THREE COMPONENTS OF AN EMOTION

As we learnt in Chapter 10, there are three components attached to each emotion.

1. Our subjective experience—what we feel and label as an emotion. This is our experience of emotions such as fear, happiness, anger, disgust, sadness and surprise. (See Chapter 10 for more detail about the range of emotions and theories of emotions.)
2. Our expressive behaviour—what others can see about what we are feeling.
   Can you tell when someone is angry? How do they express their emotion? Verbal and non-verbal cues assist us in reading other people's emotions. This component is the main focus of this chapter.
3. Physiological arousal within our body, such as changes in heart rate and breathing rate. Our bodies react when we experience an emotion. The ways our bodies physiologically react to each emotion will be discussed further in Chapter 12.

FIG 11.1» Talented actors are able to express a number of emotions.

11.1 INVESTIGATE

Emotional charades

1. Write the names of the following six emotions on separate pieces of paper and put them into a box or envelope: happiness, disgust, surprise, sadness, anger and fear.
2. Write the following scenarios on separate pieces of paper and put them into another box or envelope:
   - walking down the street
   - greeting a friend
   - opening a birthday present
   - typing on the computer
   - speaking at school assembly
   - going for a job interview.
3. Get the first volunteer to randomly pick one emotion and one scenario. Pretend to express this emotion while acting out the scenario.
   - How long does your group take to guess your emotion?
   - How long does your group take to guess your scenario?
4. Repeat this activity with other members of the group taking turns to act out the emotions and scenarios.

Variations:

A few volunteers stand in front of the class and play this at once. They can either all act out the same emotion and scenario or different emotions for the same scenario.

- How do their facial expressions, posture and gestures differ for each emotion? Are there similarities?
- Which is most useful—facial expressions, posture or gestures—for guessing the correct emotion? Or is it a combination of all three?

OUR EXPRESSIVE BEHAVIOUR

WHY IS EMOTIONAL EXPRESSION IMPORTANT?

Communicating emotions effectively is a crucial part of our social behaviour. Expressing emotions can provide deeper sharing of thoughts and a greater understanding between people. Our relationships, however, can be seriously affected if we fail to communicate properly or if the expression of our emotions is not controlled in an appropriate manner.

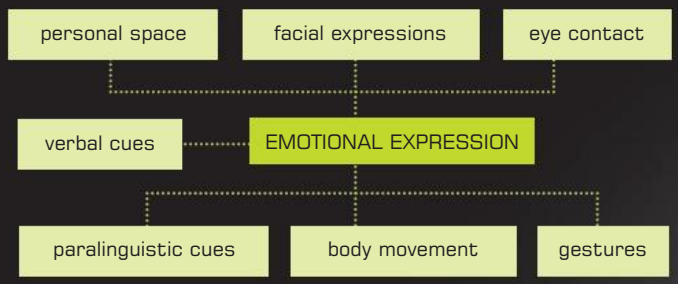


FIG 11.2» Ways that emotions can be expressed

On the other hand, there are times when expressing emotions is not to your benefit. Sometimes emotions can be overwhelming and, indeed, destructive. Expressing immediate or reactive emotional responses, as in Mandy's case in 11.2 Investigate, can also be unhelpful.

There may be times when hiding your emotions is appropriate. For example, you may be upset at having to wait in line at the canteen for most of lunchtime or try to suppress a smile at a 'funny' situation in class that the teacher finds serious. However, hiding significant emotions can be counterproductive and even lead to serious physiological and psychological problems.

11.2 INVESTIGATE

Mandy is having trouble keeping up with her school work and she thinks she may not pass her examinations. At home, she is continually arguing with her older brother. She is not enjoying her after-school paid work. In an attempt to catch up on school work, she stays home on the weekends to study. This, however, upsets some of her friends.

At the end of a class, Mandy's teacher unexpectedly announces that there is a major test tomorrow. Mandy 'explodes'. She jumps out of her seat and swears at her teacher, throws her books on the ground and leaves the room.

In small groups of 2 to 4 people, answer the following questions:

1. Is Mandy's behaviour appropriate?
2. Is Mandy's behaviour self-destructive?
3. What effects could Mandy's behaviour have on her relationships with other members of the class, including her teacher?
4. What would be some better ways for Mandy to communicate her feelings?
5. Is her expression of anger simply masking a different fear? What is this emotion likely to be?

FIG 11.3» Text messaging: Without paralinguistic or non-verbal cues, the intent of the message may be unclear. Is this person in trouble? Can you think of another reason for this message?

VERBAL CUES

Jacob has just started teaching at a new school. The principal takes him on a tour of the school and he listens intently to her instructions and advice. Jacob receives verbal cues from the content of what is said. **Verbal cues** are the *exact* words that are said or written.

Jacob also receives **paralinguistic cues**, which are all the other **non-verbal cues** related to the speech that provide him with information. Paralinguistic cues include the tone of voice, the length of pauses, fillers such as 'um' or 'er' and laughter and sighing. Verbal communication is made up of verbal and paralinguistic cues.

Verbal communication is quite different from written communication. We need to be careful when text messaging or writing emails as they can be misinterpreted because they lack paralinguistic cues. One way to add paralinguistic cues is to use capital letters—for example, capitals are sometimes used to express anger or other emotions.

What are some ways to express humour, sarcasm and sincerity in your written work?

FIG 11.4›› Emotions can be very obvious in young children. As we get older, we become better at hiding our true feelings.

11.3 INVESTIGATE

'I enjoy your company'

1 See how many ways you can change the intent of this message, 'I enjoy your company', by just using paralinguistic cues. Ask another student to guess the intent of your message. Try the exercise again with the message 'I like your new shoes'.

Encouraging emotional expression

2 In small groups, discuss the following questions:

- **a** Do we teach children to express emotions effectively?
- **b** Why do we become better at hiding our true feelings as we get older?
- **c** In our society, when is emotional expression encouraged or allowed? When is emotional expression discouraged?
- **d** How do cultures differ in how they encourage or discourage emotional expression?
- **e** Learning from watching others, known as modelling, is one of the most common ways we learn to express our emotions. If a person has learnt unacceptable ways of expressing their emotions, alternative responses must be learnt. What is an example of an unacceptable way to behave in response to frustration? How can modelling help a person learn an alternative response?

REVIEW 11.1

1 What are the three components of an emotion?
2 What does expressive behaviour mean?
3 How do verbal cues convey a message?
4 How do verbal cues differ from paralinguistic cues?
5 Pick one paralinguistic cue and explain how it can convey a message.
6 Why can written communication, such as an email, be misinterpreted because of the lack of paralinguistic cues?

It's written all over your face

Have you ever taken note of the facial expressions of strangers in a public place, such as on a train, in a supermarket or at the airport? These facial expressions can offer fascinating insights into their emotions, especially when the people are communicating with others. Even without being able to hear what two people are talking about, watching body language and facial expressions can often communicate the general message of what is being said.

On the other hand, some people can school their facial expressions to express very little and can portray a stoic, blank look that is virtually unreadable. As we grow older, we become more skilled about hiding our facial expressions.

Your face consists of 44 muscles. These muscles are responsible for about 5000 facial expressions, everything from a cheesy smile to a subtle grimace.

Paul Ekman, a pioneer and expert in the field of facial expressions, has identified six fundamental or basic facial expressions that are universally made and recognised around the world. In his classic study, the **facial expressions** of happiness, sadness, anger, fear, disgust and surprise were shown to people in different countries around the world (Ekman & Friesen 1975). Participants in United States, Spain, Japan, Chile, Argentina, and even in a remote area in New Guinea were able to recognise the facial expressions.

However, some subtle cultural differences in facial expressions do exist. One study found that American participants could distinguish between American and Australian faces when they smiled but not when their faces were neutral (Marsh et al. 2007). Another study found that Americans, who are more open to expressing emotions, tend to look towards the mouth to interpret others' emotions while Japanese people, who are more

FIG 11.5» Universal facial expressions: can you identify the six basic emotions— happiness, sadness, anger, fear, disgust and surprise—in these photographs?

guarded, looked towards the eyes (Yuki et al. 2007).

We probably have a 10 per cent advantage over outsiders when it comes to reading expressions from people within our country and culture (Elfenbein et al. 2007). This helps explain why messages can be misinterpreted more easily when we travel to other countries.

Understanding different cultural expressions and gestures may assist communication and understanding between cultures. Defence force personnel and diplomats are getting expert help in this area, especially specific to Middle Eastern cultures. International businesses are appreciating the subtle differences and travellers are advised to learn more about the culture before setting off overseas.

did you know? Teenagers are more likely than adults to misinterpret facial expressions, such as surprise or fear, as being anger. Could this help explain why some people tend to be more aggressive during their teenage years?

FIG 11.6» There are similarities across different cultures in expressing some basic emotions such as happiness.

11.4 INVESTIGATE

Body language and culture

Body language is very much influenced by our culture. Some types of body language seem universal while others seem specific to our particular culture. Think about your cultural experiences and how they have influenced who you are. For example, consider the following questions:

- What is your ethnicity? Where did you, your parents, your ancestors originally come from?
- What is your religion?
- Are you male or female?
- How old are you?
- Where do you live?

In what ways do these details about your life influence the way you communicate a message through body language and facial expression?

Discuss with the class how you think your culture has affected your expression of emotions (facial expressions, personal space, gestures and movements).

FIG 11.7» A simple gesture, such as waving, can communicate a friendly goodbye to most Australians but signals 'no' to Western Europeans.

Eye contact

Have you ever felt uncomfortable talking to someone because they are wearing dark sunglasses and you can't see their eyes? If so, then you already understand the importance of eye contact. The eyes can offer a window to someone's feelings.

Unless eye contact is culturally offensive (as it may be in some countries such as Japan or Korea), a greater degree of eye contact can be a sign of liking and interest. The more someone uses eye contact with us, the more they appear to be showing an interest in what we are saying. Less eye contact may be a sign of lack of interest, or perhaps shyness. It is important, however, that the eye contact is not continuous; otherwise, it is seen as staring. Being stared at will probably make you feel uncomfortable, as staring can be a sign of hostility or anger.

Gestures and movements

'Marlo is walking with an extra spring in his step today.' 'Georgia slowly slumps into her chair.' What position is your body in right now? Are you sitting attentively, leaning forward and nodding with confirmation? Or are you leaning back, arms crossed and vaguely looking elsewhere? The way we move our hands when we talk, how we walk into a room or tilt our head when we're listening gives others an insight into our emotions. These combinations or clusters of body movements can reveal much about a person.

There is quite a range of gestures specific to any culture. For example, the thumbs-up sign can indicate many things including 'hitchhiking' throughout most of the world, 'all is good' to Australians, 'one' to Italians and 'five' to Japanese.

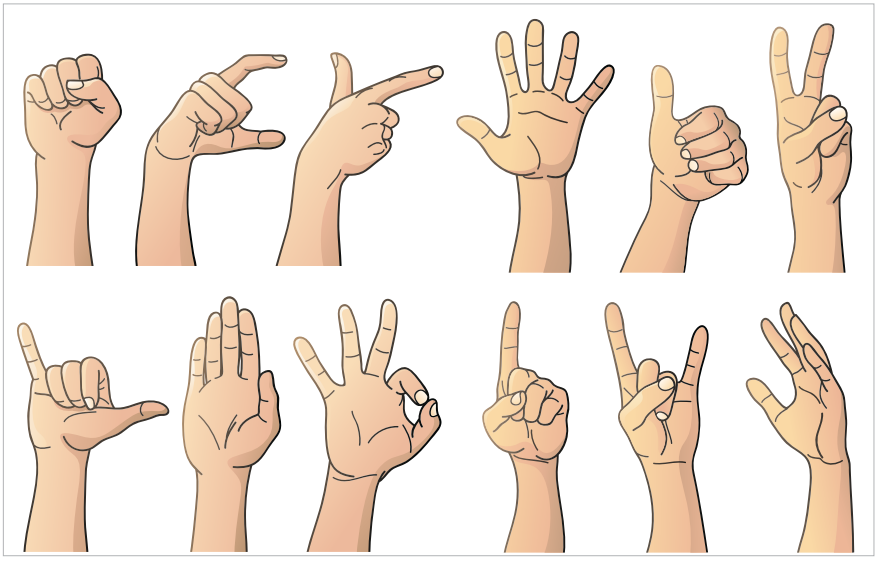


FIG 11.8» What message does each of these hand signals convey? Remember: each may be interpreted differently throughout the world.

REVIEW 11.2

1 Approximately how many facial expressions have been recorded? How many facial muscles are involved in expressing these emotions?
2 According to Ekman, what are the six universal facial expressions?
3 What does Ekman mean when he states that these six facial expressions are universal?
4 Outline one subtle difference in facial expressions between cultures.
5 What message can too much eye contact convey?
6 Why is it important to be aware of culture differences? Relate your answer to eye contact.

11.5 INVESTIGATE

Recognising emotions in body language without facial features

How important is the face in expressing emotions? Can we identify emotions without facial expressions? A recent study found that most people are good at recognising emotions from body-language cues alone, without viewing facial expressions, with 'fear' being the hardest to recognise (Van der Stock et al. 2007). The study also highlighted the importance of using the whole body in combination with facial expressions and tone of voice to communicate messages correctly.

1 Look at each photograph and identify the emotion that the person is expressing: happiness, sadness, anger or fear.

(a)

(b)

(c)

(d)

2 Collect the class responses and calculate the number of times each emotion was correctly identified (see page 147 for correct identification). Place the class data in the following table:

Photograph	Emotion expressed	Emotion correctly identified (number of times)	Emotion incorrectly identified (number of times)	Emotion correctly identified (%)
a				
b				
c				
d				

3 What did the results suggest about identifying emotions from body language?

4 Were there emotions that were more difficult or easier to identify than others?

5 Did the results support previous findings by Van der Stock et al. (2007)? Discuss possible reasons for any differences.

Personal space

Have you ever felt uncomfortable when your teacher stands in front of your desk to read your work, even when you know your work is quite good? Or perhaps when a stranger has stood too close to you while you are in a queue? It is likely that you have. We like to keep our own portable 'bubble' around us that changes in size, depending on factors such as the circumstances, our culture and how much we like and know the other person. This bubble is also known as our **personal space**.

You may not be aware of the distance from others you like to keep until someone actually gets too close to you for your liking and invades your personal space. According to Hall (1966), the distance we like to keep from others is quite significant and indicates how close we are to that person.

TABLE 11.1» Hall's zones of personal space

Distance	Name of zone	People allowed in zone
0–45 cm	**Intimate**	Romantic partners and young children. People using this zone are very close; they can whisper, touch and smell the other person.
45–120 cm	**Personal**	People we like and know well, including close friends.
1.2–3.6 m	**Social**	People that we know but don't know well, such as classmates. While people know each other, they have more of a working relationship and like to keep some distance.
3.6–7.5 m	**Public**	A formal, impersonal, non-interactive zone. People are either strangers or barely know each other.

Of course, there are other factors that can change the distances in these zones. Personal-space zones can differ from person to person for a number of reasons, such as cultural ones—Australians, for example, usually like to keep more space around them than Italians.

The distance we keep from others can also reveal our prejudices (Hayduck 1978). Do you tend to stand further away from someone with a disability, such as someone in a wheelchair? It seems that most people do and this can be interpreted as a negative message, such as rejection. Personal space not only reveals how much you like a person but it can also reveal your prejudices towards certain groups in the community.

11.6 INVESTIGATE

All about the bus!

1 Set up the classroom as if it is a bus. Allow enough seats for each student in the class.

For each row, have three seats together, then the aisle, then two seats. Pretend that all the students are strangers. Now board the bus, one person as a time. Get your teacher to take note of where people sit.

- Which seats filled up first?
- Which seats filled up last?
- Try to explain the pattern of seat filling that occurred. What body-language cues did you identify?

Body language

2 Watch a body-language show such as one by Allan Pease, a well-known Australian expert in body language. WWW»

The information can assist you in many areas of everyday life, including job interviews.

3 Make a list of positive body-language behaviours. What message does each convey?

4 Watch *Ask the Experts*, Episode 35, 'Body language' on the ABC website. WWW»

FIG 11.9» When walking down the street, we tend to look away when passing a stranger in an attempt not to invade their personal space.

Are you interested?

When you are interested in what someone has to say and you like them, your body tends to adopt an open posture. Your arms and legs are not crossed, you lean in to the person and your feet tend to point in their direction. When you smile, you tend to show your teeth. How are you sitting right now? Are you interested in this topic? What is your body language saying?

Are you leaning back, arms and legs crossed, body turned to the teacher or the textbook? Your body posture is closed. You are not smiling and, when you do, you do not show any teeth. These are signs that you are simply not interested.

When you flirt, some body signals are the same as for showing interest, for example the open body posture. When flirting, you might flick your hair, play with your jewellery or watch and offer long, sideways glances to the other person. You may even expose your wrists (this is especially true for females). Most of us will be totally unaware that we are doing all this! A person responding to another with a closed body posture and a quick glare is simply not interested!

Conclusion

Conveying a message is much more complicated than merely using the right words. The way we speak these words, including the tone of voice and the number of pauses, and the way our body expresses this message are of utmost importance. Our facial movements, eye movements, gestures and movements, and personal-space zones are all monitored. Cultural differences also need to be considered before inferences can be made. Fortunately, most of the time, the intent of the message is communicated correctly.

11.7 INVESTIGATE

Please help Philipa

Philipa has recently moved to the city and has begun work in a high-rise building. She needs to take the elevator to get to her office each day. She is upset about how rude people are to her on the elevator. Please give Philipa some of the 'unwritten rules' about boarding and behaving on an elevator (for example, where should she stand, where should she look, what should she say and so on). Relate these rules to your knowledge of personal space.

REVIEW 11.3

1. Explain how gestures and body movements, such as the way we walk into the room, convey a message. Include two examples.
2. Can the six universal emotions be identified without facial expressions? Explain your answer.
3. What is personal space? How do people feel when their personal space is invaded?
4. Consider the following relationships. Which personal-space zone would be the most appropriate? Explain your answer.
   - two students from the same secondary school who know each other enough to say hello
   - a Year 10 student and his or her teacher
   - two students in the same class
   - strangers walking in the park
   - strangers at a crowded concert

FIG 11.10 What messages are the people in this photograph conveying? Who is showing the most interest?

Investigate 11.5, page 145: The emotions expressed in the photographs are (a) sadness, (b) anger, (c) fear and (d) happiness.

CHAPTER SUMMARY

- There are three components to an emotion: the subjective experience (what you are feeling), the expressive behaviour (how you convey your emotions to others, intentionally or unintentionally) and the physiological arousal within your body (the way your body reacts internally to your emotions).
- A message can be conveyed using verbal cues. These cues relate exactly to what has been said or written. Using these in isolation can been problematic. Paralinguistic cues add meaning to these words. These additional cues, such as tone of voice, laughter, giggles and pauses, provide valuable insight into the intent of the message.
- Paul Ekman, a renowned psychologist, found evidence to suggest there are six basic emotions that can be recognised universally across all cultures: happiness, sadness, anger, fear, disgust and surprise.
- Subtle differences in expressing messages exist between cultures. Culture relates to a person's background, religion, where they live, gender and age. Subtle differences can be found in all areas of verbal and non-verbal communication. These differences need to be acknowledged and understood to avoid misinterpretation and conflict.
- Eye contact can be important. Too much eye contact can make another person uncomfortable while too little may be interpreted as not caring or shyness.
- Gestures, such as the thumbs-up sign, and body movements, such as stomping into a room, can convey important messages about thoughts and emotions. People are capable of reading these signs without the input of facial expressions or verbal communication. However, fear is often the most difficult to recognise.
- Personal space is a person's surrounding portable 'bubble'. Uncomfortable feelings occur if this space is invaded by others. Personal space changes in size depending on factors such as the circumstances, culture and how much we like and know the other person. Hall suggests that there are four zones: intimate, personal, social and public.
- Conveying and interpreting messages from verbal and non-verbal cues is a complicated task. Fortunately, most of the time, the intent of the message is communicated correctly.

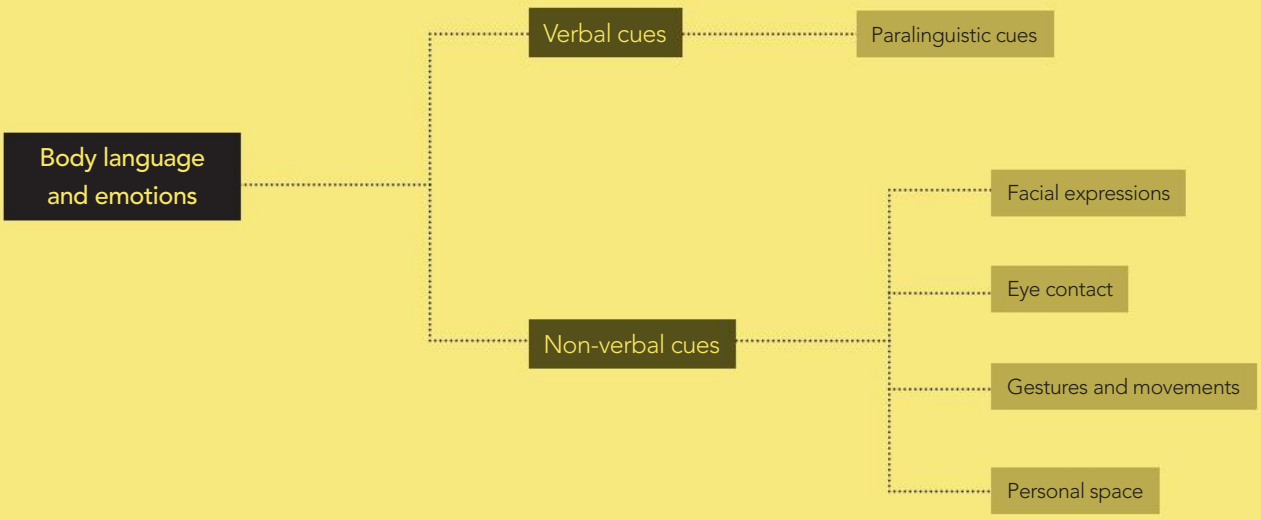


FIG 11.11>> Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 Paralinguistic cues are used to express emotions. An example of a paralinguistic cue is the:
- **a** tone of voice
- **b** spoken word
- **c** expression on the person's face
- **d** hand gestures that are used while speaking.

2 The _____ facial muscles are responsible for producing approximately _____ facial expressions.
- **a** 8; 6
- **b** 15; 400
- **c** 44; 5000
- **d** 54; 2000

3 Which of the following is not a universally recognised facial expression?
- **a** disgust
- **b** contempt
- **c** fear
- **d** anger

4 The personal space commonly found between _____ is known as the _____ zone.
- **a** very close friends; personal zone
- **b** public speakers and their audience; social zone
- **c** classmates; intimate zone
- **d** lovers; public zone

5 You are sitting by yourself at a busy shopping centre. A stranger sits besides you. You immediately move your body away from the stranger and put a bag of shopping between the stranger and yourself. You are probably doing this because you are
- **a** trying to show them your shopping
- **b** trying to make yourself invisible
- **c** being independent
- **d** trying to preserve your personal space.

6 List the six universal facial expressions. Outline one piece of evidence that suggests they are universally recognised across all cultures.

7 Why do we become better at hiding our emotions from others as we get older?

8 Describe how eye contact can help convey a message.

9 Using examples, explain how the use of eye contact can differ between different cultures.

10 In terms of gestures and posture, why is it often important for people to learn about a different culture before visiting?

11
- **a** What is meant by personal space?
- **b** According to Hall, what are personal space zones? Include a personal example for each zone.
- **c** How can the personal space between two people differ depending on their relationship and culture?
- **d** How can personal space reveal prejudices?

12
- **a** What is an open body posture and what can it reveal about your emotions?
- **b** What is a closed body posture and what can it reveal about your emotions?

13 What are some possible signs of flirting?

14 Do you think humans are good at relaying and interpreting verbal and non-verbal messages? Explain your answer.

Extend yourself

15 What gender differences have been found with recognising facial expressions?

16 Research what your handshake says about you.

17 Find out more about people who experience some difficulty interpreting verbal and non-verbal cues from others. For example, you could consider some forms of autism, alexithymia or prosopagnosia.

18 Find out some of the differences in body language across cultures. WWW

LIAR, LIAR

LIKE IT OR NOT, WE HAVE PROBABLY ALL LIED AT SOME POINT IN OUR LIVES.

Can you think of a time when you lied? Maybe you didn't want to tell someone that you hated their new haircut because you wanted to avoid hurting their feelings. Perhaps you tried to cover up the fact that you had forgotten a close friend's birthday or you didn't like their cooking. Maybe the real reason why you were late to school is too silly or too painful to discuss with others. Have you ever exaggerated or deliberately understated an event? Or maybe you don't believe this is lying. What do you think?

CAN YOU SPOT A LIAR?

Imagine that you are a nurse. You volunteer to take a test to determine whether you can keep positive and calm in the event of a disaster occurring. You watch a very disturbing film in which many people are suffering from horrendous injuries. You are told to pretend that the film was pleasant, to smile brightly and to mask your true feelings. You then take the test—an interview in which you are asked about the film and to describe your feelings. Who might be able to spot you are lying?

A research study (Ekman & O'Sullivan 1991) was conducted to evaluate various people's ability to detect lying. One group of nurses viewed an emotionally disturbing film and another watched a pleasant film. The nurses were then asked about the film and to describe their feelings, but the group who had watched the disturbing film was told to pretend they had viewed the other film. Members of a panel that included psychologists, judges, customs officers, secret service officers, non-specialist adults and college students were asked to determine who was lying. The only people who demonstrated an ability to detect lies were the secret-service officers. They relied more on asking cleverly constructed questions than reading facial expressions.

12.1 INVESTIGATE

Catch a liar

1 In small groups, discuss the following:
   - Do you believe that you can catch a liar?
   - What methods would you use to tell if someone is lying or not?
   - What methods have you seen employed on television shows or in movies?

2 In a small group, discuss the following questions in the context of your life. After the discussion, give a quick summary of your main findings to the rest of the class.
   - Is it ever appropriate to lie? Explain your answer and give examples.
   - When can lying be dangerous?
   - Who benefits from a lie?

More recent studies have found that other professional people with special training in deception, including psychologists, can also make accurate judgments, although no one is 100 per cent accurate (Ekman, O'Sullivan & Frank, 1999).

Can you spot a liar? What tell-tale signs do you look for—looking down, shuffling of the feet or hesitation in answering your questions? Most of us are only correct 45–60 per cent of the time. We are not very good at detecting lies. That is because a pattern of responses to a lie that is true for all people simply does not exist. There are some behaviours, brain activity and physiological responses that may indicate lying but these are not always reliable.

Research into detecting lies is now focusing on brain activity, thermal readings, body language and clever questioning techniques. Although more and more sophisticated methods are being devised to determine when people are lying, there is no foolproof method. In this chapter we will consider some of the methods that are used to detect lies and which are the most suitable. We will consider why all the methods can be unreliable and how this links to theories of emotions.

FIG 12.1» *Pinocchio* is a traditional Italian story that encourages children not to lie. Every time Pinocchio told a lie his nose grew—an easy way to spot a lie!

LYING AND EMOTIONS

What is the connection between lying and emotions? The act of lying might cause us to feel an emotion (our subjective experience), such as guilt or nervousness, and it is this emotion that can sometimes be detected by others when we lie.

THE COMPONENTS OF EMOTIONS

Apart from our subjective experience, there are two other components to every emotion: our expressive behaviour and psychological arousal.

EXPRESSIVE BEHAVIOUR

We are interested in finding out whether someone is telling the truth in a wide range of circumstances, from conversations with friends to suspected criminals being interrogated by the police. How can knowledge of emotions be used to catch someone in a lie?

In everyday life, monitoring someone's body language may help distinguish between the truth and a lie. There are at least five types of cues that may offer us insight, although they must not be used in isolation to detect a lie:

1 **High-pitched voice**. It has been found that people often use a slightly higher-pitched voice when lying (Ekman et al. 1976). Sometimes words may be out of order or muddled and be spoken too quickly.
2 **Microexpressions**. Often when telling a lie, our facial expressions will reveal the truth for a fleeting moment (few tenths of a second) before we hide the truth (Ekman & Friesen 1975).
3 **Eye contact**. Most people when lying tend to avoid eye contact or blink more often (Stiff et al. 1989), especially in our culture. Squinting may be an attempt to hide the eyes, especially if this is not something they normally do. Some people might hold your gaze for too long—as if to say 'How dare you accuse me?'—in an attempt to convince you that they are innocent. It is important to remember, however, that cultural differences exist. For example, in some cultures it is considered rude and offensive for a child to look an adult in the eyes.
4 **Adapters**—hand movements. The more hand movements a person uses, such as repeatedly touching the face or another part of the body, the more likely it is that the person is telling a lie (Zebrowitz 1991). Hands that are hidden, such as hands in pockets, can also be a sign of deception. Politicians are trained to keep their hands where we can see them in an attempt to send the message that they have nothing to hide.
5 **Head movements**. Saying 'no' while nodding or 'yes' while shaking their head, may indicate that a person is not telling the full truth. The person may be concentrating on the spoken lie without controlling the head's movements.

To be successful at reading body language, you must consider all the speaker's different cues, known as a **cluster**, not just one simple action. For example, it is worth noting that some people can spend a lot of time controlling eye contact and voice when telling a lie. In doing so, however, they may forget to control their hands and look rigid and uncomfortable. Cultural differences and other plausible explanations for any mixed messages (for example, the speaker experiencing feelings of fear or embarrassment, rather than guilt) must also be considered when judging whether or not the speaker is lying.

Reading body language to detect a lie can be aided by appropriate questioning techniques. A teacher trying to

FIG 12.2» It is often easy to tell when a child is lying. Detecting lies becomes more difficult as the liar gets older. Go online and watch *Ask the Experts*, Episode 30, 'Lying' on the ABC website. WWW»

find out which student was involved in a serious incident on the oval at lunchtime would probably not be able to easily judge the truthfulness of an answer to a question such as 'Were you on the oval at lunchtime?' This question only demands a simple yes or no answer and is one that the student could easily anticipate. A better question would be 'Where did you eat lunch during lunchtime?' This question is less likely to be expected and demands a longer answer, giving the teacher more time to monitor body language. Follow-up questions that require longer answers and referring back to information from previous questions will also assist in determining the speaker's truthfulness.

Of course, some people can be very skilled at lying and their body-language cues may not reveal their lie, especially when it is intermingled with elements of truth. Other people can give cues that suggest they are lying when in reality they are just anxious about their responses.

REVIEW 12.1

1 What are the three components of an emotion?
2 What may happen to a person's voice when they are telling a lie?
3 What are microexpressions?
4 What are adapters and how may they indicate lying?
5 a When can eye contact reveal a lie?
  b What are the possible cultural implications with monitoring eye contact in order to detect a lie?
6 Why is it important to look for clusters of body language when deciding whether a person is truthful or not?

PHYSIOLOGICAL AROUSAL

Bethany turns the corner and gets a 'sinking feeling' in her stomach. Rikky's hands start trembling as he accepts an award at school assembly. As they arrive at a party, Kara turns to her friend and says 'I'm so excited it feels like my heart is pounding out of my chest.'

The examples above refer to physiological changes within our body—the first component of an emotion. The **autonomic nervous system** is responsible for these physiological changes. It controls the internal organs, glands and muscles over which we do not seem to have direct control. This means in most cases we cannot voluntarily speed up or slow down their workings.

The autonomic nervous system

The autonomic nervous system consists of two branches: the sympathetic nervous system (for arousing the body) and the parasympathetic nervous system (for calming it down). They are structurally different and operate in different ways. They usually have the opposite functions.

Imagine you have just got off the train at your station. It is dark and no one else seems to be in sight. Suddenly you hear whispering. You are scared.

Your **sympathetic nervous system** is activated. It immediately triggers a physiological arousal response causing:

- your pupils to become dilated (get bigger)
- your heart rate to increase
- your breathing rate to increase
- an increase in sweating

Sympathetic		Parasympathetic
Pupils dilated, dry	Eyes	Pupils constricted, moist (tears)
Dry	Mouth	Salivating
Goose bumps	Skin	No goose bumps
Sweaty	Palms	Dry
Passages dilated	Lungs	Passages constricted
Increased rate	Heart	Decreased rate
Supply maximum to muscles	Blood	Supply maximum to internal organs
Inhibited	Digestion	Stimulated

FIG 12.3» Physiological responses of the sympathetic and parasympathetic nervous system

- the hair on your body to stand on end
- your mouth to become dry (decrease in salivation).

You then realise that the noise is just your older brother and sister waiting to drive you home. After a few minutes, you start to relax as the parasympathetic system kicks in. The **parasympathetic nervous system** basically reverses all the arousal responses that the sympathetic nervous system triggers. It causes the following physiological responses:

- your pupils become constricted (get smaller)
- your heart rate decreases
- your mouth becomes more hydrated (increase in salivation)
- your eyes tear up (in some cases).

REVIEW 12.2

1 Which branch of the autonomic nervous system is first to respond to a situation? Why does the activation of this branch occur first?

2 For each of the following physiological responses, state whether it is a function of the sympathetic or parasympathetic nervous system:
   - **a** increased heart rate
   - **b** slowing down of the digestive system
   - **c** increased sweating
   - **d** tears
   - **e** decreased rate of breathing.

POLYGRAPHS AND LIE DETECTION

Lie-detector tests are often discussed in the media. Sometimes, a person who is accused of a crime wants to clear their name by sitting a lie detector test. Some radio programs even go to the extreme of getting listeners to sit a lie detector test purely for entertainment purposes.

Lie-detector tests are used in some countries for criminal trials but their use is banned in Australia. They are becoming more popular in Australia in other areas, such as private detective work.

What is a lie detector? Can they really detect lies? Read on to find out!

A **polygraph** measures physiological responses such as blood pressure, heart rate, breathing rate and galvanic skin response.

The **galvanic skin response** (GSR) is linked to sweating. Two electrodes are placed on the skin and the amount of current conducted is measured. Activation of the sympathetic nervous system will cause more sweat and this moisture makes it easier for the electric current to travel across the skin's surface, increasing conductivity and increasing the GSR reading.

The use of a polygraph as a lie detector assumes that the emotion caused by telling a lie will activate the sympathetic nervous system, causing physiological arousal. Therefore, telling a lie will cause an increase in blood pressure, heart rate, breathing rate and GSR. It assumes that a person who does not lie will not experience guilt and so will not have an emotional physiological reaction.

FIG 12.4» A polygraph tester analysing the physiological recordings in an attempt to detect whether the subject is telling the truth

12.2 INVESTIGATE

Digital polygraph

Read the article 'Lies in your inbox' on page 155 and answer the following questions.

1 What are the five indicators of lying in text and email messages? Include an example for each indicator.

2 How accurate are these indicators?

3 Would you have any hesitation with using such a program? Explain your answer.

4 How does the rate of lying differ between emails and phone conversations? Why do you think we lie more on the phone?

Lies in your inbox

Are all the electronic messages that you receive telling the truth?

Most likely, an occasional electronic message that you receive may not be entirely truthful. Psychologists are researching ways to detect lies within electronic messages such as emails and texts.

Following a three-year study, researchers at Cornell University have produced a new computer program designed to uncover lies. After analysing thousands of electronic messages, they have noted five indicators that are often associated with lying.

1. Electronic messages containing lies tend to be about 28 per cent longer than those telling the truth. Therefore, it might be suspicious if an email from someone is longer than usual.
2. The liar is more likely to blame others in their messages. Therefore, look for an email that entirely blames another person.
3. The liar is likely to express negative emotions about how they are feeling. Are they saying they are stressed out? Maybe it's because they are uncomfortable with lying!
4. Electronic messages that contain lies might seem to go overboard in proving that they are telling the truth. To do this, they tend to use more sense words, such as *see*, *hear*, *feel* and *touch*, and more pronouns, such as *she*, *he* and *they*.
5. Liars are often deliberately vague about a situation or event. For instance, they may not give a specific explanation for their whereabouts at a certain time in an attempt not to be caught out.

The computer program carefully scans the message looking for such changes and has been shown to be accurate about 70 per cent of the time.

Further research at Cornell has shown that people lie via email about 14 per cent of the time. Alarmingly, the rate of lying doubled when people talk over the phone. Perhaps we lie less via email because our messages are recorded in black-and-white for posterity.

It may be time for you to scan your inbox!

THE CONTROL QUESTION TEST

When administering a polygraph, there is a traditional and widely used questioning technique called the Control Question Test. When undergoing a polygraph test, the subject is asked a number of control questions.

The **Control Question Test** consists of 'Control' questions that are designed to create a baseline of physiological responses. They are not directly related to the incident that is being investigated and some (but not all) are designed to provoke an emotional response, for example 'What year level are you in?' and 'Have you ever cheated on a test?'

The subject will also be asked a number of relevant questions about the incident that is being investigated, for example 'Did you steal the laptop computer?'

If the physiological reaction to relevant questions is higher than reaction to control questions, it is concluded that the person is lying.

Study Figure 12.5. According to the polygraph, the subject had a stronger physiological reaction to question 3 than the other questions. As a result the subject could be identified as lying.

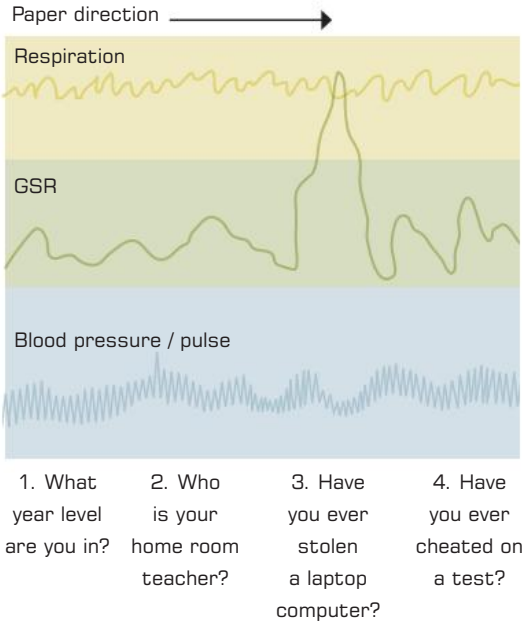


FIG 12.5» The polygraph and use of control and relevant questions to detect lying. Often the results are inaccurate and must be treated with extreme caution.

did you know?

- People who suffer from **antisocial personality disorder** are notoriously clever at deceiving and manipulating others. They can be superficially charming but have a disregard for others' feelings and show no remorse if they violate others' rights. As a consequence, they are often in trouble with the law. For these people, telling a lie does not elicit an emotional response. They show no remorse. Therefore, a physiological response is highly unlikely. Such a person would probably pass a polygraph test.
- People who are **compulsive** or **pathological liars** often start lying from a young age and over the years their lies gradually become more extensive and complicated. They tell lies with ease and, according to some, almost uncontrollably and involuntarily. Often their stories have an element of truth and, nearly always, portray them in a positive, even heroic, light. Such people would probably pass a polygraph test.

RELIABILITY OF POLYGRAPHS

Can polygraphs reliably indicate whether or not a person is lying? Most studies clearly indicate no. Polygraphs only detect physiological responses, not the extent to which a person is telling the truth. Polygraphs may indicate there is an emotional response to a question but, as most emotions cause the same physiological responses, it cannot be certain which particular emotion is causing the response. There are a number of problems with using a polygraph as a lie detector:

- An innocent person may become fearful or anxious when asked the relevant questions. This would lead to a large physiological response.
- A guilty person might feel no remorse for their crime, might not care that they are lying and therefore might not experience a large physiological response to the relevant questions.
- A person might manipulate their response to either the control or relevant questions. They could deliberately tense their muscles in the control questions or focus on breathing patterns in the relevant questions. It is believed that some people have 'fooled' polygraphs by deliberately causing pain to themselves (e.g. treading on a drawing-pin in their shoe) to raise their baseline response when asked control questions.

It takes a trained operator to accurately read a polygraph and even they can only measure physiological responses, not lies. At worst, polygraphs as lie detectors can be dangerously misleading; at best they are unreliable. In Australia, polygraph machines cannot be used for evidence in criminal trials.

CASE STUDY

Ivan Milat and the Backpacker Murders

In the early 1990s, seven bodies were uncovered in Belanglo State Forest, New South Wales. Each person had been murdered and the bodies partially buried. This series of shocking discoveries sent police on a hunt for the serial killer dubbed the Backpacker Murderer.

Ivan Milat was subsequently found guilty of the murders. There is speculation that he committed many more murders and could be Australia's most prolific mass murderer.

Throughout his trial, Ivan Milat never showed any sign of emotion. Throughout his life, he lacked emotional feeling and had a strong desire to dominate and manipulate others. Using a polygraph as a lie detector on Milat would be worthless—lying would not provoke an emotional response.

Milat is currently serving seven consecutive life sentences, never to be released from prison.

Transcripts of interviews with police and Milat are available online. WWW»

THE GUILTY KNOWLEDGE TEST

The Guilty Knowledge Test has been developed recently and is gaining recognition among experts as a useful tool in certain circumstances. Instead of asking open-ended questions about a crime, the **Guilty Knowledge Test** asks multiple-choice questions, including the correct answer among alternatives. This test relies on the subject recognising the correct answer.

TABLE 12.1›› Examples of questions from Control Question and Guilty Knowledge Tests

Test	Question
Control Question	Did you steal the laptop?
Guilty Knowledge	Where did the thief steal the laptop? a In the back of the gymnasium. b Near the front door in the senior school locker room. c At the bus stop. d On the seat next to the principal's office.

The Guilty Knowledge Test assumes that if a person has inside information about a crime, they will try to conceal this knowledge when they recognise the correct answer. This concealment will cause a change in the person's physiological response that the polygraph will detect. The guilty person is likely to breath more slowly, sweat more (increase GSR), and experience a drop in heart rate momentarily. Recognition is harder to hide than fear or guilt.

The Guilty Knowledge Test can be difficult to administer for a few reasons:

- The investigators must know some inside information so that the correct option is given in the test. All other options must be plausible.
- Details about the crime on which the questions are based cannot be leaked to the general public. The Guilty Knowledge Test is based on the premise that only the perpetrator of the crime (and investigators) will know certain details. If the details are made public, innocent parties will 'recognise' the correct answer.
- The Guilty Knowledge Test relies on a physiological response to questions and such a response does not mean that the subject is guilty 100 per cent of the time. Some people are more skilled at concealing their physiological responses than others, while others may react physiologically for reasons other than guilt.

Neither the Control Question Test nor the Guilty Knowledge Test is perfect, although the latter test is less likely to falsely label innocent parties as guilty. It has been found that, while the Control Question Test may incorrectly return a 'guilty' outcome in about 30 per cent of cases, the Guilty Knowledge Test will only have such false positives up to 10 per cent of the time.

FIG 12.6›› The Guilty Knowledge Test is not infallible. Some people are more skilled at concealing their physiological responses or react for reasons other than guilt.

12.3 INVESTIGATE

Spouses turn to lie-detector tests

Read the article on page 158 and answer the following questions.

1. What types of people are seeking polygraph tests from the private company, Australian Lie Detection Polygraph?
2. For what reasons are people seeking a polygraph test from such companies?
3. What physiological changes can be measured by computerised polygraph machines?
4. What serious implications may such tests have on a relationship?
5. Do you think polygraph tests should be used for this purpose? Explain your answer.

Suspicious spouses turn to lie-detector tests

By Lou Robson

In a small room in the suburbs, Paul Woolley is performing a lie-detector test. He attaches receptors to his client's fingers, wrists and chest and prepares to ask questions of a personal nature. There are questions about infidelity, money and the parentage of children.

Each year, hundreds of people from all walks of life pay between $800 and $1000 to be hooked up to a polygraph machine and grilled on every aspect of their personal lives.

'Basically people come to me when they are so consumed by doubt that it's affecting their relationship,' said Mr Woolley, of Springwood in Brisbane's south.

The 38-year-old, who runs Australian Lie Detection Polygraph, said couples made up 90 per cent of his work.

Modern polygraph machines are computerised and use mathematical sequences to analyse results. Highly sensitive receptors monitor changes in heart rate, breathing and skin reflexes, such as sweating, to determine an outcome.

Things can get heated. Mr Woolley, who completed a psychology degree at Griffith University before studying polygraph science in the US, said some clients tried to argue or bribe their way out of a bad result.

'It's a mixed bag, that's for sure,' Mr Woolley said.

'But all they want is the truth, and either way they get to move on.'

Adapted from Sunday Mail, 6 March 2005

BRAIN SCANS

Psychologists are now looking at the use of brainwave patterns and brain scanning techniques to detect lies.

The **electroencephalograph** (**EEG**) records brainwave patterns. Often, when a person recognises something familiar, they exhibit a characteristic brainwave pattern known as **P300**. Therefore if a person recognises the answer on a Guilty Knowledge Test, they are likely to show a P300 brainwave. While using this technology could be a useful adjunct to the Guilty Knowledge Test and polygraph to help screen for lying, it is not foolproof. Guilt cannot be assumed just because a person recognises the correct response and a P300 brainwave occurs.

Current research is focusing on using **functional magnetic resonance imaging** (***f*MRI**) brain scans to indicate when people lie. In various studies, people have been told to lie while undergoing an *f*MRI brain scan. It appears that some parts of the brain—areas of the frontal lobe and the anterior cingulate cortex (ACC)—are more active than others when constructing a lie or concealing the truth. These areas in the frontal lobe play a key role in memory and attention, while the anterior cingulate cortex plays a role in detecting conflicting information, such as recognising the correct information but trying to conceal the truth. Use of *f*MRI scans in conjunction with using the Guilty Knowledge Test may increase the likelihood of catching a person in a lie. It should be remembered, however, that using brain scans will not provide 100 per cent proof of a person's guilt. For example, if there is damage to the relevant areas of the frontal lobe (such as in the case of some people with anti-social personality disorder), no increased activity will be shown.

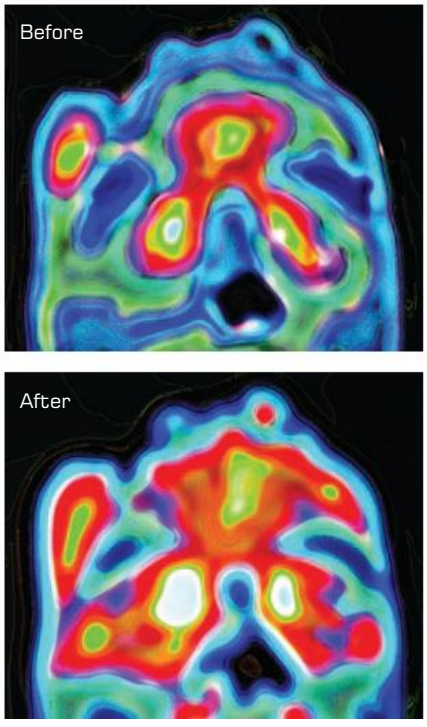


FIG 12.7» Thermal images from a heat-sensor camera of the face of a subject before and after lying. The red areas indicate blood flow.

Spotting lies with a heat-sensor camera

Heat-sensor cameras may help sort truth from lies. These cameras can detect increased blood flow around the eyes—a response that could occur when someone is lying. Unlike the polygraph, the process is quick to administer and the resulting images are relatively easy to read.

In 2002, 20 volunteers were randomly assigned to one of two groups (Pavlidis et al. 2002). Eight participants in the first group were asked to stab a manikin and steal $20 from it. The other 12 participants did not carry out this 'crime'.

The 20 participants were then put in front of a thermal **heat-sensor camera** and asked about the crime. The camera correctly identified 6 out of 8 'guilty' participants and 11 out of 12 'innocent' participants.

The participants were also tested on a polygraph and similar results were found.

RESEARCH AND DETECTION OF LYING

More research into the types of questioning techniques and the detection of lying behaviours and bodily responses is needed to make detecting deceitful behaviour more reliable.

It must be noted that most of the current research has been done in experimental laboratories or under artificial conditions. The findings from these artificial settings may not be true for liars in real-life situations, especially when the liar will suffer repercussions when (or if) the truth is discovered.

While some experts are highly skilled at detecting lies, they can still be misled by a skilful liar.

12.5 INVESTIGATE

Misuse of lie detectors

Tony is the owner of a small company and enjoys listening to breakfast radio. He was shocked this morning when he heard one of his employees sit a lie detector test on the program. The employee failed the test, including when they answered 'yes' to the question 'Do you like your boss?'

Based on your knowledge from this chapter, what advice would you offer Tony? Does this mean that the employee does not like Tony? What should Tony do? Should there be serious repercussions for the employee? Could there be an alternative explanation for the employee's 'failure'?

12.4 INVESTIGATE

Heat sensors and lying

Read about the experiment by Pavlidis et al. (2002) in the text and research it online. Answer the following questions.

1. In this experiment, how many participants took part?
2. What were the two experimental conditions in the experiment?
3. What were the results?
4. How did these results compare to the polygraph test results?
5. Could heat-sensor cameras be used by police when interviewing suspects for a crime? Explain your answer.
6. Could heat-sensor cameras be used to provide conclusive evidence in the criminal court system? Explain your answer.

REVIEW 12.3

1. Which physiological responses does a polygraph usually measure?
2. What is the galvanic skin response?
3. What assumptions are made when a polygraph is used as a lie detector?
4. What is the Control Question Test? What is the difference between control and relevant questions?
5. What is the Guilty Knowledge Test? When may the results indicate a person is lying?
6. Name the characteristic brainwave pattern that is sometimes linked with lying.
7. Which parts of the brain may increase activity when a person is telling a lie?
8. Explain the problems with experiments performed in research laboratories under artificial conditions.

CHAPTER SUMMARY

- Detecting a lie can be an incredibly difficult and sometimes impossible task. On average, most people can only detect a lie 45–60 per cent of the time.
- Body-language experts will consider a number of body-language signs, known as clusters, when trying to determine if a person is telling the truth. Body-language cues such as a high-pitched voice, fleeting facial expressions known as microexpressions, reduced eye contact and fidgeting hand movements can indicate lying. However, it can also indicate fear or some other emotion, not necessarily guilt.
- Physiological arousal occurs when an emotion is experienced. The more intense the emotion, the greater the physiological arousal. Physiological arousal is controlled by the autonomic nervous system. There are two branches of the autonomic nervous system: the sympathetic and parasympathetic nervous system. The sympathetic nervous system prepares the body for a quick response. The parasympathetic nervous system calms down the body after the initial response.
- Polygraphs measure physiological responses such as blood pressure, heart rate, breathing rate and galvanic skin response. When polygraphs are used as lie detectors, it is assumed that an increase in physiological responses will indicate lying. This is not always the case. Results from a polygraph test cannot be used as evidence in criminal courts in Australia.
- When sitting a lie detector test, people are most likely to be asked control and relevant questions that make up a Control Question Test. If there is an increase in physiological arousal between the responses to control and relevant questions, then a person may be guilty of lying.
- Another method of asking questions is the Guilty Knowledge Test. This uses a series of multiple-choice questions with the correct answer among the alternatives. It appears that it is harder for a person to hide their recognition of the correct answer than it is to lie. A physiological change that occurs when a person recognises the correct answer might indicate that the person may know facts known only to the guilty party (and investigators).
- The Guilty Knowledge Test can be combined with brain imaging techniques. Often when a person recognises information, a P300 brainwave can be detected. More activity in the anterior cingulate and frontal lobe may also occur. This can provide more evidence about a person's true knowledge about an event.
- Some people, including those suffering from antisocial personality disorder and compulsive (pathological) liars, do not feel remorse and their lies may not be detected by experts using body language, polygraphs, clever questioning techniques and brain scans.
- Many experimental studies are artificial in nature—they do not study real liars in situations where the consequences of lying are serious. Therefore, the extent to which these findings reflect real-world scenarios is open to debate.
- More research in real settings that combines techniques, such as clever questioning, body language and brain imaging by highly trained people, may increase the likelihood of detecting lies.

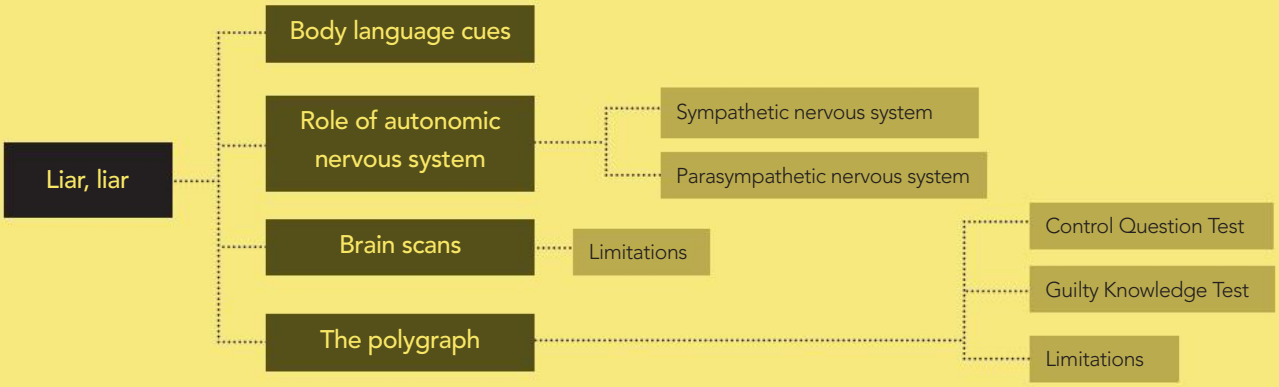


FIG 12.8» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 Most people are able to detect a lie _____ of the time.
   - **a** 95 to 100 per cent
   - **b** 60 to 75 per cent
   - **c** 45 to 60 per cent
   - **d** 35 to 50 per cent

2 In terms of body language, a cluster is:
   - **a** scrunching up the face when lying
   - **b** a number of lies told one after another
   - **c** a number of fidgeting hand movements
   - **d** a number of different body-language cues displayed at the same time.

3 The physiological response associated with a pleasant emotion is activated by the:
   - **a** autonomic nervous system
   - **b** sympathetic nervous system
   - **c** parasympathetic nervous system
   - **d** somatic nervous system.

4 The device that records a number of physiological responses is called a:
   - **a** universal machine
   - **b** body-language detector
   - **c** galvanic skin response
   - **d** polygraph.

5 Henry is caught cheating on a test. What physiological responses would you expect him to experience?
   - **a** increased salivation
   - **b** increased sweating
   - **c** constriction of his pupils
   - **d** decreased heart rate.

6 Detective Finley is interviewing the suspect of a crime. Outline any mannerisms that might indicate the suspect is lying.

7 What is a polygraph? What does it measure?

8 Why should findings from a polygraph be treated with caution when they are used to investigate the truth?

9 What is the Control Question Test?

10 What is the Guilty Knowledge Test? What are this test's limitations?

11 What parts of the brain are more active when a person is concealing information that they recognise? How may this knowledge be used with the Guilty Knowledge Test to help detect lies?

12 Why have P300 brainwaves been linked with the Guilty Knowledge Test?

13 Why is there a need to carry out more research in real-world settings?

14 State whether each of the following statements is true or false.
   - **a** Most people can detect a lie 90 per cent of the time.
   - **b** The sympathetic nervous system is involved in calming the body.
   - **c** Microexpressions are facial expressions that a person uses for a few seconds to cover up a lie.
   - **d** The galvanic skin response (GSR) measures a person's blood pressure.
   - **e** Control questions on the Control Question Test are designed to establish a baseline of physiological responses.
   - **f** Feeling scared can produce the same physiological response as feeling guilty.
   - **g** A person cannot fool a polygraph test.
   - **h** The use of polygraph machines as lie-detector tests can be used as evidence in criminal trials in Australia.
   - **i** The frontal lobe is often more active when a person is constructing a lie.

Extend yourself

15 Find out how popular the use of the polygraph as a lie detector is within Australia and throughout the rest of the world.

16 Find out more about antisocial personality disorder. How common is it? What are its diagnostic features, symptoms and possible treatments?

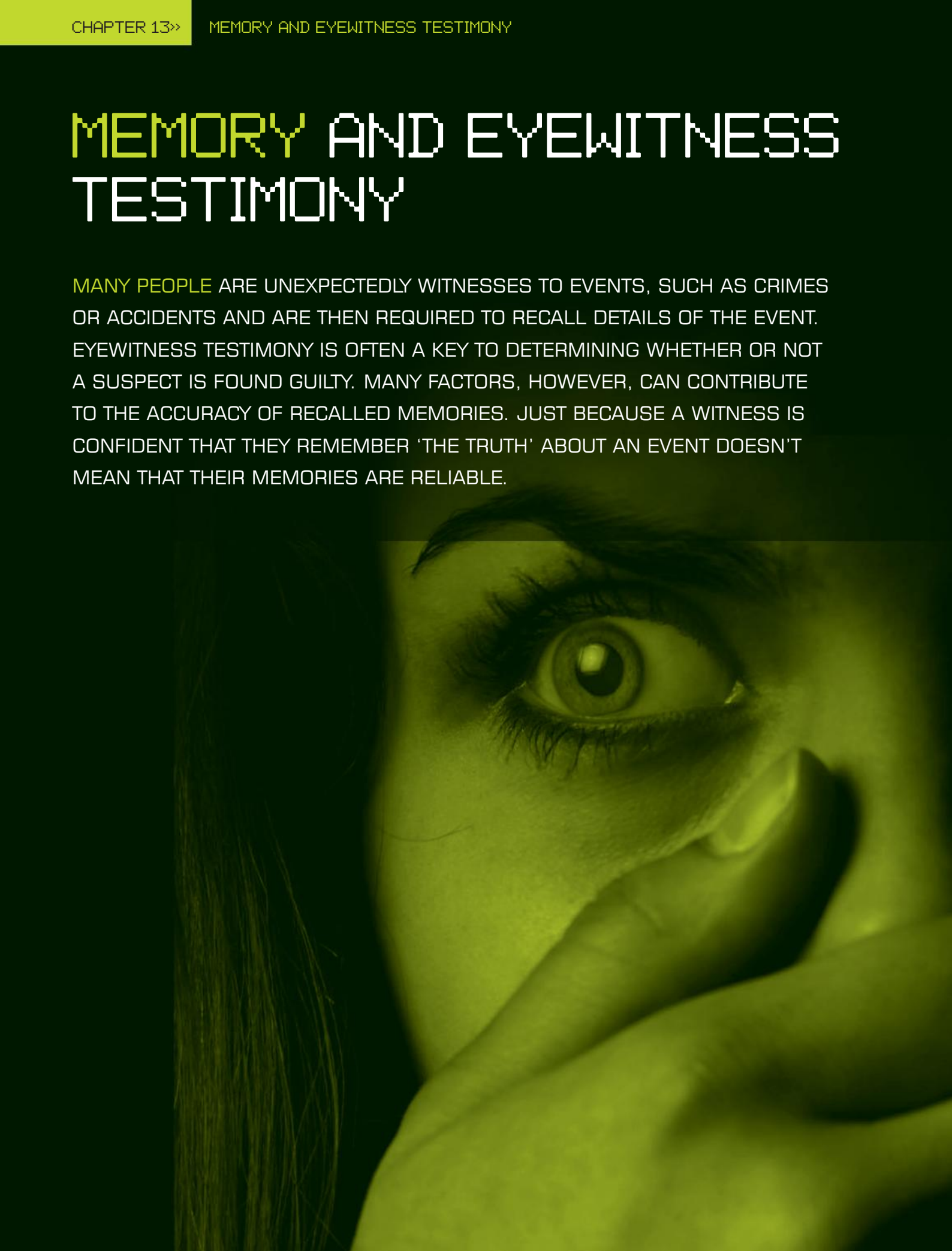
17 Find out more about compulsive (pathological) lying. How common is it? What are its diagnostic features, symptoms and possible treatments?

18 Why do some people make up elaborate stories to fill in blanks in their memories? Learn about confabulation. WWW

19 What are the latest research findings about using fMRI brain scans and clever questioning techniques to detect lies told by criminals in real-life situations?

MEMORY AND EYEWITNESS TESTIMONY

MANY PEOPLE ARE UNEXPECTEDLY WITNESSES TO EVENTS, SUCH AS CRIMES OR ACCIDENTS AND ARE THEN REQUIRED TO RECALL DETAILS OF THE EVENT. EYEWITNESS TESTIMONY IS OFTEN A KEY TO DETERMINING WHETHER OR NOT A SUSPECT IS FOUND GUILTY. MANY FACTORS, HOWEVER, CAN CONTRIBUTE TO THE ACCURACY OF RECALLED MEMORIES. JUST BECAUSE A WITNESS IS CONFIDENT THAT THEY REMEMBER 'THE TRUTH' ABOUT AN EVENT DOESN'T MEAN THAT THEIR MEMORIES ARE RELIABLE.



WITNESSING A CRIME

Witnesses at the scene of a crime rarely get notice that they are about to become a key part of a case that may require testimony in court. This means that the witnesses are not necessarily focusing on the various details of what is happening—and there may be many things happening quickly. Our memory is not designed to be able to recall events unless we are able to pay attention to what we see. Anyone who is a witness to an armed robbery, a hit-and-run accident or a brutal assault outside a nightclub will be subject to many psychological factors that will determine how accurately they will recall what they saw.

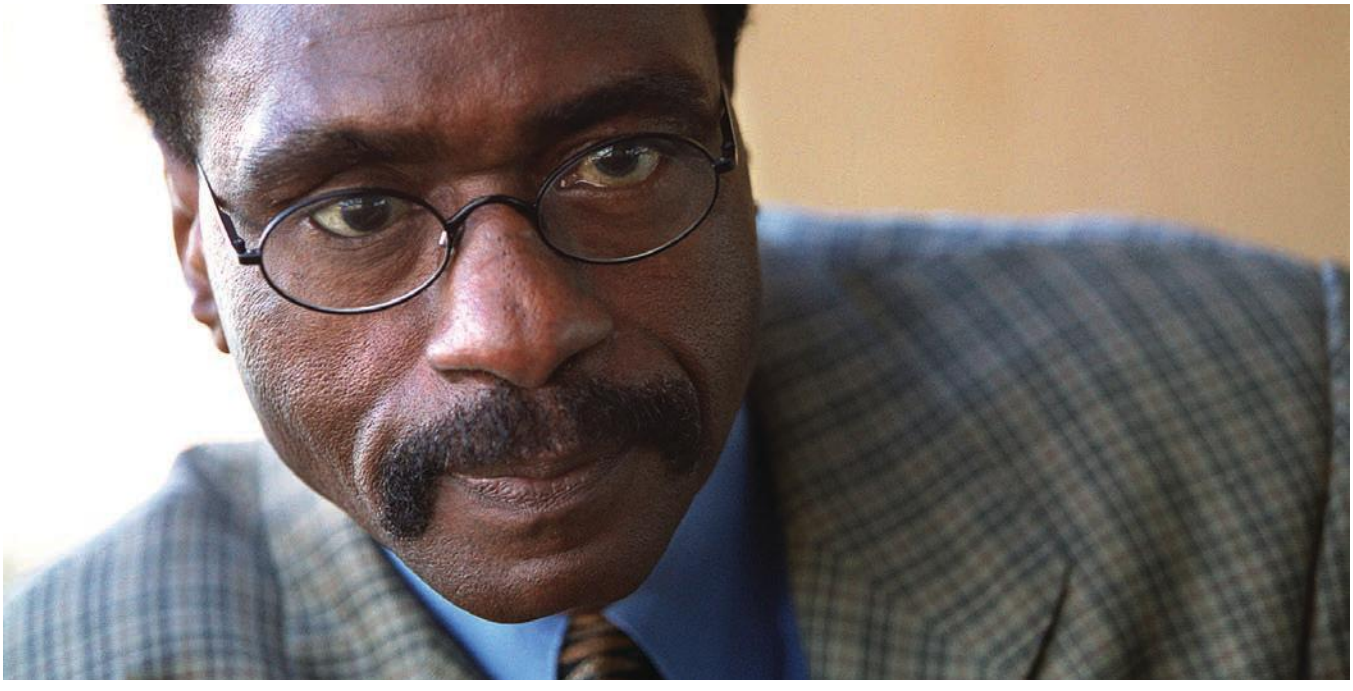
Details from eyewitnesses can become an important aspect of police investigations and subsequent trials to determine the cause of the event. These details may be the key factor in either dismissing charges or else convicting a person of the crime. The details obtained from an eyewitness present at the scene of an accident or crime are known as **eyewitness testimony**. A person who applies psychology theory and skills to understanding the crime is a **forensic psychologist**.

While eyewitness accounts have led to many rightful convictions, they can also lead to cases of mistaken identity. There are many convictions that have been subsequently overturned as a result of DNA or other evidence that has proven a suspect's innocence.

One such case was that of Rubin 'Hurricane' Carter. Carter was a young, professional boxer with an aggressive style in the ring that led to winning many titles and the promise of a long career. However, his dreams were cut short when he was arrested in 1966 for the murder of three white patrons of a bar in New Jersey. The evidence that convicted Carter was shaky. A key factor in his conviction was eyewitness testimony from a petty criminal, Alfred Bello, who was in the area at the time of the shooting. Other eyewitnesses reported seeing two African American men at the scene, but Bello was the only one to identify one of those men as Carter. This positive identification from Bello resulted in Carter being found guilty of the murders and sentenced to three life sentences in prison. A dedicated effort by a small group of people who believed in Carter's innocence eventually saw him released in 1985. The judge who was presiding over the appeal claimed that Carter was the victim of racial prejudice rather than fact. The eyewitness testimony in this case was inaccurate and misleading.

did you know? The film *The Hurricane*, starring Denzel Washington, and Bob Dylan's song 'Hurricane' both document Carter's story.

FIG 13.1» Rubin 'Hurricane' Carter was the victim of an eyewitness's inaccurate memory.



MEMORY AND EYEWITNESS TESTIMONY

Eyewitness testimony is when a person present at the scene of a crime gives a description of what they saw. This can include details of the assailant as well as the order of events. Eyewitnesses are often under a great deal of pressure to recall details of what they may have observed in a brief moment. Accounts of eyewitnesses during the trial of a suspect are heavily dependent upon the accuracy of memory.

As amazing as our memory can be at recalling past events, facts and people we know, it is also prone to error. There are many factors that can influence our memory of events, but we first need to understand how memory works. We can also forget information completely, especially if it is information we have not accessed in a long time. Forgetting is a common phenomenon for all of us!

THE THREE STAGES OF MEMORY

To be able to retrieve a memory, we must first have encoded the information, and then stored it. At any of these stages, a number of things can occur which means our recall may not be accurate.

There are three stages of memory:

1 **Encoding**. Information must first be converted into a form that our brain can understand. If details are not properly encoded, we will not be able to recall details accurately at a later stage. The encoding process can be affected by factors such as our emotional state and the attention we are paying to the situation. Focusing our attention on details will increase the chances that they will be encoded and stored into our long-term memory. For example, if we are focused on what we are studying, we have a much better chance of being able to recall the information when we need it, such as in a test. If we are not focusing on what we are doing but watching television instead, our chances of encoding information accurately may be reduced.

2 **Storage**. The information we encode is stored in our memory. We have short-term and long-term memory capacity, but it is our long-term memory we rely upon for recalling events we have witnessed.

3 **Retrieval**. Retrieval is the process of recalling information to use. We have a number of different types of memory, but eyewitness accounts often require **autobiographical memory** (episodic memory), where we recall events that we have experienced. Some people think our memory works like a video tape that can 'replay' the events as they happened. This, however, is not how memory works, and memory is prone to many errors.

13.1 INVESTIGATE

Testing your memory!

How well do you know Australian money? Try these activities to test your memory for detail.

- How many straight sides are there on a 50-cent coin?
- How many kangaroos appear on a one-dollar coin?
- There is a kangaroo and an emu on the 50-cent coin. On which side of the coat of arms does each stand?
- True or false—the same image of the Queen is used on each Australian coin.
- Which coin carries an image of the Southern Cross constellation?
- Draw the Telstra and ANZ bank logos from memory.
- Sketch the Australian flag from memory.

How did you score? Why might someone score badly on tasks such as these? Go to the OUP website to see the correct images. WWW»

REVIEW 13.1

1 What is eyewitness testimony?
2 What is the role of a forensic psychologist?
3 Describe the role that racial prejudice may have played in the eyewitness testimony that convicted Rubin Carter.
4 What are the three stages of memory? Briefly describe what occurs at each stage.
5 What is an autobiographical memory?

FACTORS AFFECTING EYEWITNESS TESTIMONY

Memory can be unreliable for many reasons. Some of these are **psychological factors**—we can be influenced by other memories, prejudices, beliefs and expectations. Other factors are **environmental factors**—the context and other aspects of the event can influence how well details are recorded in memory in the first place.

RETRIEVAL CUES

Sometimes, a memory is there but we need help to access it. **Retrieval cues** are stimuli that assist our recall of memories. For example, we may have forgotten a childhood memory until it is triggered by an old photo or a favourite toy we come across unexpectedly. Memories can be triggered by any of our senses, but are most commonly triggered by sights, sounds and smells.

The retrieval of memories can also be **context-dependent**. This means that we are unable to recall them unless we have the right context or situation. For example, a drunken man who loses his wallet is more likely to remember where he left it the next time he is drunk! Can you remember recalling memories when you are in a particular place, such as revisiting your old primary school, or a house you lived in when younger?

Studies by Shapiro and Penrod (1986) suggested that witnesses might find identifying suspects in photographs more difficult than identifying them in a line-up, because a real situation provides additional cues such as body movements and expressions. Eyewitnesses may also find that crime re-enactments and revisiting crime scenes may provide the retrieval cues necessary to recall details that have been stored but are inaccessible. Police investigators will often take both eyewitnesses and criminals to a crime scene to provide a context in which to recall more details about the event.

13.2 INVESTIGATE

Memory triggers: retrieval cues

Sometimes suggestion can trigger a memory you thought you had forgotten. Try these cues for retrieval and see if they trigger any old memories for you:

- your first pet
- your first day at school
- the colour yellow
- your fifth birthday party
- the sound of something flapping in the breeze
- the smell of the beach
- a childhood holiday
- your favourite childhood toy
- a childhood Christmas
- your first plane flight.

Reflect upon your memories. How accurate do you think they are? What factors may influence their accuracy? Compare your memories of an event with someone else who was there. Are your memories the same? If there are differences, why might this be so? How important are retrieval cues in recalling events and facts? What revision techniques might be useful to provide retrieval cues when revising for a test?

FIG 13.2» Collecting evidence at a crime scene

WEAPON FOCUS

The presence of a weapon in a situation has been shown to influence the memory of the event. This phenomenon is called **weapon focus**. If our attention is focused on an object such as a weapon, we can be distracted from other details of the crime or the features of the assailant.

Loftus, Loftus and Messo (1987) tested the influence of a weapon on a number of subjects' memory for other details. They showed the subjects a film depicting an event in a shop. One group of subjects was shown footage of a customer pointing a gun at the cashier, while the other group of subjects saw a customer hand over a cheque. The group who watched the footage of the customer with the gun was so focused on the actual weapon that their recall for other details about the customer was much less detailed than for subjects who saw footage of the customer handing over the cheque.

RECONSTRUCTIVE MEMORY

When we recall a memory of an event, we are reconstructing the event in our mind. Memory, however, is not always a complete record, and we tend to fill in any gaps that we can't recall so that the story will make sense. **Reconstructive memory** may therefore be shaped by our own beliefs, prejudices (such in the case of Rubin 'Hurricane' Carter), and expectations of what we expect to have occurred. Famous psychologist and researcher in eyewitness testimony, Elizabeth Loftus, believes that our tendency to reconstruct memories leads to unreliable recall from eyewitnesses.

Memory can also be inaccurately reconstructed if an eyewitness is stressed by the event as it happens, or if insufficient attention is paid to details when an event happens quickly. When asked by police to describe the face, build or clothing of an assailant, an eyewitness can search their memory for details that they did not actually notice when the event was happening. This can lead to witnesses of the same event giving quite different accounts of what was seen. Typical changes that occur during reconstruction can include adding non-existent detail, and distorting or substituting details.

In an experiment conducted by Buckhout (1974), an assault was staged on a college professor. Immediately following the event, 141 witnesses were questioned. Their accuracy on details such as appearance, age, weight and build was only 25 per cent, showing a high level of inaccurate reconstruction of the event.

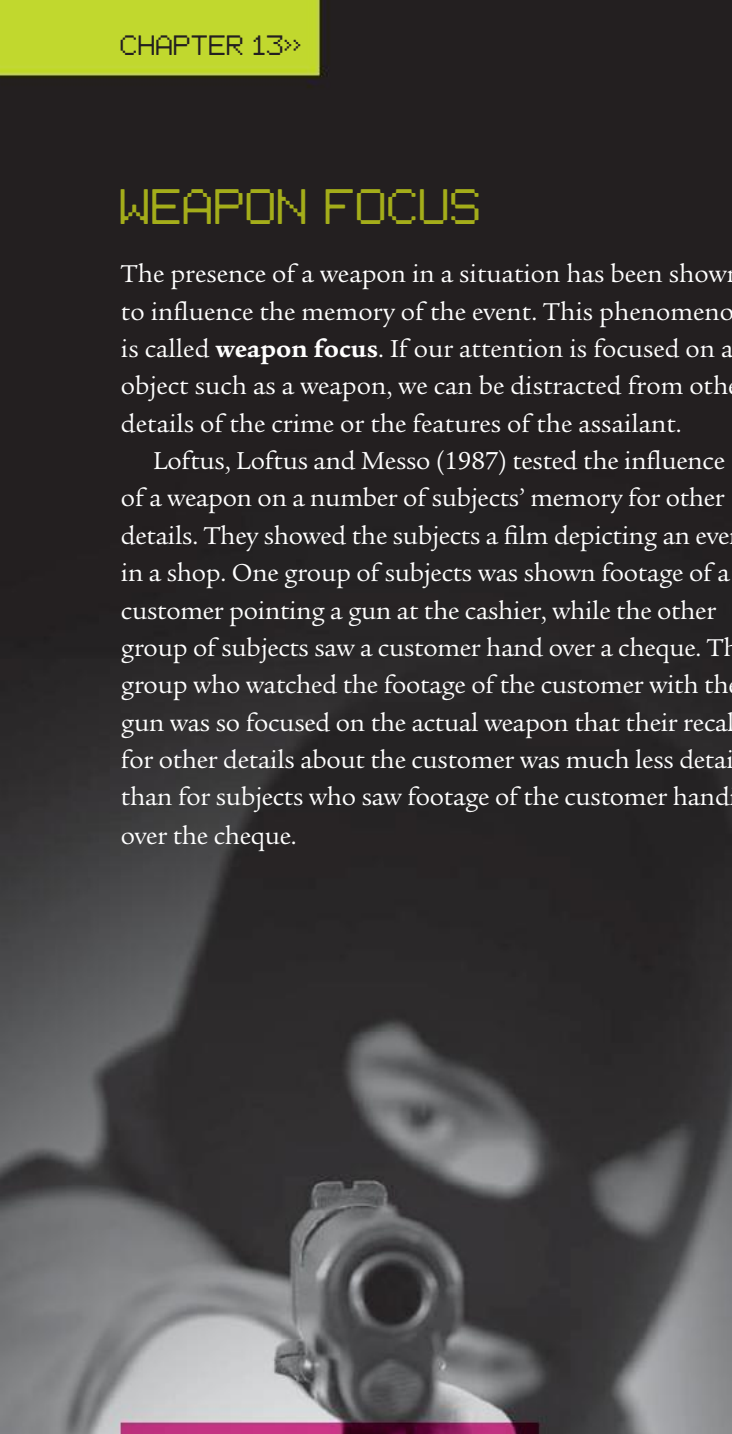


FIG 13.3» Weapon focus: memory of other details is diminished when we are focused on a weapon.

CASE STUDY

A case of mistaken identity

A bizarre example of how memory can be reconstructed inaccurately is the case of an Australian eyewitness expert, Donald Thomson, who found himself the victim of an inaccurately reconstructed memory. Dr Thomson is a psychologist who was interviewed on television about his recent studies on eyewitness testimony. Soon after the interview, he was arrested and charged with rape. It was discovered, however, that Thomson had a watertight alibi—he was on live television at the time of the rape. He was eventually released when it was found that the victim had seen Dr Thomson on television at the time she was being raped. She had stored his face in her memory and incorrectly reconstructed the event. Ironically, Dr Thomson had been on television to discuss the unreliability of eyewitness testimony!

Memory can also be inaccurately reconstructed because we might update our memory based upon new information. If a witness identifies a suspect from a photograph, they may actually be recognising the suspect's face from images seen on television or in the newspaper. This can increase the witness's confidence in the identification but is also likely to lead to mistaken identity.

As time elapses, memory may also become less accurate. This may have implications for the accuracy of an eyewitness when there is a significant period of time between witnessing the event and giving evidence. The more time a witness had to observe the event, the more likely they are to have paid attention and stored details accurately.

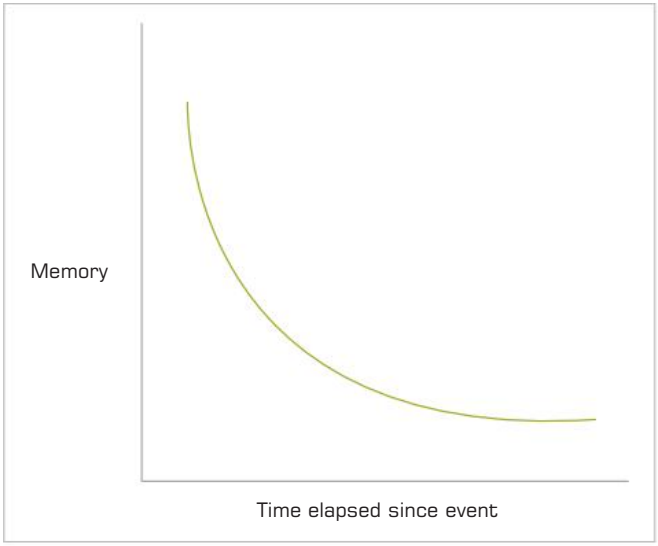


FIG 13.4›› Forgetting curve: as time elapses, our memory of an event can become less accurate.

REVIEW 13.2

1 What is a retrieval cue and how can it be useful in recalling memories?
2 What is a context-dependent memory? Give an example.
3 Describe how weapon focus can influence the details recalled by an eyewitness.
4 Describe one similarity and one difference between reconstructive memory and a movie.
5 What factors might contribute to a reconstructed memory being inaccurate?

MISLEADING INFORMATION PRESENTED TO EYEWITNESSES

Misleading information given at the scene of the crime may influence an eyewitness's recall of the event. In a study by Loftus (1979), a theft from a woman's handbag was staged at a busy train station. The woman left her bag unattended, while a male accomplice removed something from the bag. When she returned, the woman claimed loudly that her tape-recorder had been stolen! A week later, eyewitnesses were questioned about the incident, and 50 per cent recalled actually seeing the tape-recorder. Some witnesses also gave details of its shape and colour, even though there had never been a tape-recorder.

FIG 13.5›› Understanding sound questioning techniques is essential to obtaining accurate eyewitness information.

The questioning techniques used by police when interviewing witnesses are also important in getting accurate information. An eyewitness can easily be put off track by **misleading questions**, and information given to an eyewitness may also lead to an inaccurate reconstruction of memory.

Loftus and Palmer (1974) set up a study to investigate the extent to which the wording of the questions can influence eyewitnesses and even prompt false memories. The experimenters set up a film of a car accident, then asked participants a variation of the question 'How fast were the cars going when they hit each other?' Different groups had the word 'hit' replaced with words such as 'smashed', 'collided', 'bumped' or 'contacted'. Results showed that the words used in the question influenced the estimated speed of the car. The word 'smashed', for example, produced the highest speed estimate, while 'contacted' produced the lowest speed estimate.

CASE STUDY

The McMartin Pre-school Trial

A famous case in the United States in the 1980s highlighted the danger of misleading questions and became known as the McMartin Pre-school trial. A vague report from the mother of a boy from the McMartin Pre-school led to a report of sexual abuse. At the time, it was not known that this mother suffered from a mental illness that affected her judgment, and so her initial report was seen as credible. A letter was subsequently sent out to all pre-school parents informing them of the arrest of an employee at the centre. The letter also asked parents to question their children, with specific suggestions of which questions to ask. As a result, there were claims of 360 children having been abused. A lengthy trial followed. All charges were ultimately dropped when it was found that the children's testimony was not consistent or credible, but was influenced by the initial misleading questions assuming abuse. After five years in jail, the accused was finally released without a conviction. This case led to a change in the laws in the US about the involvement of children in testifying.

FALSE MEMORIES

New research by Bernstein and Loftus (2009) suggests that it might be easier to manipulate memory than previously realised. The researchers 'placed' false memories relating to food preferences into subjects by suggesting the subjects had particular food likes or aversions (which were not actually true). For example, after telling subjects they had been made sick from eating an egg salad (an event that had never happened), the subjects showed a decreased preference for the food and a reduced willingness to eat it. Implanted information (or 'false memories') may therefore have very real consequences in terms of changing our behaviour, as well as changing the way we think and feel about an experience. What implication does this have for eyewitness testimony, when eyewitnesses may be given misleading information that they may actually believe is the truth?

PHOTOFITS AND IDENTIKITS

Photofits and identikits can also be used to assist eyewitnesses to create an image that represents the face of a suspect. This can then be used to help identify the suspect. An eyewitness will often recall some features but not all, or they might recall a general image but not specific detail. A photofit or identikit is a technique that enables a witness to select features based on a 'bank' of possible shapes and sizes in the hope that one might look similar to the one observed. In this way, an image is slowly developed that is hoped will accurately represent the suspect to assist in identification. The process of developing a photofit or identikit picture can be very overwhelming for an eyewitness, especially if they do not recall the details they are asked to identify. Police will sometimes use mugshots of known criminals or artistic impressions created by police skilled in drawing features as they are described.

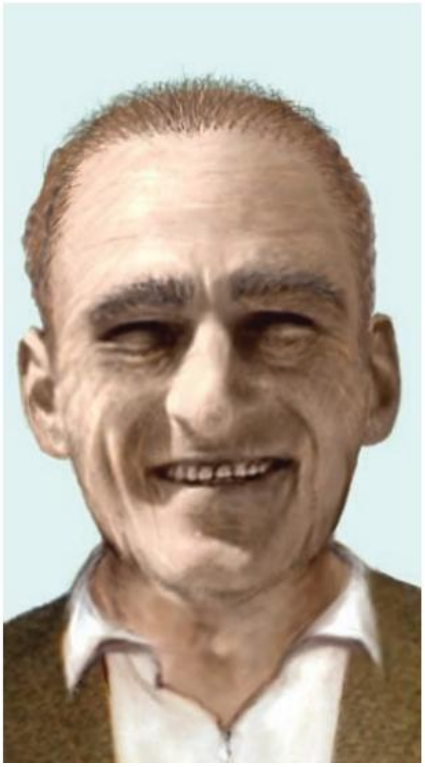


FIG 13.6» This image shows a police photofit of Elmer Crawford as they think he would look like today—he was aged 41 when he went missing in 1970. The Crawford family were found dead in the family car, at the bottom of a cliff at Port Campbell, on Victoria's west coast, in suspicious circumstances, in 1970.

POLICE LINE-UPS

Since the development of the use of DNA in identification, many people convicted of crimes have been exonerated because the DNA evidence has not supported their involvement in the crime for which they were committed. This has highlighted the potential for inaccuracy in the way in which eyewitnesses identify suspects.

Police commonly use line-ups for eyewitnesses to identify a suspect. A fair **police line-up** is one in which all people used in the line-up potentially fit the description given by the witness, but where the suspect is accompanied by people known to be innocent. This increases the chance that the actual suspect will be identified. If there are people included who do not resemble the eyewitness description in any way, the line-up will be biased towards the ones that do fit the description.

13.3 INVESTIGATE

Can you pick the suspect?

Two eyewitnesses described a suspect in a robbery this way:

- late teens, 15–16 years old, no more than 18 years old
- small build, weight about 65–75 kg
- frizzy and curly hair.
- Australian male, Caucasian
- 175–180 cm in height

Look at the photographs below. Which one do you think is the suspect?

1

2

3

4

5

6

When a similar study was conducted on a university campus, the line-up almost guaranteed the selection of one suspect. If a particular description can only be applied to one suspect, then the line-up is considered to be biased.

1. Which suspect did you select based upon the description? Explain why.
2. In a similar study, suspect number 5 was most commonly selected by participants. Is this consistent with your guess?
3. Why would this be considered a biased line-up?
4. What factors could contribute to a fairer line-up?

Go online for more examples of studies conducted on factors influencing the accuracy of police line-ups.

WWW»

Problems with using line-ups and photo identification

There are some common problems in using line-ups and photo identification for eyewitnesses to recognise suspects:

- An expectation that the suspect is included in the line-up or in the selection of photographs may lead to mistakenly identifying the person/photograph that is the best fit.
- Eyewitnesses may have observed the suspect in less-than-ideal conditions. Poor lighting, insufficient time to record details in memory and distance from the suspect can make it difficult to identify personal features clearly.
- Photographs used for identification may not highlight features that the eyewitness paid attention to; for example, a limp, a particular facial expression or tone of voice will not be represented by photographs or other images.

FIG 13.7» Mugshot example

13.4 INVESTIGATE

Can you identify the suspect?

1 Create your own police 'line-up'.

- **a** Create a 'crime' that has been committed by one person. Describe the crime scene, with details of what happened and when. Select a photograph (from a magazine or newspaper) of the 'suspect' of the crime.
- **b** Create an eyewitness description to fit your suspect, based on the photograph selected.
- **c** Create a 'line-up' for identification of the suspect, using the photograph of your suspect and a further five images from a magazine or newspaper. Ensure that you make it a fair and unbiased selection. Paste the images onto a sheet for your police line-up.
- **d** Select four subjects to select the suspect. Read your eyewitness description and details of the crime scene to each subject, one at a time. Ask each subject to identify the suspect, and then give you a reason for their choice.
- **e** Reflection

› How accurate were your subjects in identifying the suspect?
› What were the key factors that led to the subject's choices? Was it clothing, general appearance or specific details?
› What additional factors might influence an eyewitness account of a suspect?

2 Creating an 'artistic impression'

Think of a face you are familiar with—it can be someone known personally to you or someone famous that you have seen many times in the media. Try to create an 'artistic impression' by sketching this person's face from memory. Focus on the detail of features such as the shape of the face and the shape and position of the eyes, mouth, nose, ears, eyebrows, chin, hairline and teeth.

Compare your sketch to either a photo of your subject or the subject themselves. How accurate is your sketch? Which details did you record most and least accurately? What factors might have influenced how accurate this sketch was?

REVIEW 13.3

1 Describe how Loftus and Palmer (1974) provided evidence to suggest that the wording of questions can influence a witness's perception of what has taken place.
2 Explain how DNA identification has led to the discovery of suspects convicted as a result of mistaken identity.
3 What is important for police to consider when organising a fair line-up for eyewitnesses?
4 How are photofits and identikits useful in assisting an eyewitness?
5 What common problems are encountered when eyewitnesses use line-ups and photo identification?

CHAPTER SUMMARY

- Witnesses at the scene of a crime are not necessarily focusing on the details of the crime scene or the suspects. This can influence how accurately details are recalled at a later time.
- Eyewitness testimony is the information provided by an eyewitness about the crime or suspects thought to be involved.
- To be able to retrieve a memory, an eyewitness must have first encoded and stored it in their memory. Many factors can influence whether details have been encoded and how accurately memories are stored.
- When we recall an event, we use an autobiographical memory. This allows us to play the scene over in our mind in the order in which it occurred.
- Memory can be unreliable due to both psychological factors (such as other memories, beliefs, expectations and prejudices) and environmental factors (such as the presence of a weapon at the crime scene, the location at the time of witnessing an event or the amount of light available).
- Retrieval cues are stimuli that assist in the recall of memories.
- By taking an eyewitness back to the scene of a crime, it may be possible to encourage the recall of memories that might be context-dependent.
- Reconstructive memory is the recall of a memory by putting together the parts of an event to 'complete the picture'. This type of memory is shaped by our own personal beliefs, prejudices and expectations.
- Misleading information at the scene of a crime or misleading questions during interviewing may influence an eyewitness's recall of events.
- The existence of DNA identification has provided additional evidence for some cases to suggest a suspect has been wrongly convicted.
- Police line-ups, photofits, identikits, artist impressions and mugshots are all aimed at assisting an eyewitness to identify a suspect. When approached in the wrong way, these methods can lead to cases of wrongly identifying suspects.
- There are many complex factors that can influence eyewitness testimony. The accuracy of memory is highly dependent on how accurately details have been recorded and how well we can retrieve details we have stored in memory.

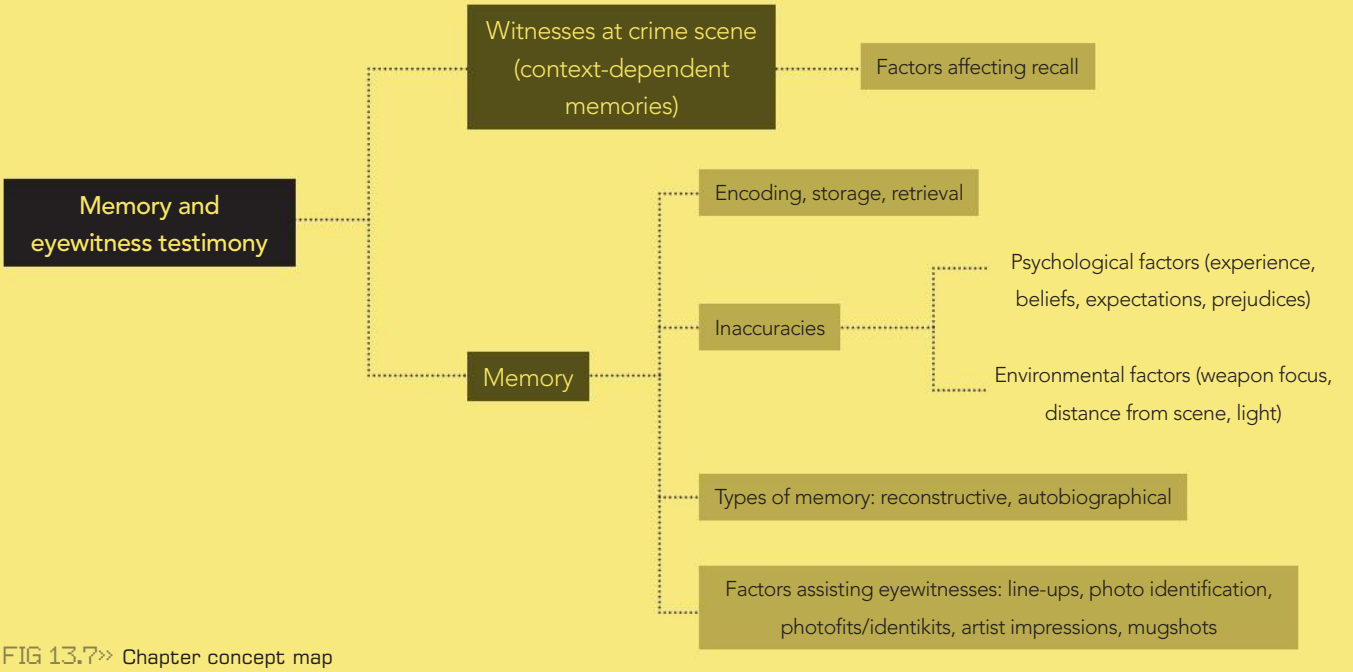


FIG 13.7›› Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 Eyewitness testimony is:
- **a** a witness to the scene of a crime
- **b** the details given about the crime scene or suspect by a witness
- **c** details about a crime presented in court
- **d** always reliable.

2 A person who develops an understanding of the psychological factors that can influence eyewitness testimony is a:
- **a** suspect
- **b** police investigator
- **c** forensic psychologist
- **d** psychiatrist.

3 The three stages of memory in order are:
- **a** storage, retrieval, encoding
- **b** retrieval, encoding, storage
- **c** retrieval, storage, encoding
- **d** encoding, storage, retrieval.

4 An autobiographical memory:
- **a** is when memories automatically appear
- **b** recalls events that we have experienced
- **c** recalls the life of a famous person
- **d** is an accurate memory.

5 Police will sometimes take an eyewitness back to the scene of the crime to help them recall memories of the event. This type of memory retrieval is:
- **a** content-dependent
- **b** misleading
- **c** context-dependent
- **d** unreliable.

6 Blair was an eyewitness to a hit-and-run accident. He had thought he had seen the car involved driving below the speed limit prior to the accident. However, when interviewed by police, he was asked the question 'What colour was the speeding car that was involved in the accident?' This type of question can encourage an inaccurate recall of the events because it is:
- **a** too detailed
- **b** unfair
- **c** misleading
- **d** irrelevant.

7 Reconstructed memory can be inaccurate due to eyewitnesses:
- **a** adding non-existent detail
- **b** distorting the events
- **c** substituting some details for others
- **d** all of the above.

8 In an experiment conducted by Loftus (1979), a theft was staged at a busy train station. When eyewitnesses were asked to report on what they saw a week later:
- **a** half the witnesses claimed to have seen items that did not exist
- **b** all of them were very accurate in their recall of events
- **c** most of the witnesses were very confident that they knew the identity of the thief
- **d** half of them did not recall being involved in the experiment.

9 An example of a psychological factor that can influence an eyewitness's recall of an event is:
- **a** weapon focus
- **b** prejudice
- **c** a stressful event
- **d** the position from which the event was witnessed.

10 A photo of the crime scene used by police to assist the eyewitness in recalling details is called a:
- **a** retrieval cue
- **b** prop
- **c** psychological cue
- **d** photofit.

11 Dylan was in the queue at the bank when two men dressed in black ran in with pistols and ordered all the customers to lie face-down on the floor. When asked to give a description of the armed men, Dylan had trouble recalling any details of what the men looked like. The reason for this is most likely to be:
- **a** he has no reconstructive memory
- **b** his attention was focused on the weapons rather than the men
- **c** he was too stressed to observe the men
- **d** the police were asking misleading questions.

12 Describe the factors police should take into account when selecting a fair line-up of suspects for Dylan to identify the men he witnessed in the armed hold-up.
13 List the factors that may contribute to an eyewitness identifying the wrong suspect.
14 Explain why police might take an eyewitness back to the scene of a crime.

Extend yourself

15 Rubin 'Hurricane' Carter spent time in prison as a result of inaccurate eyewitness testimony. Research this man who has been instrumental in highlighting the issue of wrongful convictions. Find out more about his background, his boxing career, his time in prison and the events that led to his release. What is he currently doing?
16 What information does DNA identification provide? How is this process conducted, and on what evidence can it be used? How accurate is this process in providing evidence about suspects involved in a crime? What are the limitations of this process? What might the future hold for DNA identification in the courtroom?
17 Elizabeth Loftus has been a key researcher in the field of eyewitness testimony. What type of psychologist is she? Where does she work? What studies is she currently conducting?
18 There have been many cases of the wrong person having been convicted for a crime based upon inaccurate eyewitness testimony. Find out about one such case and relate the details.
19 Hypnosis is thought to be a means of accessing memories that an eyewitness is unable to access. How successful is this method? How does hypnosis work? How reliable are the memories retrieved this way?
20 Polygraphs are sometimes used in criminal cases to find out if suspects and witnesses are telling the truth. What is a polygraph and how does it work? How accurate are they in identifying someone who is telling the truth?
21 Courts of the future may be better able to utilise eyewitness testimony by having a greater understanding of ways to accurately recall memory. Imagine—what science might be available to judges and lawyers to ensure the accuracy of the recollections from witnesses to crime?
22 Go online to play the eyewitness testimony game: How well can you remember faces? WWW

SPORTS PSYCHOLOGY

ODDS ARE THERE IS AN ASPECT OF YOUR LIFE THAT YOU WOULD LIKE TO IMPROVE. SPORTS PSYCHOLOGY CONSIDERS WAYS TO IMPROVE PERFORMANCE—BUT ITS APPLICATIONS ARE NOT LIMITED TO THE SPORTING FIELD. THE MAIN CONCEPTS CAN BE USED TO INFLUENCE MOST ASPECTS OF OUR LIVES INCLUDING SCHOOL, WORK AND OUR PASTIME ACTIVITIES.

SPORTS PSYCHOLOGY AND PRACTICE

In the lead-up to the 2000 Sydney Olympics, each sport utilised the services of a sports psychologist. This was one of the reasons why Australia was so successful.

The Australian Institute of Sport, Australian Football League and other major sporting associations employ sports psychologists and recognise the value of their services. Sports psychology is more than just a loud chant before the start of a game—it is a frame of mind that carries over into effective training practices, great teamwork and all stages of the game. Sports psychologists work closely with the players from an early stage in their career. Dealing with competitive anxiety and arousal, improving self-confidence and motivation, learning and perfecting new skills, goal-setting and working as an effective team are just some of the areas that a sports psychologist concentrates on.

In this chapter we will consider the importance of practice, motivation, arousal and team cohesion on performance. These aspects are not restricted to the sporting field but can relate to other areas of your life.

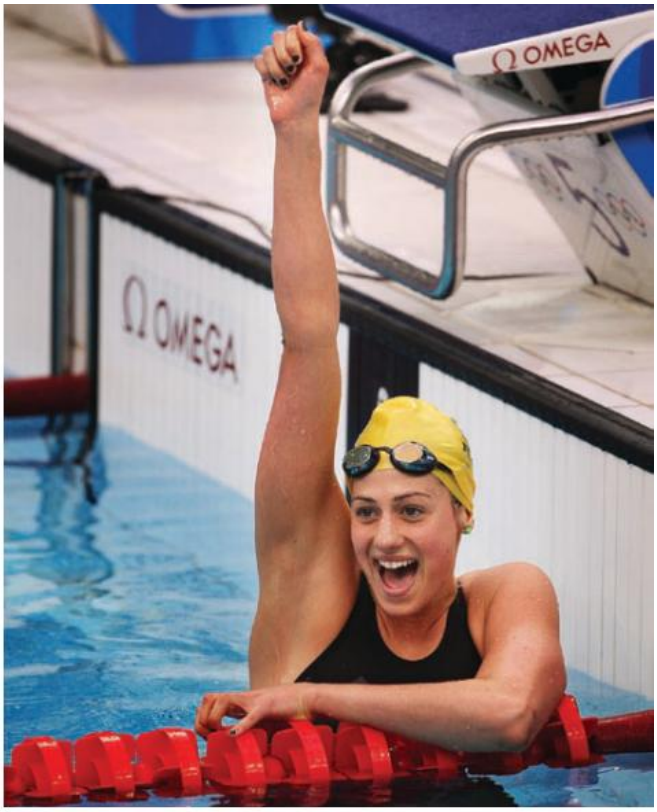


FIG 14.1» Swimmer Stephanie Rice wins Olympic Gold at the Beijing Olympics 2008. On average, it takes sportspeople at least ten years of practice, hard work and sacrifice to gain the necessary skills to achieve this kind of success. What is their motivation?

14.1 INVESTIGATE

Sports psychologists

Check out reputable sources of information on sports psychology such as the Australian Institute of Sport and the APS Sports Psychology websites.

WWW»

- Where do you train to become a sports psychologist?
- How big is the demand for sports psychologists?
- What are the main areas of sports psychology research being undertaken in Australia?
- Does your favourite sporting team or athlete employ a sports psychologist? Is there a particular psychological issue that your team or athlete needs to address?
- How can sports psychologists help elite athletes in other aspects of their lives, including recreation time and retirement?

WHY PRACTISE?

This may seem a simple question but the benefits of practice are complex. It is likely that you have heard the phrase 'practice makes perfect' many times and noticed the positive effects of practice. Practising can improve performance and also help when performing in front of an audience by boosting confidence and reducing anxiety.

Practice can be a great team-building exercise and increase your enjoyment of the sport—especially when you can see all the hard work paying off.

There are, however, risky practice techniques. For instance, too much of the same thing can lead to boredom and dissatisfaction with the sport. Looking at ways to overcome these slumps is a focus of sports psychology.

THE LEARNING CURVE

It can take time to master a new skill. At first you may struggle as you learn the skill. With each trial, however, you begin to improve. Typically, improvement is rapid in the beginning—your performance increases in leaps and bounds. After a number of trials, however, further improvement is often minimal and can even taper off as you become skilled in the task. This pattern is called a **learning curve**. (See Figure 14.2.)

One thing to note is that the relationship between learning and performance is not as straightforward as it seems. *Learning* is an internal process while *performance* is a behaviour. Learning and knowing the skill does not always mean you will be able to perform.

Even after you have learnt a new skill it may take some time before your performance improves. In some cases, it may be physically impossible to improve performance—not all of us are built to be professional athletes!

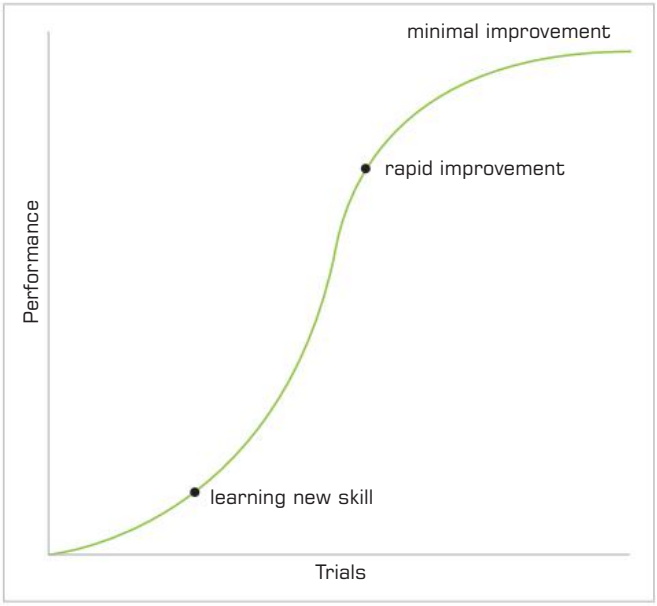


FIG 14.2» The more you practise the better your performance, but there is a limit.

14.2 INVESTIGATE

The learning curve: my memory is backward!

What you need: 10 narrow sheets of paper (fold an A4 piece of paper four times, open and cut or tear along the crease marks), pen, stopwatch or clock.

Step 1 Label the sheets 1 to 10.

Step 2 When your teacher says 'go', write the alphabet backwards on sheet 1, starting from Z. If you finish the alphabet, start again from Z. After 25 seconds, your teacher will tell you to stop. Stop immediately, turn over the sheet and place in a new pile. Get your new sheet ready to start again (you have five seconds).

Step 3 Repeat step 2 until all 10 trials have been completed.

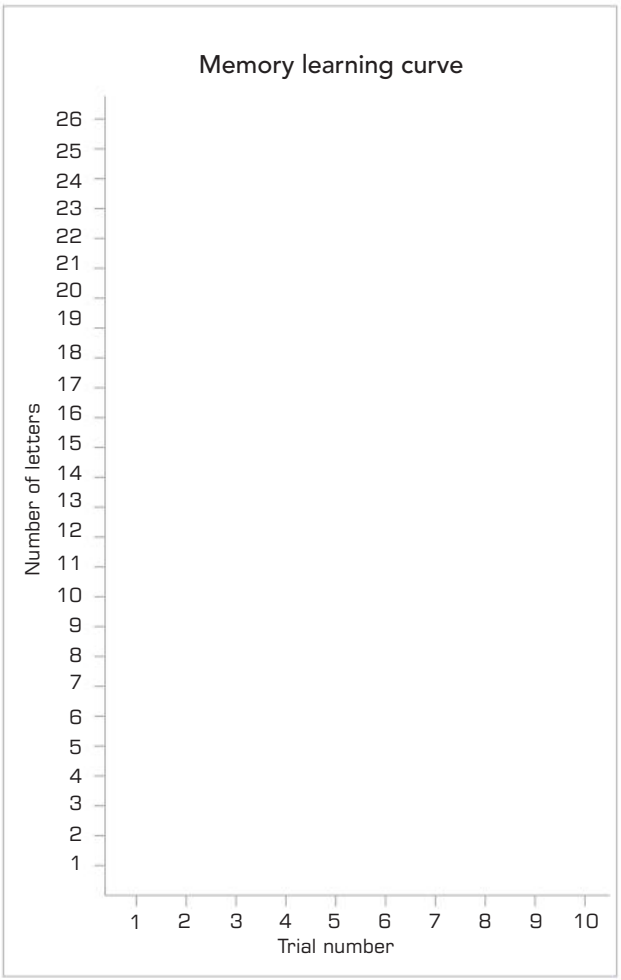
Step 4 Collate your results. Add up how many letters of the alphabet you correctly wrote for each trial.

Step 5 Copy the graph onto graph paper and plot your results.

1 What is the shape of a typical learning curve?

2 Did your graph represent a typical learning curve? Describe any differences.

3 A number of other variables, such as previous learning or a distraction during a trial, could have influenced the data. Outline two such variables and describe how each could have influenced the results.



14.3 INVESTIGATE

Go juggle

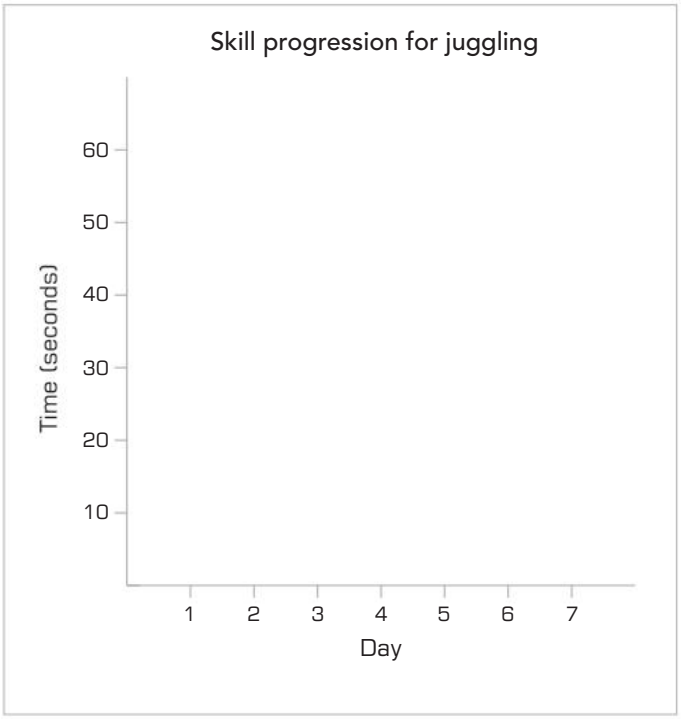
Try learning a brand new skill, such as juggling, over the next week or so. Set aside time each day (20 to 30 minutes) to practise. At the end of each practice session, time how long you can juggle without dropping a ball.

Copy the graph onto graph paper and plot your progress.

Note: If you already know how to juggle, pick another skill to learn or make the task more difficult (for example, use four juggling balls).

1 Did your graph represent a typical learning curve? Describe any differences.

2 A number of other variables, such as previous learning, a distraction during a trial or the audience effect, could have influenced the data. Outline two such variables and describe how each could have influenced the results.



The use of imagery

FIG 14.3» Imagine that you have just been given a free kick in front of the goalposts. The final siren sounds and your side needs a goal to win the match. Before you kick the goal, you mentally rehearse the kick. You imagine how your arms and legs will move before, during and after the kick. You then execute the perfect kick and celebrate your team's victory.

The use of **mental imagery** allows you to practise whenever and wherever you want. Research suggests that mental practice can lead to better performance and can be as powerful as physical practice. In addition to practice, athletes use this tool to learn correct techniques and apply skills to new situations.

Imagery can help you in a range of motor skills, not just those associated with sporting performances. For example, it can assist surgeons in the operating room, musicians performing at a concert and lifesavers undertaking a rescue. Imagining what it will be like sitting your exam can also help you relax when in the real situation.

Next time you are in a situation where you need to execute a motor skill, mentally rehearse the performance first. Try this:

- Use **vivid images**—visually imagine as much detail as possible. Think about each body movement.
- Use **slow motion**—imagine performing the task slowly at first but speed up once you get the hang of it.
- **Observe experts**—watch them perform the same skill and imagine yourself doing the same thing.

Mental imagery—the power is all in your head!

THE AUDIENCE EFFECT

Having an audience can improve our performance or make it worse. An audience includes all those watching you perform, such as spectators, other members of your team, your coaches and the opposition.

Performing in front of others can increase performance when the task or skill is well-learnt and mastered or simple. A person can become more alert and motivated to perform, and this can lead to better results.

Conversely, performing in front of others can decrease performance when the task or skill is complex or yet to be mastered. A person can become too alert, which can lead to poorer results.

These two influences are known as the **audience effect**. An audience is more likely to improve our performance on a simple or mastered task and hinder our performance on a complex or new and yet-to-be-mastered task.

Knowledge of the audience effect can be used to enhance performance. A coach can:

- get team members and others to train with each other. This can increase effort as they become more motivated to perform
- get team members to train alone when first learning a new skill or task
- teach team members techniques to shut out distractions from the audience.

REVIEW 14.1

1. What are the main features of the learning curve?
2. According to the learning curve, what is likely to happen to our performance after we have practised a new skill a number of times?
3. When is an audience most likely to enhance performance?
4. When is an audience most likely to impede performance?
5. How can knowledge of the audience effect be used to enhance performance?
6. Does mental practice improve performance? Explain.

FIG 14.4» When children are performing a simple or mastered skill, an audience can motivate them and lead to better results.

WHY ARE SOME PEOPLE HIGHLY MOTIVATED?

Jodie, Tahlia and Francis are planning their next rock-climbing adventure. This time they want to camp overnight on a rocky ledge.

Max trains for two hours each morning before going to work.

Walter reduces his time at his paid work and volunteers for charity work for a humanitarian organisation.

Chris is driving to his favourite fish-and-chip shop. He doesn't mind the one-hour drive to get there.

Meredith is waiting for a surge of energy to get her to tidy up her room.

Rory just couldn't be bothered going for his daily jog around the park today.

- What drives our behaviour?
- Why do some athletes practise for hours each day?
- Why would someone risk their life, reduce their income or drive kilometres to get food?

Motivation is the driving force behind behaviour that leads us to pursue some things and avoid others. It is affected by our biological make-up, our culture and our experiences. Motivation works with our emotions to influence our behaviour.

Motivation refers to the internal processes that activate, guide and maintain our observable behaviours. It is a concept that can be difficult to measure.

FIG 14.5» What is your motivation to exercise?

14.4 INVESTIGATE

Write to yourself in the future

You need an envelope and some writing paper for this activity.

1. Address the envelope to yourself. Label it 'private and confidential' and clearly mark the year you wish to open the letter (perhaps in three years' time or later—after you have completed your secondary education).
2. Write the date, the class, your teacher, the name of your school and your age.
3. Now write the letter. Take your time. Treat this letter like a time capsule—something for you to treasure in the future. In your letter, address the follow questions:
   - **a** Why are you at this school?
   - **b** What is motivating you to successfully complete this year level?
   - **c** How well do you wish to go in this subject? How will you know if you have reached this level?
   - **d** Did you choose this class? If so, why?
   - **e** What will your study habits be like this year? Will they change during the next couple of years? What is motivating you to study? Explain your answers.
   - **f** What are your goals beyond this year level? This could be in terms of health, hobbies, friends and family, career, study and so on. Where would you like to be when you reopen this letter? What is motivating you to set and achieve these goals?
4. Seal your letter in the envelope. Put it somewhere for safe keeping OR give it to someone you trust and ask them to post it to you in three years' time!

14.5 INVESTIGATE

Sofie—our swimming actress

Sofie is the oldest child in her family and is completing Year 12. Next year she would like to study engineering at university. She is a member of the Victorian swimming squad and the local drama group.

- Why is Sofie a member of the local drama group? Think of as many reasons as possible.
- Do you think there is more than one reason for Sofie's membership in the swimming squad?
- Discuss the difficulties with determining what motivates a person. You should refer back to your reasons as each theory is presented.

Our society values positive thinking and achievement as demonstrated in the popular children's story 'The Little Engine That Could' by Watty Piper. The moral of this story is simple: if you strive for success and believe you can succeed, then you will overcome obstacles and succeed.

FIG 14.6» 'The Little Engine That Could' is an example of positive thinking.

INCENTIVE THEORY

Why are you reading this textbook? What is your incentive? **Incentive theory** considers the external forces that *pull* us (such as a reward) and the internal forces that *push* us (such as enjoyment) to perform a certain behaviour. Incentive theory is based on two types of motivation—intrinsic and extrinsic.

Intrinsic motivation comes from within us. We can have a push from *within* ourselves, with no sign of external reward. We can strive for a feeling of satisfaction and fulfilment. We are most likely to persist with mastering a skill or carrying out an activity when the motivation comes from within us. Intrinsic motivation affects our thinking patterns and determination to succeed.

Think of your favourite sporting star. Top performing athletes are intrinsically motivated. They are committed to the training and taking part in the sport for its own sake. They don't do it for money or fame (although this could be seen as an added bonus). They are likely to pursue excellence and push themselves to improve.

Extrinsic motivation comes from outside us. It is behaviour that is motivated by rewards and punishments given by other people. It may be based on a need to have many friends, improve your social status, achieve at work or receive an encouraging word. Extrinsic motivators also include more tangible rewards such as a pay rise, trophy, award or promotion.

What is your favourite subject at school?

An intrinsically motivated student will study hard because they enjoy learning. They may investigate a topic further or indeed learn about a subject not taught at school. The motivation to study comes from within themselves.

An extrinsically motivated student will study hard because they enjoy receiving top marks. They study to pass the examination rather than develop a full understanding of the topic. They are not inclined to investigate a topic further unless they receive further external rewards (such as extra marks).

Most likely you are both intrinsically and extrinsically motivated to study. You may receive some pleasure in learning about your favourite topic and also enjoy the praise from your family when you receive a good mark.

In a recent Victorian study of Year 5 to Year 9 students in a range of primary and secondary schools, students recorded high positive scores on a scale concerning their motivation to learn. However, they indicated that they were only

FIG 14.7›› Working hard to receive a reward, such as a trophy, is an example of extrinsically motivated behaviour.

interested at a low level in their classroom work. Hence they were unlikely to be directing their motivational energy into their school work, which they found to be unstimulating. These students were not intrinsically motivated to engage in their classes (Russell, Mackay & Jane 2003).

In a study of a Victorian secondary school, Kronborg et al. (2008) examined the attitudes of Year 7 students towards their learning environment. Students in mixed-ability science classes, and high-ability extended curriculum classes in English and mathematics, completed surveys examining their perceptions towards achievement, motivational orientation and overall satisfaction with their classes. Results indicated that students with involvement in extended curriculum classes had more positive perceptions of these classes, and their overall attitude towards learning in the mainstream environment was also more positive.

A finding of particular interest was that the high-ability students rated themselves as more intrinsically motivated and less extrinsically motivated than peers in mainstream mixed-ability classes. Thus they had motivational orientations that were more likely to be associated with achievement even in mixed-ability settings.

Improving motivation in life's activities

While rewards (an extrinsic motivator) can improve enjoyment and self-esteem, they can also decrease the level of satisfaction, especially if the individual feels as if he or she is losing control of the situation. Here are some tips on using rewards to increase intrinsic motivation:

- Use positive rewards such as praise and encouragement. The rewards must be valued by the person.
- Focus on what was done well (such as great effort and skill), not just performance. Reward performance, not just winning.
- Avoid the use of punishment.
- Set realistic goals that are challenging and rewarding.
- Let the person take part in the decision making and goal setting.
- Training sessions should be well organised, varied, fun and challenging. They should focus on the mastery of skills and learning.
- Work on team spirit—provide time and social events where team members can get together and become friends.

14.6 INVESTIGATE

Debate: Should a student be given money from their parents for a top grade?

What are the dangers of receiving $50 for each 'A' that appears in your report? Will there be consequences in future years? Discuss in terms of intrinsic and extrinsic motivation.

Pick one side of the debate and find a supporting research study.

CULTURAL DIFFERENCES

We must acknowledge that we live in an **individualistic society** where individual achievement is important. There are clearly positives and negatives attached to this way of life. There are also **collectivist societies** where individual achievement is not important and may even be considered indecent and embarrassing. Some cultures actively avoid personal recognition, such as the Zuñi Indians who once thrived in the USA. In Zuñi culture, if individuals were put in the spotlight, such as by heroically saving a life, they would often disappear from the tribe for months on end before returning quietly.

NEED FOR ACHIEVEMENT

Elite athletes are likely to have a high need for achievement. The **need for achievement (nAch)** is the desire to compete with a standard of excellence. A person with high nAch has a need to do well, to succeed and avoid failure. They are likely to choose a moderately difficult task over a fairly easy or very difficult task. A moderately difficult task will be a challenge but they are more likely to succeed than with a very challenging and very difficult task. On the other hand, completing a fairly easy task will be of little challenge and so success won't be as enjoyable.

People with high nAch enjoy success. They tend to:

- persist longer at a task in order to reach their goal
- take pride in their accomplishments
- attribute their successes to their abilities
- attribute their failures to forces beyond their control
- choose moderately difficult tasks over fairly easy or very difficult tasks
- be more willing to compete—to put themselves in situations where their performance can be measured against others'.

This may explain why some athletes succeed and others of equal ability do not.

A classic study involves the ring toss game, nAch and difficulty of the task (Atkinson & Litwin 1960). Participants were free to choose their distances from the targets. The researchers found that those with high nAch tended to choose distances that were challenging but not impossible. Participants with low nAch or a high fear of failure tended to choose very close or far distances, ones that would either guarantee success or offer a good excuse for failure.

Did you participate in the ring toss activity? Do you think it relates to nAch?

The Impostor Phenomenon

You have it all—why keep training and working at a furious pace? Why work yourself into an early grave?

In the book *If I'm So Successful Why Do I Feel Like a Fake?* (1985) psychologists Harvey and Katz describe the Impostor Phenomenon. The **impostor phenomenon** explains why high achievers are motivated to keep working, even though they have already achieved greatness. Up to 70 per cent of high achievers think that their achievements are due to luck, not skill. They fear they will be found out, exposed and rejected. They keep working or training at a hectic pace, rarely taking time out to relax.

Can you think of other reasons why someone is motivated to keep working, even when they have reached the top?

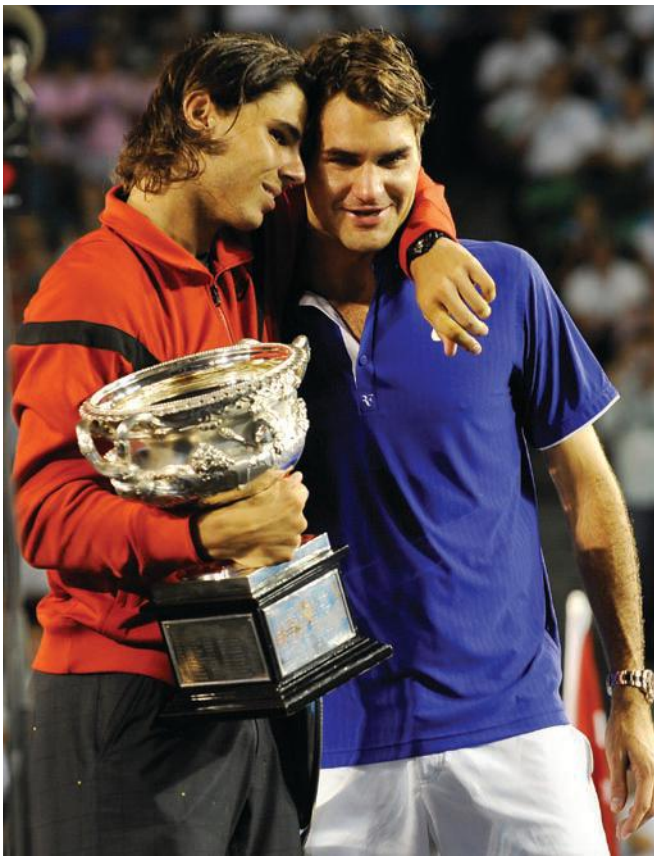


FIG 14.8» After a record 237 consecutive weeks ranked No. 1 in the world, Roger Federer dropped to second behind Rafael Nadal. Federer has already won over $90 million, more money than he can reasonably spend in his lifetime. What motivates him to keep submitting to the emotional stress and physical strain of the tennis circuit?

14.7 INVESTIGATE

The need for achievement and the ring toss game

What you need: ring toss game, chalk or marking tape.

Instructions

- Set up the ring toss game in your classroom or another suitable area.
- Mark three throwing lines (2 m, 4 m and 6 m away from the target).
- Each student selects one of the throwing lines. They then get three attempts at throwing the ring on the target from this line.

Questions

- Which line did you select? Why?
- How did you feel about your performance? Did you succeed or fail?
- If given another turn, which throwing line would you select? Why?
- Which throwing line was the easiest? Which was the hardest?
- According to research on the need for achievement, which throwing line would someone with a high need for achievement choose? Why?
- Do you think this simple activity relates to the need for achievement? Explain your answer.

FIG 14.9» The ring toss game has been used to study the relationship between nAch and the difficulty of a task.

REVIEW 14.2

1. What is the difference between intrinsic and extrinsic motivation?
2. Why is it often important for a person to be intrinsically motivated to reach their ultimate goal?
3. Describe three actions by your parents and teachers that may help you with your school work by improving your intrinsic motivation.
4. Outline three characteristics that are common for people with a high need for achievement (nAch).
5. Why do people with a high nAch tend not to choose easy tasks?
6. What is the impostor phenomenon?

PSYCHED UP FOR AN EVENT

Some athletes and other performers need to get psyched up before an event; others try to remain calm. Some listen to hard rock music; others to slow classical music. What is your preference? Why? In this section, we consider the need to be pumped or psyched before an event and why some people seek extreme experiences.

CHOKING

At the 2008 Beijing Olympics, Australian diver Matthew Mitcham stepped up to the 10m platform for his final dive and 'nailed it'. Matthew performed the dive of his life, a near perfect dive that put him in the lead. He then had to watch the Chinese favourite, Zhou Luxum, perform his last dive. Zhou uncharacteristically messed up his dive and ruined China's hopes of winning all eight diving gold medals.

Zhou was outright favourite and had the weight of his nation on his shoulders. Have you ever watched a top athlete fall apart during an event? They may be the favourite or be winning by a clear margin, but they abruptly stop performing anywhere near their best. It is as though they suddenly become aware of the enormity of the situation and think too much about executing the most basic skills.

Conversely, have you ever admired an athlete for not succumbing to the intense pressure and performing at their best? Matthew's performance under such pressure was admirable.

Failure to perform near optimum levels when under intense pressure is known as **choking**. Choking can occur suddenly and it can be extremely hard to overcome. For some athletes, choking can become a seemingly automatic behaviour at a certain point when winning is likely. It can be a difficult behaviour to break, and regaining self-confidence to avoid repeating the mistakes requires hard work for many.

There are methods that can help athletes execute a skill with precision without becoming self-conscious when they are under extreme pressure. Methods that can be used to overcome or avoid choking include:

- learning relaxation techniques
- using imagery—imagine performing at your best when under extreme pressure at a crucial stage in the event
- training as if you are at a crucial stage in the event
- learning techniques to block out the crowd—many athletes avoid reading, listening or talking to the media prior to an event.

FIG 14.10» Diver Matthew Mitcham wins an Olympic gold medal.

YERKES-DODSON LAW

The Yerkes-Dodson Law can help explain why we can perform under pressure and why we can fall apart. The **Yerkes-Dodson Law** states that we need to maintain a level of arousal that is *optimal* in a given situation, in order to perform at our best.

Arousal relates to our level of alertness and readiness to respond to a stimulus. Arousal is a combination of motivation, anxiety and the stimulating environment. It is both psychological (your emotions, such as excitement and terror) and physiological (those factors controlled by your autonomic nervous system, such as heart rate and sweating).

Imagine you are about to play in the soccer final. To play your best you need a certain level of arousal, not too high or too low. This is called **optimal arousal**. You do not want to start the game with a very low or high level of arousal. An optimal level is the level needed for the best performance.

Optimal levels of arousal vary between individuals and tasks. For any given task, if we are over- or under-aroused, our performance will suffer.

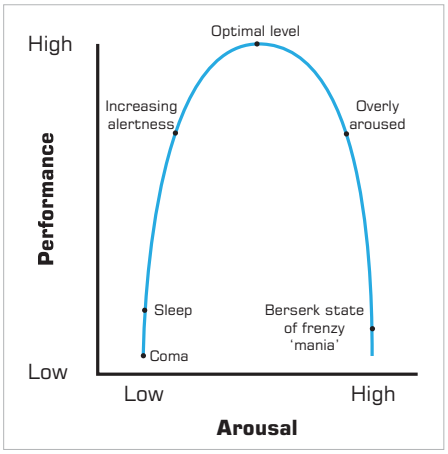


FIG 14.11» Yerkes-Dodson Law: the relationship between levels of arousal and performance

When placed on a graph, the Yerkes-Dodson Law resembles an inverted U.

TABLE 14.1» Effects of levels of arousal

Levels of arousal	Type of effect	Examples of effects
Too low	Under-arousal	Boredom Lack of interest Tiredness Poor performance
Too high	Over-arousal	Anxiety Stress Uptightness Poor performance

FIG 14.12» The Yerkes-Dodson Law: Elite athletes, such as Lauren Jackson, practise turning a complex task into an easy task. They also learn strategies to control levels of arousal during the match so that they can produce their best performance.

Simple tasks require a higher level of arousal than complex tasks. An elite basketball player is shooting free throws in a game. She has practised this many times and it is now a simple or easy task. However, if she has too much arousal (such as she may experience when shooting with scores level after the final siren), this may lead to her missing her shot.

Simple task → requires higher levels of arousal → high performance

Complex task → requires lower levels of arousal → high performance

A complex task requires greater concentration but a lower level of arousal. A pianist is playing a tricky piece of music; she would perform best in a quiet environment rather than a rowdy one because a lower level of arousal is more likely to produce the best performance.

Sensation seekers

Arousal can be used to explain why some people participate in extreme sports. These individuals could be described as having a 'thrill-seeking personality'. High sensation seekers prefer and seek very high levels of arousal. They look for new and exhilarating experiences.

According to Zuckerman (1979), when compared with low sensation seekers, high sensation seekers are:

- more willing to engage in *thrill and adventure activities* that involve some degree of risk. Such behaviours include skydiving, bungee jumping, white water rafting and surfing.
- more willing to *seek new and unusual experiences*. These may include volunteering for unusual experiments or demonstrations, backpacking in foreign countries, going to wild parties and having unusual friends.
- uninhibited. They are more prone to ill-advised and dangerous behaviours such as drug and alcohol abuse, gambling and risky sexual behaviour.

14.8 INVESTIGATE

Yerkes-Dodson Law and basketball free throws

What you need: Basketball, basketball court, pen and paper.

1. This is a class activity. You will need to move to the basketball court.
2. One at a time, each class member should have two shots for goal from the free throw line. Note the number of goals. This will be our LOW AROUSAL data. (It is important to keep the environment constant during this time. Students should stand in one area and keep quiet while class members are shooting for goals.)
3. The class should jog around the court three times and continue to jog and talk while each person in turn takes their shots, repeating step 1. This will be our HIGH AROUSAL data.
4. Back in the classroom, divide the class into three groups and relate each to the type of task (simple, medium, complex):
   - **a** little or no experience at playing basketball = COMPLEX task
   - **b** some experience at playing basketball = MEDIUM task
   - **c** very experienced at playing basketball = EASY task
5. Fill in the following table:

Type of task	Amount of experience	No. of goals before jogging (low level of arousal)	No. of goals after jogging (high level of arousal)
complex	little or no experience at playing basketball		
medium	some experience at playing basketball		
simple	very experienced at playing basketball		

Questions

1. According to the Yerkes-Dodson Law, which conditions should produce the best performances for each type of task?
2. Do the findings support the Yerkes-Dodson Law? Discuss.
3. A number of other variables, such as practice and the audience, could have influenced the data. Outline two such variables and describe how each could have influenced the results.

more likely to experience boredom. They have a lower tolerance for routine and repetition.

High sensation seekers tend not to get as stressed as low sensation seekers; however, they may experience more difficulties at school and have poorer health habits. Their optimal level of arousal is higher than that of others and they need to do more to achieve it. A person low in sensation seeking would probably be satisfied in a tranquil and quiet environment. They are happy and comfortable with a quiet life but can get stressed if things change unexpectedly. Most of us fall somewhere in between—sometimes we like adventure, sometimes we don't!

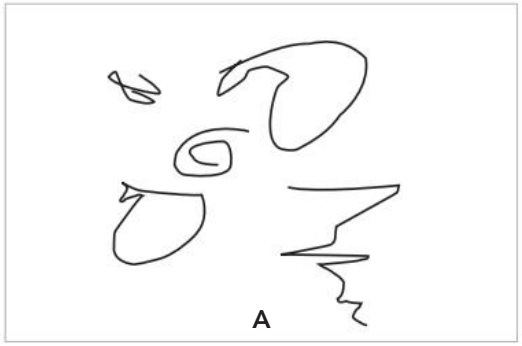
FIG 14.13›› Extreme sports and sensation seekers. Would you ever consider any of these activities?

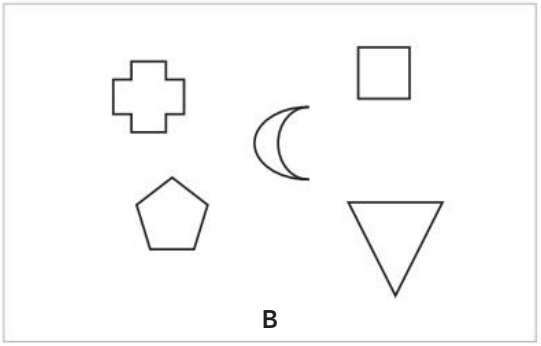
14.9 INVESTIGATE

Do you seek out sensation?

Answer the following TRUE or FALSE questions.

1. I would really like to try skydiving.
2. I prefer to meet new people rather than the same old faces each day.
3. I don't mind 'roughing it' when I go on holidays.
4. I hate the thought of doing the same activities day in and day out.
5. I would have enjoyed being an explorer or pioneer in the early days of white settlement in Australia.
6. I prefer to dive straight into the cold ocean rather than taking my time to get wet.
7. I don't like the thought of relaxing in front of a fire on a cold, wintry day.
8. I sometimes like to do activities that are frightening.
9. I like people who are not afraid to express their emotions, even if they are a bit wild at times.
10. I would like to backpack through Third World countries.
11. I prefer Figure A to Figure B





Add up the number of TRUE responses. The more true responses, the more likely you are a high sensation seeker.

(CAUTION: It is important to note that this is just a very rough indication—this survey is a modified and shortened version of the Sensation Seeking Scale.)

Adapted from Zuckerman, M. (1979). Sensation Seeking: Beyond the optimum level of arousal. Hillside, NJ: Erbaum

Daredevils get a jump ahead

By Fiona Smith

Oracle chief executive Larry Ellison, Virgin chief executive Richard Branson, Leighton Holdings chief executive Wal King, and Westfield Group managing director David Lowy are all famous for their thrill-seeking personalities. Sydney Adventist Hospital doctor Glenn Singleman is a less famous adrenalin junkie, but has clearly thought a lot about it. He and his wife go BASE jumping, and have broken records doing so. He says extreme thrill seekers have 11 copies of the D4DR gene, while the risk-averse have only one or two. Unsurprisingly, Dr Singleman and his wife each have 11 of the genes. Both go on the speaking circuit to talk to corporate groups about their experiences, and share their belief that fear should not be allowed to rule a person's life.

At the University of NSW's Australian School of Business, professor of business psychology Chris Jackson has found that sensation seeking tendencies can create the Richard Bransons and Bill Gates of the business world (the latter's risk-taking was more about building his Microsoft empire than jumping out of hot air balloons). Professor Jackson,

with Peter O'Connor from the School of Psychology at the University of Queensland, has found that people with high levels of sensation seeking do better in performance tests. They say they have come up with a personality model that will be a stronger predictor of performance in the workplace than previous tests.

Sensation seeking is a double-edged sword, however, Jackson says—high sensation seekers are more likely to be in prison, take drugs, or gamble—but if they express their personality in a positive way and moderate it by goal setting, powerful entrepreneurial abilities are often the result.

Australian Financial Review (Abstracts), 15 July 2008

14.10 INVESTIGATE

BASE jumping

BASE jumping is jumping from fixed objects such as Buildings, Antennae, Span (bridges) and Earth with a parachute. The sport is becoming more sophisticated and attracting more elite athletes. Read the above newspaper article Daredevils get a jump ahead and answer the following:

1. Why do you think people participate in such an extreme sport as BASE jumping?
2. How does sensation seeking theory explain why people are motivated to participate in such an extreme sport as BASE jumping?
3. What gene has been linked to sensation seeking?
4. Based on the findings in this article, what advice would you offer a person with a high sensation seeking personality?
5. Should extreme sports such as BASE jumping be legal? If yes, should there be any restrictions? Explain your answer.

Further research: Find out if BASE jumping is legal in Australia.

REVIEW 14.3

1. What is meant by the term 'arousal'?
2. What level of arousal are we best to achieve in a given situation?
3. How does the optimal level of arousal for a simple task differ from that of a more complex task?
4. What are some of the negative side effects of low arousal?
5. What is 'choking'?
6. Use an example to illustrate your understanding of the psychological term 'choking'.
7. When is choking most likely to occur?
8. What are some techniques that can be used to avoid or overcome choking in sport?

THE IMPORTANCE OF TEAMWORK

Just like at school and in the workplace, there are many team sports that require members to interact and work together. Team members need to respect each other, have a sense of a shared purpose and foster a collective identity. A team can have the best and most skilful individuals but fail to perform. Team cohesion—working together in a positive manner to achieve a goal—is required.

GROUP PROCESS

Sports psychologists work with teams at the start of the season to encourage teamwork, for example setting goals for the season. Read through the stages that a group goes through to become a team and link each with the process of setting and working towards goals.

A group usually needs to experience four stages to become a team. These are:

1. **Forming**—getting to know other members of the group and their roles within the group. This is the initial 'ice-breaker' stage.
2. **Storming**—brainstorming ideas, challenging the leader and competing for power. This can be a creative but stormy process.
3. **Norming**—deciding on a course of action. This is when a group starts working effectively together and has a common goal.
4. **Performing**—members identify with the team, understand the value of each individual's contributions and perform accordingly.

TEAM COHESION

Team cohesion is the degree to which a team works well together. Building team cohesion is likely to improve sporting performance. A coach can help build cohesion by:

- giving team members opportunities to get to know each other
- letting team members play a role in decision making
- clearly defining the roles and expectations of each team member
- encouraging communication between team members
- building group identity such as having a team mascot, T-shirt and/or song.

To further improve team performance and morale, coaches need to monitor each individual's performance and provide encouraging feedback. They need to look out for:

- **Social loafers**—those individuals who tend to hide in the crowd and do little work. Often you hear a commentator say that the team is 'carrying' them. 'Social loafing' is a term meaning that some individuals reduce their effort during group work.
- **Social suckers**—those individuals who tend to take over and perform most of the work.

FIG 14.14›› Teambuilding games are designed to build trust between members.

14.11 INVESTIGATE

Group work in the classroom

Group work at school is often encouraged. Most of the time it can be a valuable experience, but sometimes it can cause stress to one or two individuals.

In pairs, discuss the following questions:

- What can be done to encourage team cohesion when carrying out group work?
- Have you ever been a group sucker? Can you remember a time when you felt let down by a group?
- Have you ever been a social loafer? Can you remember a time when you did little to contribute to group work?

14.12 INVESTIGATE

Help motivate Ramon

You are a sports psychologist and understand the importance of motivation.

Ramon has been playing soccer since he was very young. Despite having a strong ability, he has lost interest in the game and no longer feels motivated. He knows that physical exercise is good for him and enjoys the friendships but no longer wants to participate in sport. How can you help?

CONCLUSION

Psychological theories can be applied to sports and other settings, such as school and work. They can help you reach your potential, increase your self-esteem and prepare you to cope with stressful events.

If ever your performance is suffering and you are not sure why, you may need to consider a number of aspects of the situation. This includes things such as too much or too little practice, boredom, tiredness and too little arousal. A break from practice, a change in routine, reconsidering intrinsic motivators, resetting goals, more detailed feedback, relaxation techniques, teambuilding exercises, good-quality sleep and a healthy diet can all help you regain confidence and hopefully see improvement.

Your hard work will pay off and you will regain your spark for the activity again. All the best—sports psychology can help you perform!

REVIEW 14.4

1. Outline the four stages that a group must go through to become a team.
2. What can a coach do to build team cohesion?
3. What is a 'social sucker' and how can a social sucker interfere with team performance?
4. What type of activities do teams undertake during preseason training? Are these related to team cohesion? Discuss.

FIG 14.15» Working together to achieve a goal can be very satisfying.

CHAPTER SUMMARY

- Practice is an important way to improve performance. The learning curve is a typical pattern that measures performance over time—usually learning is rapid and then steadies or tapers off. Mental imagery can be a powerful tool to practise and master a skill or technique.
- An audience can help or hinder performance. This is known as *the audience effect*. An audience is more likely to improve our performance on a simple or mastered task. An audience is more likely to hinder our performance on a complex or new and yet-to-be-mastered task.
- *Motivation* refers to the internal processes that activate, guide and maintain our observable behaviours. It can be difficult to measure but is the driving force that leads us to pursue some things and avoid others. Motivation is influenced by our biological make-up, our culture and our experiences. It works with our emotions to influence our behaviour.
- Incentive theory considers the external forces that *pull* us and the internal arousal that *pushes* us to perform certain behaviours. *Intrinsic* motivation is the push from within ourselves, with no sign of external reward. *Extrinsic* motivation refers to the rewards and punishments given by other people. It considers expectancy. If we expect to achieve a desired goal, then we are more motivated to work towards this goal.
- An optimal level of arousal is the level needed for the best performance. For any given task, if we are over- or under-aroused our performance will suffer.
  - When placed on a graph, the Yerkes-Dodson Law resembles an inverted U.
  - Optimal levels of arousal vary between tasks and individuals.
  - Simple tasks require a higher level of arousal than complex tasks.
  - High sensation seekers have a higher optimal level of arousal than others and need to do more to achieve it, so they are more likely to participate in thrilling and adventurous activities.
  - A person low in sensation seeking would probably be satisfied in a tranquil and quiet environment.
- The need for achievement (nAch) is the desire to compete with a standard of excellence. A person with high nAch has a need to do well, to succeed and to avoid failure.
- For a team to perform at its best, team members generally need to respect each other, have a sense of a shared purpose and foster a collective identity. The team needs to go through a number of group processes: forming, storming, norming, performing. Team cohesion, working together in a positive manner to achieve a goal, is required. Social loafing needs to be minimised.

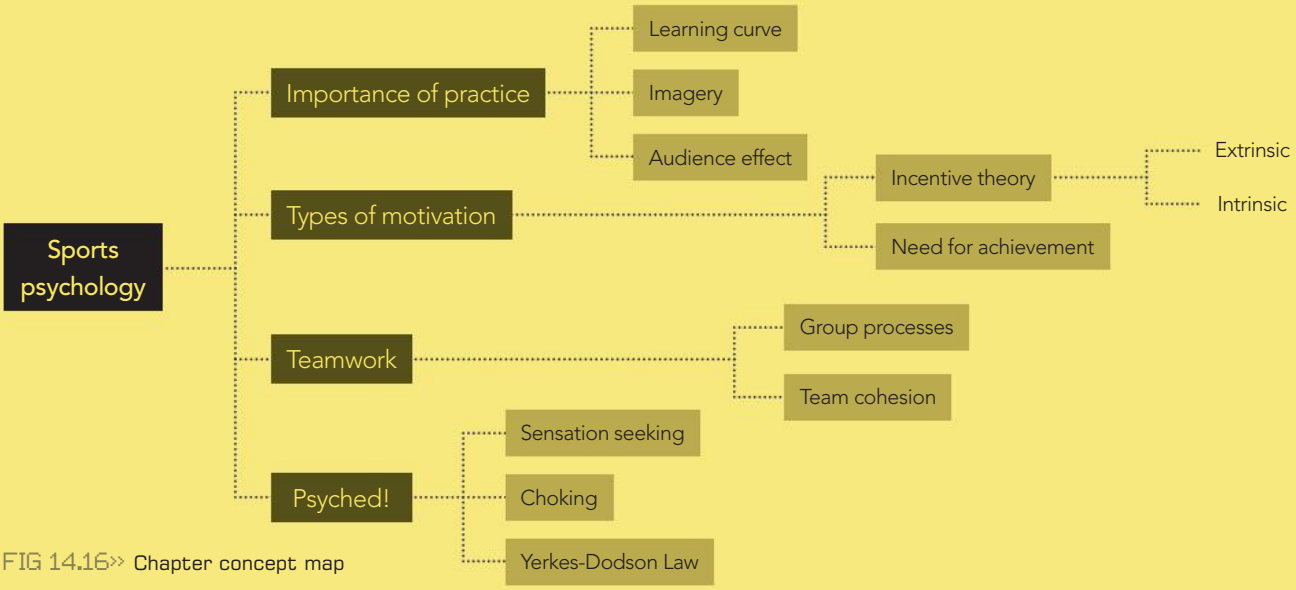


FIG 14.16›› Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 Brenda is playing golf and playing well. In front of a crowd on the last hole; however, she misses a tricky long putt that would have won her the match. Her miss in front of the crowd could be due to
   - **a** the audience effect
   - **b** the practice effect
   - **c** sensation seeking
   - **d** extrinsic motivation.

2 Caitlin loves making jewellery. She decides to sell her jewellery at the local shopping centre five days a week for a living. After a year, she starts to lose interest in making jewellery. This is probably because:
   - **a** her physiological need has been reduced
   - **b** her motivation changed from intrinsic to extrinsic
   - **c** she has a high need for achievement
   - **d** she is a high sensation seeker.

3 Sue has a low need for _____. She usually sets herself goals that require _____ to achieve.
   - **a** achievement; more skill than luck
   - **b** sensation seeking; more skill than luck
   - **c** achievement; more luck than skill
   - **d** sensation seeking; more luck than skill.

4 People with a high need for achievement:
   - **a** tend to be moderate risk takers
   - **b** do not persist long at a task
   - **c** avoid competition
   - **d** attribute their successes to forces beyond their control.

5 Debates and arguments about deciding the course of action are more likely to occur during the _____ stage of group process.
   - **a** forming
   - **b** storming
   - **c** norming
   - **d** performing.

6 What is team cohesion and why is it linked to sporting performing?

7 In terms of an individual's achievement and motivation, explain a difference between individualistic and collective societies.

8 Match the terms in the box with the correct definition.
   - **a** Picture formed when visually rehearsing the execution of a motor skill in one's mind. _____
   - **b** Internal process that activates, guides and maintains observable behaviours. _____
   - **c** The effect that performing in front of others has on performance. _____
   - **d** The degree to which a team works well together. _____
   - **e** A pattern on a graph that measures the effect of practice on performance. _____
   - **f** Failure to perform near optimal levels when under intense pressure. _____
   - **g** The level of desire to compete to a certain standard. _____
   - **h** High achievers that believe that their success is due to luck, not skill. _____
   - **i** The need to maintain a level of arousal that is optimal in a given situation in order to perform at our best. _____
   - **j** A pull from outside to behave in a certain way due to external rewards. _____
   - **k** A push from within ourselves to behave in a certain way with no external reward. _____

learning curve	mental imagery
audience effect	motivation
intrinsic motivation	extrinsic motivation
need for achievement	impostor phenomenon
choking	Yerkes-Dodson law
team cohesion	

9 You are about to sit a very important examination. Use your knowledge of the Yerkes-Dodson Law and its relationship with simple and complex tasks to explain why it is important to study and sit practice exams.

10 How can the knowledge of the incentive theory help you reach your ultimate goals in life? Explain how you put some of this into action.
11 Do you have a part-time job or earn pocket money?
   a If so, what are the major reasons for you to work? Create a list.
   b Relate the items of the list to the incentive theory.
12 What is the difference between learning and performance? Why is it important to keep this difference in mind when plotting a learning curve?
13 Brett has a big golf tournament on the weekend.
   a What advice could you give Brett about the value of mental imagery?
   b Give Brett some tips on how best to mentally rehearse for the game.
14 How can a coach use his or her knowledge of the audience effect to enhance performance?
15 Why is it important for a coach to think of ways to increase intrinsic motivation?

Extend yourself

16 How does the level of aspiration affect performance? Are higher levels of aspiration likely to increase performance? Do group standards and previous success impact on aspiration and performance?
17 How can teachers increase intrinsic motivation in the classroom? Start with Edward Deci's research findings.
18 What, if any, types of music do your favourite athletes like to listen to before a game? How does this relate to arousal and performance?
19 Do you like listening to music before sport? What, if any, types of music do your favourite athletes like to listen to before a game? Can you relate this to arousal and performance?

PERSUASION: THE ART OF SELLING AND ADVERTISING

THINK ABOUT A RECENT ITEM THAT YOU'VE BOUGHT. WHY DID YOU BUY IT? DID YOU HAVE TO CHOOSE BETWEEN A RANGE OF PRODUCTS OR WAS IT A SPECIFIC LABEL THAT YOU WERE AFTER? DID YOU REALLY NEED IT? DID YOU BUDGET FOR IT OR WAS IT AN IMPULSE PURCHASE?

What did you wear last weekend? Was any item of clothing a brand name?

Businesses want you to purchase their products. It is in their best interests—they want, or rather need, their business to be successful. They want their product to be well known and desirable. Methods to market goods, services, issues and causes attract a high amount of psychological research. In fact, this area of research is exploding!

SOCIAL INFLUENCE AND PERSUASION

During the Second World War, psychologist Kurt Lewin persuaded American housewives to assist with the war effort and modify household diets in an attempt to save higher-protein foods for the troops. His methods were successful and were the beginning of a wave of research into social influence and persuasion.

Persuasion and advertising is a billion-dollar industry. Psychological research in this area is more popular than ever. Salespeople can undergo extensive training and learn a number of clever techniques designed to capture a sale. These techniques can start with using simple statements and strategies through to careful use of body language. You don't have to be selling a product in a shop, though, to be a salesperson. Many others are interested in promoting their message, for example business managers, charity groups and even school principals. Clever advertisements are created to capture the target audience's attention.

This chapter considers the persuasive techniques used in sales and advertising. First, we will look at some of the techniques a salesperson may use to directly influence a potential customer. Then we will consider advertising and the techniques it uses to change our attitudes. Then we will consider why psychological research in the area of selling and advertising is often controversial—are we buying a product because we really want to or are we tricked into doing so? Are we being exploited?

Persuasion can be defined as the process of changing a person's attitude. It can occur via a number of different techniques—from presenting a reasonable argument to using music in a store or employing a celebrity to promote the item.

State Library of Queensland, Image No. 109855

FIG 15.1» Advertisements like these in the 1940s started a new era of social influence and persuasion.

15.1 INVESTIGATE

Persuasive selling techniques

Have you ever experienced one or more persuasive selling techniques or tricks to make you buy? If so, describe what happened.

1. Was the technique effective? (Did it work—did you buy or donate money?)
2. Can you think of any other persuasive selling techniques? You may have heard about these from others or in the media (radio, television, the Internet and so on).
3. Do you think some techniques are more effective than others?
4. Do you have any ethical concerns about the use of such persuasive techniques?

CHANGING ATTITUDES

Have you ever been told that you have a 'good attitude' or 'need to improve your attitude'?

We use the term 'attitude' in everyday language. It can be positive, neutral or negative. An attitude is an evaluation of an item, behaviour or issue. We can look at what an **attitude** consists of and relate this to how we can be persuaded to change it.

Components of an attitude

Heath has a strong attitude towards the environment. He wants to reduce his carbon footprint.

According to traditional theory, Heath's attitude consists of the following three components:

1. **A cognitive (beliefs) component**—Heath believes that our environment is suffering because of our large production of greenhouse gases.
2. **An affective (feelings) component**—Heath feels that the use of greenhouse gases is bad.
3. **A behavioural (the way we act or are predisposed to act) component**—Heath is likely to actively reduce, reuse and recycle goods.

Try using the term CAB to remember the three components.

Advertisements are designed to create or change your attitude towards the product or issue. They want you to act to change your behaviour. Advertisements can be seen to appeal to one or more of the three components of an attitude. For instance, advertisements may::

- give factual statements (cognitive component)
- make you laugh (affective component)
- ask you to act today for a great discounted offer (behavioural component).

FIG 15.2» What is your attitude towards the Australian Netball Team? Do you enthusiastically support the team?

CASE STUDY

Clare Oliver

FIG 15.3» Clare Oliver

Clare Oliver was a remarkable young woman. At 22 years of age, she was a vibrant and energetic person who had just finished her studies and had everything to live for. Tragically, Clare was diagnosed with skin cancer.

Clare blamed getting cancer on her desire for a tan during her teenage years. She believed that a mixture of sunbathing and using tanning salons caused her melanoma—the most common cancer for people aged 15–30 years.

Bravely, Clare launched a campaign to warn other young women about the deadly dangers of using tanning salons. Her strength and determination led to new regulations in the tanning salon industry. It also raised awareness among teenagers and young adults of the risks of getting a tan, with the result that many stopped visiting tanning salons. Clare's brave fight and the success of her campaign highlighted the importance of advertising a health issue.

Clare passed away at the age of 26, some four years after being diagnosed with cancer. Her TV advertisement can be viewed online. WWW»

15.2 INVESTIGATE

What's my attitude?

1 Attempt to break down the following attitudes into their three components, using the table below.
   - **a** Eli has a negative attitude towards alcohol—it is a dangerous drug.
   - **b** Bree believes that Sportsgirl has the best clothing.
   - **c** Maria has a strong positive attitude towards the Australian Diamonds (netball team).
   - **d** Simon loves listening to heavy rock music.
   - **e** Liam enjoys riding his bike.
   - **f** Now think of one of your own personal attitudes.

2 Look at the advertisements in a magazine or newspaper. Cut out examples of advertisements that appeal to each attitude component. Explain your choices to the class or in a small group.

Attitude	Cognitive component	Affective component	Behavioural component
Eli's attitude			
Bree's attitude			
Maria's attitude			
Simon's attitude			
Liam's attitude			
Your attitude			

The case of Clare Oliver

Read the case study about Clare Oliver and answer the following questions.

1 Why do you think Clare's campaign was successful in raising awareness of the dangers associated with tanning salons?

2 Which attitude components does Clare's advertisement appeal to? Explain.

3 Despite knowing the risks, why do you think some young adults and teenagers still visit tanning salons? Do you think their behaviour will change in the future? Why or why not?

Do attitudes always reflect behaviour?

Considering the components of an attitude is only the beginning of this complex area. Attitudes are not a good predictor of behaviour. A person, like Heath, may have a positive attitude towards recycling but not always recycle. He may recycle goods at home but throw recycled goods into the non-recycled bin at school. He may also turn a blind eye to a good friend who refuses to recycle even though he is an advocate for this behaviour. Why is his behaviour inconsistent?

I like chocolate. I know too much is unhealthy. I am aware of all the facts and would really like to cut back on my chocolate consumption. However, I still find myself reaching for another piece of chocolate. How do I justify my behaviour? I try to eat dark chocolate because it contains more anti-oxidants than normal chocolate—I know anti-oxidants are good for me! Not the best excuse, is it? So, despite my uneasy feeling about eating chocolate, I still eat it. Why?

Cognitive dissonance theory offers an explanation. If we experience an uneasy feeling when our attitudes and behaviours simply do not match up, we can either change our attitudes or find an excuse for our behaviour. This removes the uneasy feeling.

Advertisers and other persuaders are well informed about this theory. They use it to motivate audiences to change their attitude and, ultimately, support or buy the product.

Cognitive dissonance could easily be the fifth way in which salespeople try to push sales on you—car salespeople are highly skilled in it.

FIG 15.4» Salespeople can be highly skilled at using the technique of cognitive dissonance to persuade you to buy their products.

1 You drive into the car yard.
2 You are approached by the salesperson who asks what you are looking for and if this car is your trade-in.
3 He says, 'It looks in pretty good condition—I'll just call a valuer to give me a price—OK?'
4 A person from the valuation department gets in your car and drives it away—you're stuck!
5 The salesperson says, 'Well, would you like to test-drive this model while we're waiting?'
6 You take the test-drive and he says, 'Of course, just had one come in yesterday that is the "g-type" with lots of extras. It's been here such a short time it doesn't owe us much—I could do you a really good price on that! Take a drive in this super g-type and see what you think.'
7 This one is so much better that you now do not think of the car you originally wanted.
8 You are given a cup of tea/coffee—a valued customer!

Now—what is the cognitive dissonance in this scenario? Well, you had intended to have a quick look—but now you have wasted three hours in the car yard (and your trade-in still hasn't returned!). Your feeling now is 'I've spent so much of my day off looking at these cars, I must really want this one!'

You can see the various techniques that have been woven around the cognitive dissonance.

15.3 INVESTIGATE

Part A: Attitude survey

For each statement below, rate whether you strongly agree, agree, have no opinion, disagree or strongly disagree.

1 The use of seatbelts saves lives.
2 Our country needs to address the growing number of homeless.
3 Exposure to the sun's ultraviolet rays can cause skin cancer.
4 Eating a low-fat diet is beneficial to one's health.
5 Drinking water is a scarce and precious resource.

Now complete Part B of this activity.

Part B: Behavioural survey

To what extent (always, often, sometimes, rarely or never) do you carry out the following behaviours:

1 wear a seatbelt when in the car
2 personally do something to help the homeless (e.g. give money, volunteer at a shelter)
3 use sunscreen whenever you go outside
4 maintain a low-fat diet
5 have less than four-minute showers.

Now compare your answers to both surveys.

1 Are there any discrepancies?
2 Can you give reasons for each discrepancy?
3 How do you feel about each discrepancy?
4 Discrepancies between attitudes and behaviour can often lead to *cognitive dissonance*—an uncomfortable feeling that can motive you to change either your attitude or behaviour.
5 Are you motivated to change your attitude or behaviour for each discrepancy? Why or why not?

(Adapted from Carkenord & Bullington 1993)

SOCIAL INFLUENCE

There are a number of successful sales techniques that sellers use. These behaviours are examples of **social influence**—situations when one person directly influences our thoughts, feelings and behaviours. We are all at risk of complying with the requests of a sales representative. However, becoming more aware of the sales techniques can help us resist social influence—that is, if we happen to recognise the technique at the time.

Shoppers prefer salespeople who appear to like them, have similar interests or attitudes and agree with them ('good choice', 'excellent idea'). Shoppers even prefer salespeople who mirror their mood. Happy shoppers will spend more money when the salesperson is cheery and energetic. Grumpy shoppers prefer grumpy salespeople.

15.4 INVESTIGATE

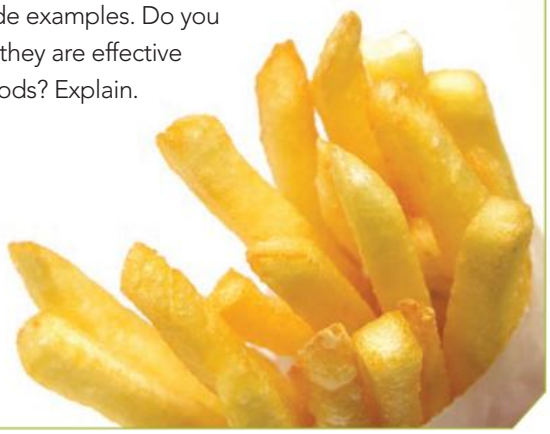
Do you want fries with that?

Fast food restaurants are renowned for training their staff to use persuasive selling techniques. For example:

- *suggestive selling* methods such as 'Would you like a drink with your purchase?'
- *up-selling* methods such as 'Would you like a large or medium?' (up-selling is more likely to influence customers to purchase a large size than *down-selling*: 'Would you like a medium or large?')

It is quite likely that some members of your class have received such training.

In groups, think of some of the methods that are used to influence you to purchase more products. Include examples. Do you think they are effective methods? Explain.



Four 'tricks of the trade' commonly used to influence customers are:

- the 'foot-in-the-door' technique
- the 'door-in-the-face' technique
- the 'low-ball' technique
- the 'that's-not-all' technique.

THE FOOT-IN-THE-DOOR TECHNIQUE

'Why not buy this small, inexpensive gift?' You think 'why not?' and buy the product. However, you are now trapped and talked into buying more expensive products as well.

This is an example of the *foot-in-the-door* technique. **Foot-in-the-door technique** relies on the principle of *commitment*. By committing, we feel we have created a positive impression—one we need to maintain. Once we commit to a small request, we are more likely to commit a larger request. To be more effective, some time should pass between the two requests and the second request must not be ridiculously high.

Companies may give free give-aways at supermarkets or in letterboxes. People receiving the goods are likely to purchase the bigger product at a later date.

Do the following television commercials sound familiar?

Ring in the next 20 minutes, purchase the first series and you'll get the second series, all seven episodes, free! That's right—FREE! That's $60 worth for the introductory price of just $19.99 (plus $3.95 postage and handling).

Pay now with your credit card and we'll send you Series 2 absolutely FREE! After that we'll send you a new episode every six weeks with no obligation.

FIG 15.5» Agreeing to a small request can lead to a large request.

THE DOOR-IN-THE-FACE TECHNIQUE

A sales representative suggests that you purchase a really expensive product. You politely turn him down. He then refers to a less expensive product. You buy the product.

This is known as the *door-in-the-face* technique. **Door-in-the-face technique** relies on the principle of *reciprocity*. We tend to reciprocate (copy) what people do for us. If the sales representative backs down from his initial request, we are then likely to back down from our initial response. Door-in-the-face is often evident when negotiating a deal.

An interesting example of reciprocity was demonstrated when Christmas cards with a personal greeting were sent randomly to strangers (Kunz & Woolcott 1976). Most strangers felt obliged to reciprocate the behaviour—and indeed only six replies stated that they did not remember the sender.

Can you think of any other examples of reciprocity? If someone buys you lunch, are you more likely to reciprocate? Will you buy them lunch next time? It can work in negative ways. Have you ever heard someone justify a behaviour because the other did it first? Two wrongs don't make a right—yet we feel compelled to reciprocate, and if we do, the outcome can be dangerous.

FIG 15.7» The low-ball technique: you purchase a car and then discover that you need to pay more for extras, including airbags, power steering and window tinting.

FIG 15.6» Researchers sent Christmas cards randomly to people they did not know. The majority sent cards back, with only six stating they did not remember the sender.

THE LOW-BALL TECHNIQUE

Congratulations on your purchase. Now you need to buy 'this and that' before you can leave with the goods!

This technique is known as the *low-ball* technique. Once you commit to a request, the conditions change and you find yourself paying more than originally thought.

Like the foot-in-the-door technique, the **low-ball technique** is based on the principle of commitment. You are likely to stay committed once you have made up your mind to commit to the original deal. Perhaps you have bought an electronic gizmo for a great price. Trouble is, it is only compatible with certain software—something else you must buy. Shonky car salespeople are known for this!

15.5 INVESTIGATE

Role play: sales

In groups of two to four, create a scenario that employs one of the sales techniques outlined. Role play the scenario in front of class members. Can they guess the technique you used?

THE 'THAT'S-NOT-ALL' TECHNIQUE

But wait, there's more! If you purchase this today I can throw in an extra goodie.

Appropriately named is the *that's-not-all* technique. With the **that's-not-all technique**, if a person hesitates, the salesperson adds something to sweeten the deal. It cleverly increases the likelihood of an impulse buy. It must be a bargain—you will walk away with more, and everyone likes to save money!

Once again, the principle of reciprocity is at work. If a salesperson throws in an extra goodie or lowers the price 'just for you', you tend to reciprocate the favour and purchase the goods. This technique differs from the door-in-the-face technique as the customer is not given time to consider or refuse the initial offer.

Consider this:

You are at a market and you feel like eating a cupcake. You ask three stallholders selling identical cupcakes how much they cost and are told the following:

a '$1.25 each but since we are closing soon, $1.00.'

b '$1.00 each.'

c '$1.00 each now although they were originally $1.25.'

Which stallholder would you buy your cupcake from?

The answer is most likely to be option (a)—an example of the that's-not-all technique. Burger (1986) carried out this study and found that 50 per cent of participants in this situation purchased the cupcake. Lowering the price sweetened the deal. This compared with much lower numbers of purchasers from the other two stalls.

FIG 15.8» Shoppers prefer salespeople who mirror their mood. Happy shoppers will spend more money when the salesperson is cheery and energetic. Grumpy shoppers prefer grumpy salespeople.

FIG 15.9» For sale: you are more likely to purchase an item when the price is suddenly lowered just for you!

REVIEW 15.1

1 Define 'persuasion'.

2 What is 'social influence'? Use an example from your life that demonstrates social influence.

3 Complete the following table:

Social influence technique	Description	Example
The foot-in-the-door		
The door-in-the-face		
The low-ball		
That's-not-all		

PERSUASIVE FACTORS IN ADVERTISING

There are a number of persuasive factors to consider when designing an advertisement. These can usually be grouped under four main headings:

1 **Characteristics of the speaker**—this is the person who is delivering the message. Factors such as creditability, attractiveness and the person's intent all play a role. The speaker is acting as a role model and image is important.
2 **Characteristics of the message**—does the message have emotional appeal? Often emotional appeal is important. Sometimes a one-sided argument and at other times a two-sided argument is more persuasive.
3 **Characteristics of the audience**—who is the target audience? Characteristics that are considered include intelligence, need for social approval, self-esteem and the audience size.
4 **Route of the message**—how is the message delivered: by phone, in person, by email, print media, websites, television, billboards and so on?

TABLE 15.1» Factors in persuasion

Factor		Explanation
Characteristics of the speaker	credibility	We are more likely to believe a person who has high credibility. Experts and those we trust have high credibility.
	popularity and attractiveness	We are more likely to believe popular and attractive speakers.
	expertise	We are more likely to believe an expert than a non-expert.
	trustworthiness	We are more likely to be persuaded by someone we consider trustworthy.
	speed of speech	We are more likely to believe fast talkers than slow talkers.
	similar to the audience	When the speaker is similar to us (e.g. in age, gender and cultural aspects), we are more likely to be persuaded if the message is about likes and dislikes. We are less likely to be persuaded if the message is about facts.
Characteristics of the message	one- or two-sided arguments	Presenting both sides of the message is more persuasive when the audience is hostile or well-educated. Focusing on the argument's strongest points and ignoring the weaker points is more persuasive.
	emotional appeal	Messages involving fear are more likely to persuade people (Leventhal et al.,1965). However, there is a limit to the degree of fear—too fearful and the viewer may not remember the details of the intended message.
	simple messages	If we are not paying full attention (and most likely we are not), simple messages are more likely to persuade us. Continually repeating the simple message is persuasive.
	appeal	A novel, eye-catching or thought-provoking advertisement appeals to most audiences. Vivid, unique and bizarre advertisements are likely to grasp our attention. We also like humorous adverts. Linking products to success, sex and happiness is more likely to appeal to us.
	intent	We are more likely to be persuaded by messages that we think are not intended to persuade us.
Characteristics of the audience	self-esteem	People with lower self-esteem are more likely to be persuaded.
	initial attitude	If you have a strong attitude at the beginning, then you are less likely to be persuaded to change your attitude. If you start with a neutral or moderate attitude, then you are more likely to be persuaded.
	expectancy	Forewarning: If you expect to be persuaded, then you are less likely to be persuaded.
Route of the message	email, web page, phone, mail, in person, print media, etc.	The route of the message must be considered in order to design an appropriate advertisement. Depending on the route, sometimes a shorter, simpler message is better.

FIG 15.10» In 2008, Michael Phelps lost millions of dollars in advertising endorsements after smoking marijuana. His trustworthiness and popularity sharply declined. He lost his status as the ideal role model.

Fear works! Well, usually...

Imagine this: you sit with a group in a small theatre and view a film that shows countless images of people with bad teeth and dental drills. You find the images repulsive.

Another group is shown a film that discusses effective teeth cleaning. They actually find the film boring.

Which group is more likely to change their behaviour?

In this classic study, participants were interviewed a week later (Janis & Feshbach 1953). About a quarter of the participants in the high fear group (disgusting images) had changed their tooth-brushing habits. A good outcome, but half of the participants in the low fear group (boring images) changed their habits. These results are interesting, but limitations to the study existed. The low fear group were given instructions about how to change their behaviour. Many in the high fear group were too horrified to take note of any instructions.

Consider the fear tactics and the slogans used for the TAC advertisements. They have been hugely successful in changing behaviour and lead the use of fear-provoking messages around the world. Tragically the road toll still exists, however, and new tactics are needed to eliminate it. To what extent will fear be part of the message? Do the TAC advertisements always rely on fear? We will have to wait and see.

15.6 INVESTIGATE

Persuasive behaviour

Refer to Table 15.1 to decide which factor in persuasion is being manipulated or is in action for each of the following scenarios.

1. At the start of her presentation, the guest speaker states, 'I have considerable experience in this industry.'
2. A sales representative states, 'This is a really good product. There is one better product that we don't sell, but you will need to pay considerably more to purchase it.'
3. A campaigner employs an attractive person to collect signatories for a petition from people at a shopping centre.
4. An advertisement for a retail store that simply states its slogan, 'Dash in for Top Deal' is played repetitively during a television show.
5. A shopper braces herself to say 'no thanks' when a shop assistant asks if he can help her.
6. A teenager watches an anti-alcohol advertisement. She is horrified at the dreadful consequences of alcohol abuse.
7. A politician is told to smile more when talking to the members of his electorate.

FIG 15.11» Disgusting footage of bad teeth demonstrates the use of fear in changing habits.

15.7 INVESTIGATE

Advertisements—love them or hate them?

1 Discuss one or two of your favourite advertisements.
- What is your favourite advertisement at the moment? Explain why.
- What factors of persuasion are evident in the advertisement?
- Who is likely to be persuaded by the advertisement?
- Will it persuade you to buy its product or agree with its point of view? Explain.

2 Now think of an advertisement that irritates you (your least favourite).
- Try to explain why this is so.
- Is it designed to be irritating? Is it clever because you are discussing it now?
- Would you purchase the product or agree with its point of view? Explain.

The power of advertising

In the ABC show *The Gruen Transfer*, a challenge is given each week to two leading Australian advertising agencies to sell the impossible. Despite the advertisements being morally wrong on many levels and quite distasteful, they demonstrate the power of advertising.

The segment is titled 'The Pitch' and such challenges have included:
- promoting the use of plastic bags
- promoting the use of child labour
- convincing people that Australia should invade New Zealand.

Watch one or two segments of 'The Pitch'. The segments can be viewed on the DVD series or can be found on the ABC website. WWW»

1 Which advertisement did you prefer? Why?

2 What techniques are they using to convince you to change your attitude?

3 Can you think of any alternative angles from which to pitch the challenge?

REVIEW 15.2

1 What type of music do you enjoy the most? Use your answer to demonstrate your knowledge of the three components of an attitude.

2 What is 'cognitive dissonance' and how can it explain why our attitudes don't always reflect our behaviour?

3 How can a salesperson use cognitive dissonance to influence a customer to purchase a product?

4 Melinda knows she has an important test tomorrow and wants to get an excellent mark. However, after dinner, she feels very sleepy and decides to watch a movie instead. What excuse could Melinda use to overcome any cognitive dissonance she might feel?

5 Why do you think trustworthiness is an important factor in the speaker? Pick a media person whom you consider trustworthy.

6 When are simple messages more effective? Use an example to demonstrate your understanding.

7 Think of an advertisement that uses fear. To what extent does fear work in advertisements? Explain.

NEUROMARKETING

Brain research in the area of persuasion and marketing is exploding. Brain scans and brainwave recordings in this area, known as **neuromarketing**, are becoming popular.

In one study, 12 young males were shown 66 photos of sports cars, sedans and small cars while undergoing an *f*MRI scan. The scans showed that one part of the brain, the *nucleus accumbens*, was more active when the boys were shown the sports car (Walter et al. 2005). The **nucleus accumbens** is a tiny brain structure that is linked to self-reward, pleasure and lust. Therefore, the sports car is linked to desire, and using its image to advertise a product is likely to link the product to desire as well.

An Australian study recorded the brainwave activity of females as they viewed television documentaries with advertisements (Silberstein et al. 2000). The advertisements that triggered an unusually fast surge of brainwave activity in the left frontal lobe were more likely to be remembered a week later. Marketing companies can use this material to predict the effectiveness of the advertisement and decide whether it is worth using.

SUBLIMINAL ADVERTISING

It was once thought that messages that are flashed quickly without our conscious awareness were able to influence our behaviour. This is known as **subliminal advertising**.

In a US cinema throughout one summer, in half the films the words 'Hungry? Eat Popcorn' and 'Drink Coca-Cola' were flashed so quickly across the screen that viewers were unaware of their existence (Vicary 1956). The sales of popcorn and Coca-Cola were measured. Sales increased when the subliminal message was flashed—50 per cent for popcorn and 18 per cent for Coca-Cola.

This study caused a storm of protest. In fact, the use of subliminal advertising was banned in some countries, although there are some reports of it being used in shopping centres in America. Barely audible whispers of 'I am honest, I will not steal' mixed with music has led to reports of a decrease in shoplifting. Further research has not provided much support for the persuasive effect of subliminal advertising.

In 1990, the heavy metal band Judas Priest went to trial due to subliminal messages in their music. The message 'Do it' was repeated in one of their songs. Two young fans committed suicide and their families blamed the track. Members of the band were not convicted, however, as scientific evidence that subliminal messages can cause such extreme behaviour does not exist. In addition, both fans had troubled lives.

Do you think the use of subliminal advertising should be legalised?

SPIN DOCTORS

Spin doctors—public relations professionals—are people who actively promote a client and are strongly sought after by corporations and political parties. Spin doctors cleverly put forward a positive message that is designed to capture people's attention and put the client in a favourable and flattering light. They actively work with the media.

Some argue the use of spin doctors is manipulative and deceptive. Others argue that there is a definite need to get the right message across. Spin doctors are able to make sense of complicated decisions and technical information and reduce these to a form that the media can use.

The use of spin doctors is quite evident at election time. Next time you hear a politician, take note of the way they are stating their message. Are they using any of the strategies discussed in this chapter? How do they turn a seemingly difficult situation into a positive one? Do they avoid the question? Do they repeat certain catchphrases? If so, why? Do they acknowledge their opposition? Do they look at both sides of the argument? If yes, do they just highlight a weak argument? Think about your answers to these questions and who the messages are intended to persuade.

FIG 15.12›› What strategies do politicians use to 'sell' their message?

RESISTING PERSUASION

Just reading this chapter will help you identify and resist persuasion. You must, however, realise that no one is immune to the sales strategies. We are all persuaded to certain degress. Fortunately, not every message will persuade us to change our behaviour or purchase the goods—many advertisements are ignored.

FACTORS THAT RESIST PERSUASION

Under certain conditions, persuasive techniques simply do not influence behaviour. Three of the factors that count against effective persuasion are reactance, forewarning and inoculation.

Reactance

Reactance is a desire to do the exact opposite of what has been asked. Being told that you must do something limits your feeling of freedom and can trigger a sense of resistance. This can be especially true for young adults. Have you ever heard a parent or teacher say, 'You do the exact opposite to what I tell you!'

Forewarning

Forewarning is having warning in advance of something hapening. To be forewarned is to be forearmed. Just knowing ahead of time that someone will try to change our attitude is a good method of defending your point of view and resisting attitude change.

Inoculation

Inoculation is a method that can increase resistance to persuasive techniques. Just as in inoculation against a disease (e.g. meningococcal or tuberculosis), a person is exposed to a weak argument on the unfavoured side. The person is likely to develop arguments to resist persuasion, and then later resist persuasion when stronger arguments are presented.

15.8 INVESTIGATE

Opposite effect

The anti-smoking message: why doesn't it work for everyone? The smoking industry donates enormous sums of money to anti-smoking campaigns. No doubt you can think of some anti-smoking advertisements. Smoking rates, however, are still high and seem resistant to change. This is especially true for young females. Is reactance at work here? Discuss.

THE 'THIRD-PERSON EFFECT'

Do advertisements influence you? If you answer no, you need to be aware of the 'third-person effect'. **Third-person effect** is when people believe that advertisements and other types of persuasive techniques will not change their attitudes and behaviour. They also believe that these advertisements will work on others. Do you fall into this trap? Extensive research shows that we can all be influenced by advertising.

On a brighter note, now that you have studied some of these techniques, you are less likely to be persuaded. Knowing and recognising techniques that are deliberately used to influence your behaviour can increase resistance.

THE HOT ISSUE: ETHICS

Is advertising doing the consumer a favour? Is making us aware of the goods, services, deals and causes in our society a good thing? What strategies can be used to resist persuasion? What do you think?

All the material covered in this chapter is controversial. Most of the arguments surround the following questions:

1. Is advertising in the best interests of consumers? Is it in the best interests of the business? When is it useful for customers to know about the product or issue?
2. Is it fair and ethical to use persuasive techniques to advertise products? Does it take away free choice for consumers?
3. Is the behaviour of customers being deliberately manipulated? Are they aware of this manipulation? Is it deceptive? Can they really resist the persuasive techniques?
4. Is it fair to link products to happiness, sex and success?
5. Should advertistements be pitched to children?

FIG 15.13» The Oaktree Foundation is an organisation run by young people that has as its aim the use of education to empower developing communities and break the poverty cycle. Are members of your school involved? (www.theoaktree.org)

15.9 INVESTIGATE

Poster: controversial use of advertising

On a piece of A3 paper, create a poster that considers the controversial use of advertising.

Begin with the five questions in the text. What are the pros and cons for each? How would an advertising company or business address each question? How would a consumer rights panel address each question?

15.10 INVESTIGATE

Promoting social issues

In groups of two to four students, select a social issue. You may want to pick an issue that is actively promoted in your school or local community. It may be one in which group members are already involved.

(Examples of organisations involved with various causes: Greenpeace [environment]; the Salvation Army, CanTeen, the Melbourne Royal Children's Hospital [social welfare]; World Vision and its 40 Hour Famine, the Oaktree Foundation [international aid and development])

1. Study the current techniques used to convey your cause's message. Do you think they are effective?
2. Design your own 30-second advertisement to promote the cause.
3. Record and play it to the rest of the class.
4. Write a report that includes the following points:
   - **a** the target audience
   - **b** an explanation of the persuasive techniques that are used in the advertisement
   - **c** whether you are more likely to contribute/donate to the cause (explain)
   - **d** how effective you think the advertisement is
   - **e** what reaction you received when it was played in class
   - **f** whether you would use the advertisement to advertise the campaign
   - **g** what could be done to improve the advertisement.

CONCLUSION

Companies spend billions of dollars on advertising campaigns each year. They carefully craft an advertisement according to their market research. Businesses train their sales team in marketing techniques designed to attract the biggest sales. Neuroscientists are researching ways to grasp our attention, promote emotional situations and increase the likelihood of us remembering a brand product. Persuasive techniques and the associated psychological research are controversial.

On a positive note, advertising plays an important role in raising awareness of social and health issues. It can be used to promote a healthy lifestyle and avoid dangerous situations. It can be used to help, support and educate those in need. Advertising can have a positive impact on our lives. Thus we can all benefit.

Others argue that advertising provides a valuable service to raise awareness of the different types of products and services on the market. How else would we know of a better product or deal? Social influence techniques may also help consumers who want to purchase the product in the first place get a better deal. Indeed, negotiating can be a two-way street.

Now that you have studied some of these techniques, you are *more likely* to resist advertising, at least to some extent. That is, if you want to resist.

Good luck!

15.11 INVESTIGATE

Please help Ben

Ben is in trouble. Every time a letter arrives advertising a product or he receives a call from a telemarketer, he purchases the product. He just can't seem to stop himself and feels compelled to carry out the request. As a consequence, he is having some financial difficulties. He is also spending a lot of time on the requests.

What should he do? Please offer Ben some simple advice that could help him resist persuasion.

REVIEW 15.3

1. Why do marketing researchers want to know when the nucleus accumbens, a tiny brain structure, is active?
2. What is 'subliminal advertising'? Do you think it is ethical? Explain.
3. Why would a large company employ a spin doctor?
4. What is 'reactance'? Use your own example to illustrate.
5. What is the 'third-person effect'? Does this describe you?
6. Why do people have serious ethical concerns about the use of persuasive techniques?
7. Should persuasive techniques be used to raise awareness of social issues? Explain your answer.

CHAPTER SUMMARY

- *Persuasion* can be defined as the process of changing a person's attitude and can occur via a number of different techniques.
- *Social influence* is when one person directly influences another's thoughts, feelings and behaviours. Techniques commonly used to influence customers include the foot-in-the-door technique, the door-in-the-face technique, the low-ball technique and the that's-not-all technique.
- Attitudes can be divided up into three components: the affective (feeling) component, the behavioural (the way we act or are predisposed to act) component and the cognitive (beliefs) component. Advertisements are typically designed to appeal to one or more of these components.
- Behaviours do not always match attitudes. There are a number of theories to explain this difference, including the *cognitive dissonance* theory. An uncomfortable feeling may be the result of a mismatch between attitudes and behaviour, and may lead to a change in attitude or behaviour or to using an excuse for the behaviour.
- When designing an advertisement, advertising agencies need to consider a number of factors including the characteristics of the speaker, the message and the audience and the route of the message.
- The use of fear in advertising has produced some excellent results in road safety. If the advertisement is too fearful, however, the intended message may be lost.
- Brain scans and brainwave recordings in the research area of persuasion, known as *neuromarketing*, are becoming popular. The research can provide information about what certain target groups may find appealing or are likely to remember. An advertisement can then be designed based on this information.
- *Subliminal advertising* is when messages are flashed quickly without our conscious awareness. Some believe that these messages can influence our behaviour although more empirical research is needed to support this notion.
- Political parties and large companies use *spin doctors* to promote a positive side to a situation. They can be very influential, particularly at election time and when a major mishap or decision has been made.
- Resistance to persuasion can occur due to a number of factors including reactance, forewarning and inoculation. Knowing and identifying persuasive tricks can lead to resistance.
- The use of social influence and advertising is controversial. Is it fair and ethical to use these techniques? Are people losing their independence to act freely or are they coerced into purchasing or donating without their knowledge? Does advertising give the consumer knowledge of different products and services? Does it assist with social and health issues?

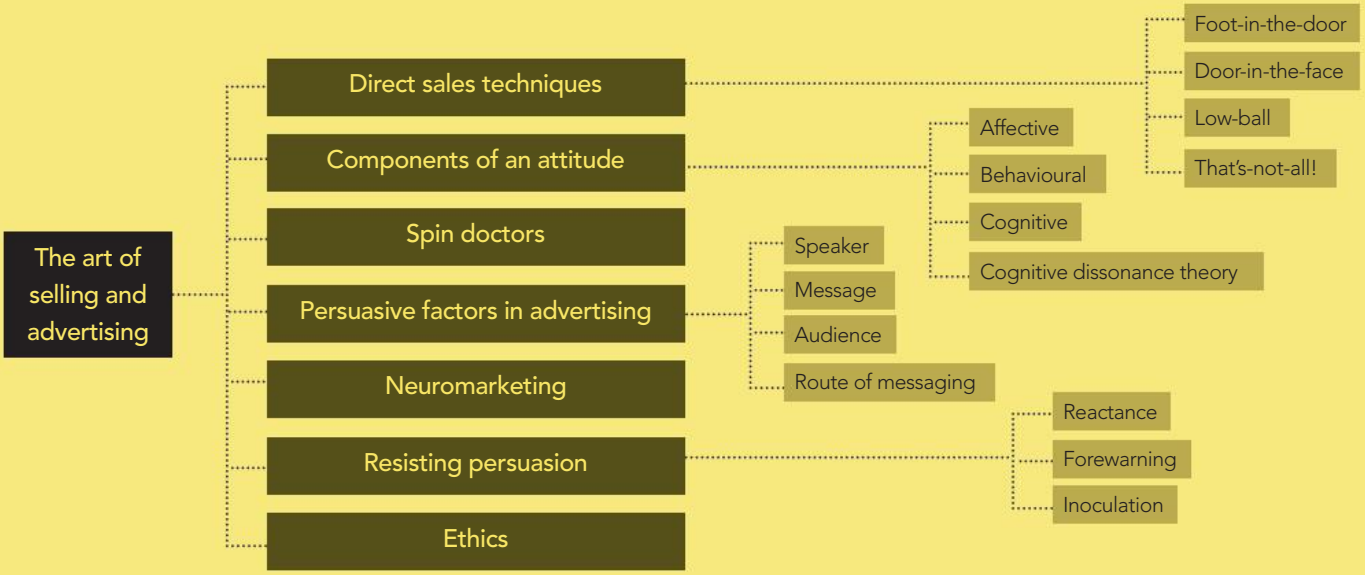


FIG 15.14›› Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 A door-to-door sales representative offers an entire computer-based student study guide to Marina for $350. She politely refuses the offer. He then offers a reduced program that only includes English and Mathematics for $90. She accepts. This sales technique is an example of:
   - **a** the foot-in-the-door technique
   - **b** the door-in-the-face technique
   - **c** the low-ball technique
   - **d** the that's-not-all technique.

2 Which of the following sales techniques relies on the principle of commitment for its success?
   - **a** the foot-in-the-door technique
   - **b** the door-in-the-face technique
   - **c** the low-ball technique
   - **d** the that's-not-all technique.

3 The way a person acts or is likely to act is known as the _____ component of an attitude.
   - **a** affective
   - **b** predictive
   - **c** behavioural
   - **d** cognitive.

4 An advertisement is shown in the cinema. People with _____ are more likely to be influenced by the advertisement than people with _____.
   - **a** high self-esteem; low self-esteem
   - **b** low self-esteem; high self-esteem
   - **c** a strong attitude opposing the attitude in the advertisement; a neutral attitude
   - **d** a neutral attitude; a strong attitude favouring the one in the advertisement.

5 John receives a phone call warning him that a telemarketer will call him the next day. As a result, John is less likely to be influenced by the telemarketer. This is an example of:
   - **a** forewarning
   - **b** reactance
   - **c** sublimination
   - **d** inoculation.

6 What characteristics of a person would an advertising agency consider when choosing a speaker?

7 Outline one theory that can explain why attitudes don't always predict behaviour. Then explain how aspects of the same theory can lead to attitude change.

8 Which social influence techniques rely on the principle of reciprocity? Explain how the principle of reciprocity can account for their success.

9 Discuss why the intent of the message may be an important factor to consider when designing an advertisement.

10 Advertisements are deliberately designed to change our attitudes and behaviours. Are all advertisements bad and unethical? Write a short essay that states the reasons for your point of view. Also, acknowledge the opposing point of view and state reasons why the opposing point of view does not outweigh yours.

Extend yourself

If this topic interests you, try reading about the following psychological theories and concepts:

11 Are there different tactics that are more persuasive depending on the medium they are used in (e.g. television, radio, Internet sites, email, phone and in person)?

12 When should a business recognise its main competition (opponents)? When the business is number one in the market or at other times?

13 How is the music played in a shopping centre chosen? Is there some music that is more likely to influence our shopping behaviour?

14 Why are some advertising materials addressed more directly to a person? For example, the use of 'dear friend' or 'exclusive member' is commonplace in letters and emails.

15 Consider brand names—why do so many include 'hard' sounds such as the 'k' sound in Coca-Cola and Kellogg's?

PERCEPTION: CAN WE EXPLAIN MAGIC WITH NEUROSCIENCE?

PEOPLE OF ALL AGES AND ALL CULTURES ARE MESMERISED BY MAGIC. WHAT IS THE SECRET BEHIND A MAGICIAN'S ABILITY TO CREATE A WORLD THAT IS SEEMINGLY UNEXPLAINED? ARE MAGICIANS REALLY THAT MAGICAL, OR ARE THEY ACTUALLY MASTERS OF FOCUSING OUR ATTENTION?

MAGIC AND NEUROSCIENCE

Magicians have captured people's imagination for hundreds of years. But is it possible that a good pickpocket could really be a convincing magician? Could a magician really be exploiting our brain's tendencies to focus attention on some things and not others? Can amazing feats on stage by illusionists and magicians actually be explained with a little knowledge and understanding of the brain and how it works?

Australian magician Timothy Hyde is able to memorise a shuffled pack of cards in just 20 seconds, or he can duplicate a drawing made outside his visual field. How does he do it? Illusionist David Copperfield has made the Statue of Liberty disappear in front of a live audience, and he has appeared to fly above the stage. How does he make this happen?

What is happening when a trick like this occurs? To understand more about what makes such phenomena work, we need to understand more about the role of the brain in how we interpret our world.

UNDERSTANDING THROUGH OUR SENSES

Sensation is the process of our body's senses registering information about the environment. At this moment your senses are being bombarded with information that you will be largely unaware of. Light is being reflected from the surface of different objects into your eyes, but how many objects are you actually aware of? What temperature is the room? What sounds are you aware of both inside and outside the room? What aromas surround you?

A great deal of information from your environment is picked up by your senses and sent to your brain. However, you will be unaware of much of it, unless your attention is directed towards something in particular. Once aware, your brain creates a **perception**, or an understanding of what your senses are telling you. This might be an awareness that you are hot and sweaty, sitting in a dimly lit room—and the smell of freshly baked donuts is wafting through the window! Our perceptions are heavily influenced by our previous experiences.

Simply looking at a tasty slice of lemon meringue pie will have no meaning unless the brain is able to interpret what the slice actually is and what it is best used for.

16.1 INVESTIGATE

How important are our senses?

1. Comfortably settle yourself into your chair and prepare yourself for this activity with a pen and piece of paper.
2. Under the heading SIGHT, list as many objects surrounding you as you can in 30 seconds. Take the time to focus your attention on as much as possible in the room.
3. Under the heading SOUNDS, describe as many sounds as you can tune in to. Focus your attention on sounds both inside and outside the room.
4. Under the heading AROMAS, describe as many smells as you can tune in to. Focus your attention on smells both inside and outside the room.
5. Under the heading SKIN SENSATIONS, describe as many sensations as possible as detected by your skin: this may be textures (e.g. from your clothing or what you are sitting on), room temperature, pressure points (e.g. from your pen or shoes) and so on. Focus your attention on as much as you can.
6. Under the heading TASTE, describe any taste sensation that you may be currently aware of.
7. Reflect on the experience of focusing your attention towards your senses:
   - **a** What sensations do you think you would have been aware of without this activity directing your attention?
   - **b** What proportion of sensations would you have been unaware of without this activity?
   - **c** As a result of this activity, what perceptions have you created about your present environment?
   - **d** What does this activity suggest to you about the importance of directing your attention to be aware of your environment? Explain why.
   - **e** Your brain filters out many of the sensations that it receives from the senses. Explain why this might be an important feature for your brain to have.

The processes of sensation and perception therefore work together to create a meaningful world for us.

Magicians utilise our abilities of sensation and perception to create tricks that amaze us. Perception is directed in a way determined by the magician, who enables the observer to believe in objects disappearing or appearing, or even moving, when that is not what is really happening at all. Magic tricks often create their 'wow' factor as a result of diverting the observer's attention away from the secretive process that is about to appear magical.

Try the activity at right. More on magic later in this chapter will help you understand some of the tricks used by magicians.

16.2 INVESTIGATE

Is mind-reading possible?

1. Focus on one of the six cards below so you can memorise the one you have selected.
2. Close your eyes and count backwards from 20 to 1.
3. Turn to page 215.

IS MY BRAIN PAYING ATTENTION?

It is not uncommon for people to claim that they were looking but did not see anything. This may result in a car accident or cause a cyclist to run into a parked car. In such cases, our eyes may be 'looking' and sensing, but the brain is not paying **attention**—it is not engaged with what is going on. If the brain is not tuned in to our environment, we simply do not understand what it is our eyes are looking at, and hence do not 'see' or have any perception of the event. This phenomenon is attributed to a tendency to be 'blind' to certain stimuli.

Change blindness occurs when an observer is unaware of a change occurring because their attention is disrupted. In an experiment conducted by Simons and Levin (1998), subjects walking across a university campus were stopped by a stranger and asked for directions. During the conversation between the subject and the 'stranger' (who was actually part of the experiment), two men carrying a door passed between them as a disruption. As the door passed, unbeknown to the subject, the 'stranger' swapped places with a man carrying the door and the substituted man continued the conversation regarding directions. When questioned, only half of the subjects noticed that the man they had been speaking to had actually changed after the door passed between them. This was despite the substituted man being of different height and build and wearing different clothes.

This experiment suggests that our perception can be influenced by distractions occurring around us. The subject was 'blind' to the change in the person he had been having a conversation with. Our brain can therefore be 'tricked'.

FIG 16.1›› Accidents can be caused by drivers not paying attention.

16.3 INVESTIGATE

How many passes?

1 View the following video link online and count the number of passes made between members of the white team. WWW»
Go to page 215 and answer the questions (do not read these before viewing the video).

In another experiment, subjects were shown a videotape of a small group of people playing basketball. They were asked to count the number of times passes were made between members of the team wearing white. When interviewed afterward, around half of the subjects failed to notice a person in a gorilla suit walk through the group of basketballers, despite the fact that she had stopped to beat her chest and briefly face the camera. The subjects who were simply asked to view the tape easily noticed the gorilla, because their attention was not devoted to counting the passes (Simons and Chabris, 1999). In this phenomenon, called **inattentional blindness**, observers can simply not notice an event, even if it is clearly in their visual field.

REVIEW 16.1

1 What is sensation?
2 What is perception?
3 Use an example to show how the processes of sensation and perception work together.
4 What is attention?
5 What role does the process of attention play in a magician working their magic?
6 What is the difference between change blindness and inattentional blindness?

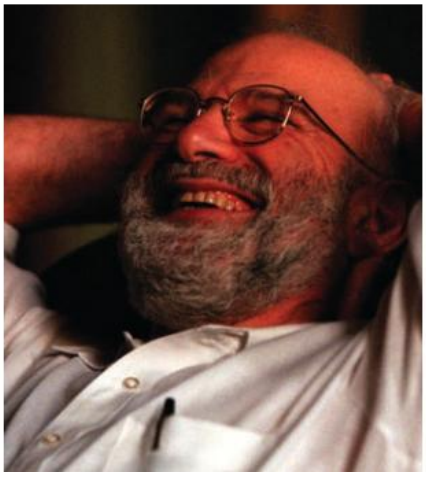


FIG 16.2» Dr Oliver Sacks is a neurologist.

WHEN A ROSE IS NOT ABLE TO BE CALLED A ROSE

In a well-known case study described by neurologist Oliver Sacks in his book *The Man Who Mistook His Wife for a Hat* (1985), a patient named Dr P had trouble understanding certain elements of his environment. He was an intelligent music professor who failed to recognise students well-known to him, although he could recognise their voices. He was also seen saying hello to a fire hydrant, and on one occasion mistook his wife's head for his own hat! These were very bizarre interpretations of the visual sensory information received by Dr P's brain.

This condition seemed to only affect Dr P's visual perception. When asked to identify a rose, Dr P was able to accurately describe it but was unable to give it the name 'rose'. However, when given the opportunity to smell the rose's scent, he was able to accurately name it as a rose.

Was there something wrong with Dr P's eyes? His eyes were working perfectly well, but his brain was unable to the assemble the visual information to create a meaningful perception of what he was seeing. Dr P's condition is known as **visual agnosia**, where the brain does not perceive visual information accurately. This usually occurs in patients as a result of brain damage caused by conditions such as a stroke affecting areas of the brain such as the occipital and temporal lobes.

Dr P's experience shows the importance of the brain's role in perceiving the world accurately. Without the effective processing of visual stimuli, we are unable to make sense of the world around us. Both sensation and perception are important in enabling us to do this.

16.2 INVESTIGATE (CONT'D)

Is mind-reading possible? (cont.)

4 Let's see if we have guessed the card you selected! We have removed your card. Check the cards below to see if yours has been removed.

5 Did we read your mind?

6 Look carefully back at the original set of cards. Can you explain the 'trick'?

7 Reflect:

- **a** What role did focusing attention play in this exercise? Explain how it worked to create the illusion of 'mind reading'.
- **b** Distinguish between the roles of sensation and perception in this exercise.
- **c** Create your own version of this test to become a 'mind reader'.

8 What other 'magic tricks' do you know that rely on attention being focused on one aspect so that other details are ignored? Describe the trick and explain the role of attention in its success. (Adapted from Pickover's ESP System)

16.3 INVESTIGATE (CONT'D)

How many passes? (cont.)

2 Did you see the person in the gorilla suit pass through the middle? Suggest reasons why you may or may not have seen the gorilla suit, with reference to the term inattentional blindness.

3 Describe a situation you can recall where you or someone you know experienced inattentional blindness.

16.4 INVESTIGATE

Sensation and perception work together

1 For each item below, use the visual stimulus to create a perception and therefore an understanding of the object.

2 What is your perception? For each item:

- **a** Name the object.
- **b** Describe it—what does it look like?
- **c** What is its function?

3 What role does prior experience with this object play in your understanding of it? Explain.

TASTING SHAPES, HEARING COLOURS AND SEEING SOUNDS

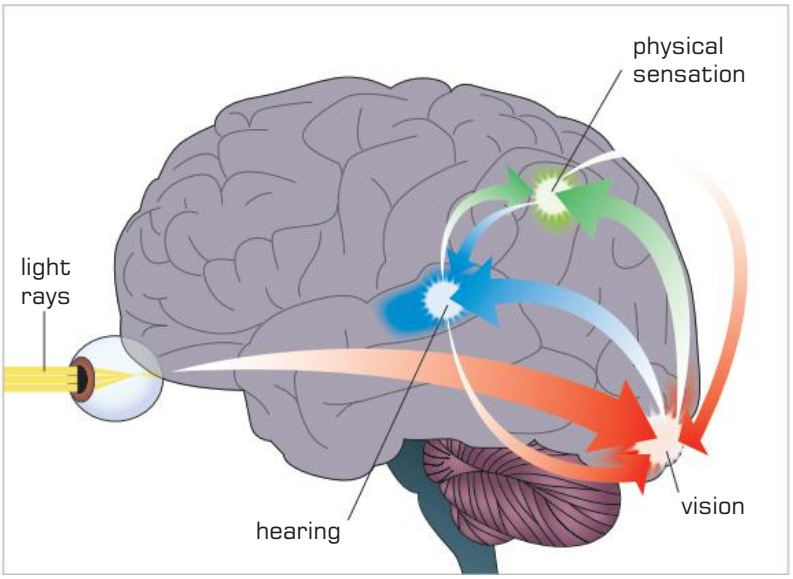


FIG 16.3» Additional connections in a synaesthete's brain enable a visual sensation to travel to different sensory areas.

did you know?

- The term synaesthesia means 'joined senses', as compared to anaesthesia, which means 'no senses'.
- Researchers in the field of synaesthesia believe it is possible that synaesthetes have excess connections in parts of their brains that non-synaesthetes do not have. Children also report synaesthetic experiences more commonly than adults, suggesting that they have excess connections between neurons that are lost over time during synaptic pruning.

Is it possible to *taste* a shape, *see* music or *hear* a colour? For most people this is an absurd thought, but for some it is a reality. This is an extraordinary condition affecting the senses called **synaesthesia**. Research suggests that it is experienced by 1 per cent of the world's population. Synaesthesia is a harmless perceptual condition that mixes the senses up—most people who have it enjoy the experience and would rather not be without it.

We all see the world from our unique perspective, but synaesthetes have a very different viewpoint from the rest of the population. They may be able to see music as colours and shapes, or even taste it. They may see numbers and letters of the alphabet as colours. There are over 20 different types of perceptual combinations, with more than half of sufferers experiencing more than one type.

Sean Day is in a unique position as he both studies and experiences synaesthesia. He sees tastes as colour—cucumber creates flashes of pink, spinach a dark purple, zucchini a dull yellow and chicken a light blue. His tastes are very normal, but he shops for food combinations based on colours that go well together. A meal could therefore consist of chicken with ice cream because he enjoys the colour combination!

Sean also sees music as colour and enjoys listening to different colours. However, he doesn't get to choose the colours different instruments create—he loves the sound of the French horn but does not enjoy the colour it creates!

Synaesthesia experiences are consistent over time. A research team led by Baron-Cohen (1987) asked a group of synaesthetes to describe the colour that was triggered when they were exposed to 100 different words. A year later the test was repeated, and the responses were consistent with the colours initially recorded over 90 per cent of the time. Investigate 16.6 will allow you to test the consistency of sensory experiences in a group of subjects over time. How would you be able to use the results of such an investigation to determine a synaesthete from a non-synaesthete?

The use of brain imaging techniques such as Positron Emission Tomography (PET) and functional Magnetic Resonance Imaging (*f*MRI) have also shown differences in neural activity within the brain between synaesthetes and non-synaesthetes. Those with synaesthesia who report coloured hearing have an increased activation of neural activity in the visual areas of their brain. This suggests that there is certainly brain activity in areas where colour perception would be expected.

16.5 INVESTIGATE

A hint of synaesthesia

1. Record the colour you visualise when you think of the following words:
   - **a** beach
   - **b** ice cream
   - **c** desert
   - **d** bedroom
   - **e** flower
   - **f** broccoli
2. Do you associate a taste? For each of the words in the above list, describe the taste you are aware of when you think of the word.
3. Do you associate a shape? For each of the words in the above list, describe the shape you are aware of when you think of the word.
4. Assuming you do not have synaesthesia, what factors might have influenced your choice of words for colours, tastes and shapes?
5. If you were to be retested on this same list of words in four weeks' time, how consistent do you think your responses might be? Explain your answer.
6. Do you know anybody who experiences synaesthesia? If so, find out from them about their experiences. What senses are triggered with their form of synaesthesia?

16.6 INVESTIGATE

Testing consistency of sensory associations

Synaesthetes are consistent in the sensory experiences they have for specific stimuli over time. How consistent are your subjects?

1. Create a list of 20 words to present to your subjects. You will be asking them to record the colour they associate with each word.
2. Select a small group of subjects. Provide each with paper and a pen.
3. Read out your list of words and ask your subjects to record the first colour that comes into their mind when they think of that word.
4. Collect their responses.
5. Repeat the activity with the same subjects two weeks after the initial exercise.
6. Compare the responses of each subject. How many words were consistently described?
7. Synaesthetes are found to have consistent responses to such word associations. Did any of your subjects respond consistently over the two-week period?
8. What extraneous variables or factors may have unfairly influenced your results?
9. An alternative investigation: Repeat the same steps as above but create an audio recording of 10 different musical instruments in place of the list of words.

As you learnt in earlier chapters, infants are born with many more neuron connections than adults. As a child grows and develops, these connections normally get 'pruned back' to improve the efficiency of the brain's function as more and more learning occurs. It is, however, thought that synaesthetes retain a large number of these connections between sensory areas. This provides the hardware for a synaesthete to have easy access to rapid messages being passed from one sensory area of the brain to another. They can therefore readily combine sensory experiences to enable the unique sensory perceptions of synaesthetes such as Sean Day.

The increased neural activity between sensory areas in the brain of a synaesthete is illustrated in Figure 16.3. In a non-synaesthete, a visual stimulus goes to the visual area of the brain (occipital lobe), but the additional connections in the brain of a synaesthete enable the messages to travel to other areas and activate other sensory lobes. Hence, sound can be tasted and music can be seen!

Synaesthesia is a condition that tends to run in families, and so is thought to have a strong genetic basis. It is possible that a genetic influence prevents the pruning back of connections in particular areas within a synaesthete's brain.

Experiencing the days of the week in colour, or seeing numbers and letters as colours are common forms of synaesthesia. In Investigate 16.5 you can try the 'synaesthesia experience' by trying to associate words with colours and shapes.

GROWTH MAY AFFECT PERCEPTION

According to Australian tennis legend John Fitzgerald, young Australian tennis player Bernard Tomic is growing like a giraffe! Bernard is finding that his rapid growth spurts are associated with poor coordination. It is possible that his rapid growth is altering his brain's perception of the world and affecting his judgment of timing between the tennis racquet and the moving tennis ball. The brain adjusts to new circumstances, so his brain is likely to quickly respond to his new 'view of the world' and his perception becomes more accurate again. Until his next growth spurt!

To reach the top, Tomic must first stop growing

Jessica Halloran, 21 January 2009

Bernard Tomic moves like a baby giraffe with a tennis racquet at times. As he grows, he struggles with his coordination and his timing goes awry, which causes him to spray tennis balls.

The lanky Tomic has already hit 190 centimetres and is still shooting upwards 'Hopefully, I can stop,' he laughs.

Davis Cup captain John Fitzgerald believes that the 16-year-old is still adjusting to his rapidly growing body.

'He's still like a baby giraffe,' he says.

Over the past three years, Tomic has grown 20 centimetres and added 26 kilograms. The past 12 months have been the most problematic, with Tomic saying he has been frustrated trying to rediscover his rhythm on court.

'Every time I step on court I feel like I've grown another half a centimetre,' he said.

FIG 16.4» Bernard Tomic (right) talks with Davis Cup captain John Fitzgerald.

'You know the ball will fly in different directions. I can't control it.

'Then I stop growing and start playing good tennis again, and then I'll start growing again and I can't hit a ball on the court.

'When I stop growing it's going to be a lot easier. It's frustrating when you're not moving or hitting the ball the right way, that costs you a few matches.'

Age, Wednesday 21 January 2009

16.7 INVESTIGATE

Stop growing Tomic!

1 Read the article 'To reach the top, Tomic must first stop growing'.

2 Answer the following questions:

- **a** Over the past few years, Tomic has 'grown 20 centimetres and added 26 kilograms'. What problems has this created for Tomic on the tennis court?
- **b** In what ways might these problems relate to perception difficulties on the tennis court?
- **c** 'Then I stop growing and start playing good tennis again, and then I'll start growing again and I can't hit a ball on the court.' Using your knowledge of the brain and possibly of brain plasticity covered in previous chapters, explain why Tomic's brain might be partly responsible for this observation.
- **d** The brain has an 'adaptive' nature. What might this mean?

CAN BABIES PERCEIVE SOUND IN THE WOMB?

It appears that babies in the womb can actually hear sounds. This means that they must be able to both sense and perceive information. A study conducted by DeCasper and Fifer (1980) showed that babies recognised their mother's voice following their birth. Using the rate of a newborn's sucking reflex as an indication of recognition, it was shown that babies would increase the rate of sucking when hearing their mother's voice as compared to the sound of a stranger's voice.

As a follow-up to this study, DeCasper and Spence (1986) had pregnant mothers read the book *The Cat in the Hat* by Dr Seuss aloud twice a day for the last 6.5 weeks of their pregnancy. Their newborns were then tested using the same sucking reflex test. They were shown to increase their sucking rate when exposed to a recording of their mother reading the same book as compared to their mother reading a different book.

For babies to be able to detect sounds in the womb, their senses must be developed sufficiently to pick up vibrations through the amniotic fluid surrounding them. To then be able to recognise sounds after birth from their experiences inside the womb, babies must be able to recall having heard the voices and sounds before. This means that the brain is already developed at this stage to be able to detect and understand sounds. The complex processes of sensation and perception are already at work. This research also suggests that babies are capable of learning. If their neurons are able to recognise familiar stimuli, they show evidence of having learned.

16.8 INVESTIGATE

Understanding research

1. What was the aim of the study by DeCasper and Fifer (1980)?
2. What technique was used by the researchers to determine that newborns recognised their mother's voices?
3. What were the results of the experiment conducted by DeCasper and Fifer (1980)?
4. What was the aim of the study by DeCasper and Spence (1986)?
5. Describe the method used to conduct this experiment.
6. What were the results of the experiment conducted by DeCasper and Spence (1986)?
7. In what way did the 1986 experiment rely on the findings of DeCasper's earlier experiment?

CULTURAL DIFFERENCES IN PERCEPTION

Many Australians love Vegemite, kangaroos, witchetty grubs and Holden cars. These are icons that many overseas visitors associate with Australian culture. However, it is more than likely that visitors to our country do not initially enjoy eating Vegemite or witchetty grubs. Similarly, Aussie travellers may be seen to turn up their noses in disgust at a glass of Fijian kava, a Scottish haggis, a bowl of German sauerkraut or an English black pudding. The idea of eating something so foreign may seem ... well, quite disgusting really! However, these foods can be a delicacy in their country of origin.

Would you try these?

- An exotic cheese from Italy called Casu marzu is full of wriggling maggots.
- Bird's nest soup is made from the nest of a swift that lives in South-East Asian caves. The nest is made from the dried saliva of this little bird.

FIG 16.5» Bird's nest soup

- Indonesia's Kopi Luwak coffee is brewed from beans that are passed out in the faeces of the civet cat, and is known as the most expensive brew in the world. It is also known as 'scat coffee'.
- The French love escargots—snails.
- Many people in Africa enjoy raw or roasted termites.
- Locusts are a delicacy in Saudi Arabia.
- Sheep's eyes are considered a delicacy in some parts of Arabia.
- Sheep testicles are eaten in Egypt.
- Dogs are considered a delicacy in some parts of Asia.
- In some East African tribes, warm cow's blood mixed with milk is a valuable source of protein.

There are many differences across cultures that influence the way we might perceive something. For one person it might be considered a treat to behold while to another the sight, smell or taste might be enough to make them faint! The same sense stimulus can create quite different perceptions.

The process of sensation is the same for any of these cultural delicacies. The processing of the sensory messages, however, is open to a great deal of different interpretations. There are many differences across cultures that influence the way an exotic dish may be perceived. One person used to drinking 'scat coffee' from a young age might consider it to be a treat, while another might find the sight, smell or taste enough to make them feel ill! The same sense stimulus can therefore create quite different perceptions.

16.9 INVESTIGATE

Food and culture

1. Explain why in some cultures a particular food is considered a delicacy while in others the same food is considered disgusting.
2. In what ways can different perceptions between cultures be used to explain this phenomenon?
3. Many of these foods are closely connected to a particular culture's history. Choose two of the examples listed on pages 219–220 and find out about the historical connection between the food and the people of that particular culture.
4. Choose one or two of the cultural delicacies on the previous page. Find a recipe that describes the preparation and presentation of this food. Share with the class!

BLIND MUSICIANS AND BRAIN PLASTICITY

There have been many great blind musicians throughout history. Stevie Wonder, Ray Charles and Andreas Bocelli are just three examples of blind musicians who have superior abilities to depict pitch. Their ears are probably no better than anyone else's, but the difference is in their highly tuned perception of sound or auditory stimuli.

When a sense is denied, it appears that one or more of the other senses is more highly tuned than normal. Therefore, blind people generally have better hearing than sighted people. It is also highly likely that without their brain being bombarded with visual information, blind people can focus much more on auditory sensations as they are fed into the brain.

FIG 16.6» Stevie Wonder is a blind musician with superior sound perception.

According to neuroscientists, **neuroplasticity** (the brain's ability to reorganise itself by forming new neural connections) may also help to explain why blind musicians have superior hearing to that of a sighted person. Areas made redundant (such as the area responsible for visual processing in blind people) may actually be used instead for the processing of other senses such as hearing. If an additional area of the brain is devoted to the processing of sound, then the improved abilities can be explained by the wonders of neuroscience.

Some cultures have historically placed great value on non-sighted musicians, suggesting their superior abilities. In ancient China, the role of the court musician was reserved for the blind, while in Japan blind lute players travelled around throughout the thirteenth and

fourteenth centuries to perform for others. Ancient civilisations may indeed have known long ago what neuroscience is now supporting!

A study conducted by Hamilton et al. (2004) showed that absolute pitch was possessed by 21 per cent of sighted musicians as compared with 57 per cent of blind musicians. MRI results on both sighted and blind musicians also showed differences between their neural mechanisms within the brain.

Another study compared *f*MRI tests of a blind musician called ML with sighted musicians of similar musical ability. ML had been blind since birth, and comparisons between the brain scans showed similar areas of neural activation. However, ML had an additional area of activation within the brain, suggesting a blindness-induced brain plasticity (Ross, Olson & Gore 2003).

MAGIC ... MAKING THE MOST OF OUR MISPERCEPTIONS

Magic and illusions are excellent examples of how our perceptions and understanding of the world are not always direct reflections of reality. It is not our eyes being tricked but our brain!

An **illusion** is when a misleading impression is presented to our senses so that our perceptions inaccurately interpret what we are looking at. We can therefore perceive something that doesn't exist. David Copperfield is a famous illusionist who commonly presents seemingly impossible feats on stage with thousands of people watching carefully. Julian Beever is a famous artist who creates three-dimensional chalk drawings on pavements around the world (see Figure 16.7). From a specific perspective, these two-dimensional drawings actually appear to be gaping holes, multi-level waterfalls or objects sitting on top of the pavement. If you walk over the flat pavement, you can see that the flat surface is not really the illusion your brain perceives.

'Magic Eye' images are another example of how our brain can be tricked into perceiving something that does not exist is reality. When presented with a two-dimensional picture, we can learn to focus on an element of the computer-generated image and trick our brain into believing we are looking at a three-dimensional one. This creates the illusion we are looking at an image with depth where none exists at all.

FIG 16.7›› Three-dimensional art by Julian Beever

16.10 INVESTIGATE

Blind musicians

1. What might be some disadvantages of being a blind musician?
2. What might be some advantages of being a blind musician?
3. Approximately one-third of musical savants are also blind. What is a musical savant? What types of abilities might they have? Why might such a large number be blind?
4. Find out more about a particular blind musician. What are their particular strengths? What opportunities or events led them to become musicians? (Some examples: Stevie Wonder [soul/R&B]; Ray Charles [blues]; Andreas Bocelli [operatic tenor]; Jose Feliciano [Latin].)

REVIEW 16.2

1. What is visual agnosia?
2. Describe the condition known as synaesthesia.
3. What area of the brain is shown in PET and *f*MRI scans to be activated when synaesthetes 'hear' colours?
4. Describe how a baby's sucking rate was used in studies by DeCasper (1980, 1986) to determine whether they could recognise sounds.
5. What evidence exists to suggest that blind people have better hearing than people with unimpaired sight?

Interesting illusions: can you make sense of these?

Illusions occur when misleading information reaches our senses and creates inaccurate perceptions.

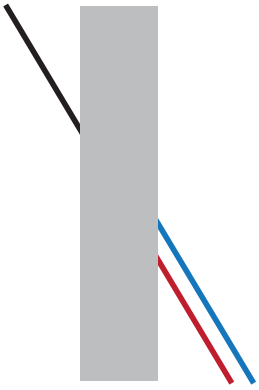


FIG 16.8» Poggendorff illusion: Which line (red or blue) is the extension of the black line?

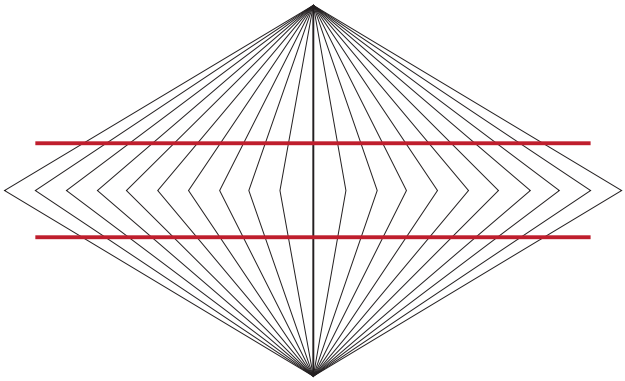


FIG 16.9» Wundt illusion: Do the red lines bend inwards? Use a ruler to check.

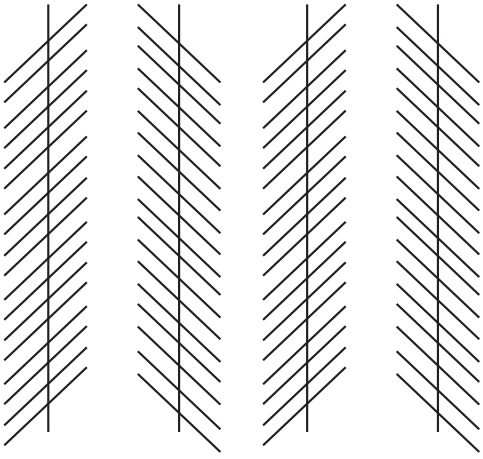


FIG 16.10» Zoellner illusion: Are the vertical lines parallel? Use a ruler to find out.

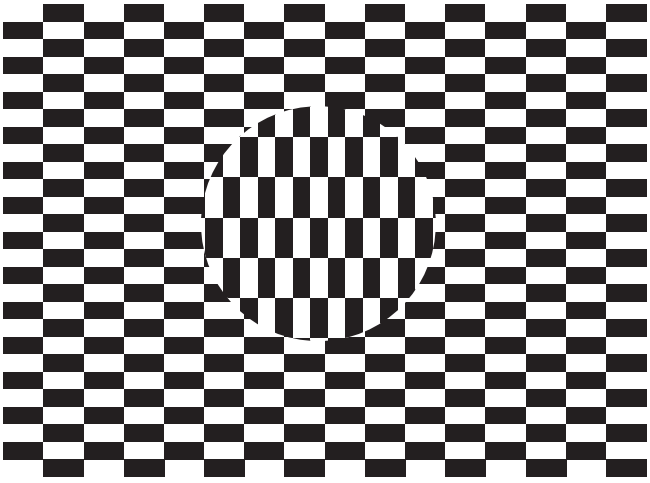


FIG 16.11» Ouchi illusion: Does the pattern inside the circle appear to float? Is this possible?

FIG 16.12» Why is this illusion called the Impossible Triangle?

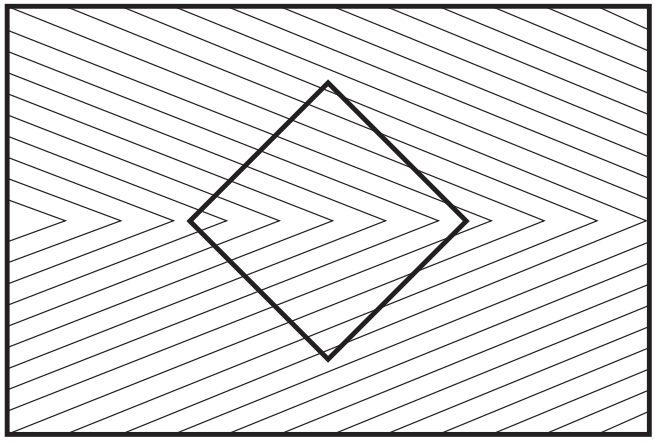


FIG 16.13» Orbison illusion: Do you see a perfect square and rectangle, or are they distorted? Use a ruler to check

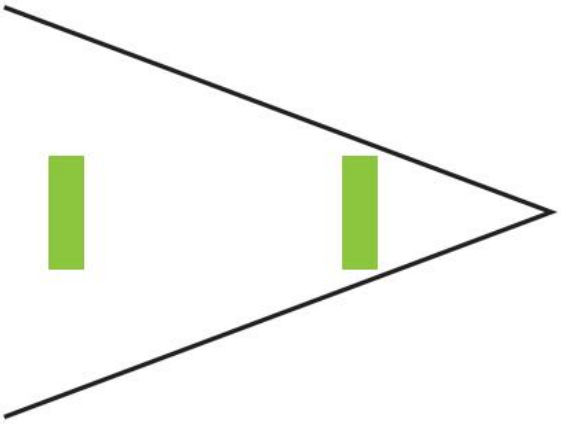


FIG 16.14›› Ponzo illusion: are the two rectangular shapes the same or different sizes? Measure with a ruler to see if you are correct.

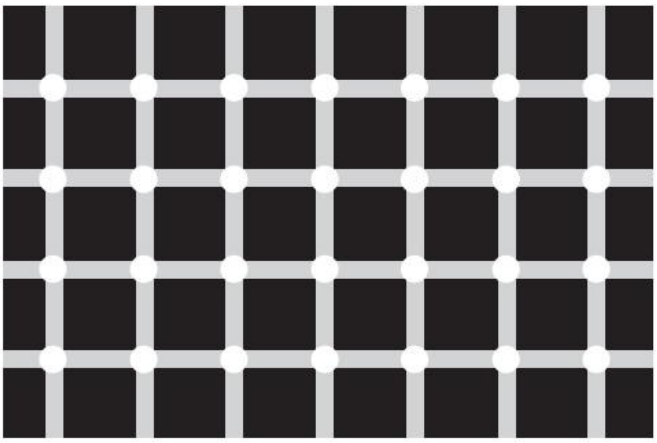


FIG 16.15›› Scintillating grid illusion: are the dots in this image black or white or even grey? Do they stay the same? Could this really be the reality?

Magicians work their magic by masterfully utilising a range of skills that interfere with our perception of reality. They can manipulate the attention and focus of an audience by controlling exactly what they pay attention to.

A magician can create magic by influencing perception in a number of different ways.

- They can focus our attention on something irrelevant to distract us from what they are really doing.
- They can utilise timing, where the trick is performed when we are least expecting to see something happening.
- They can overstimulate our senses with light or explosions so that we can be temporarily blinded, giving a split-second opportunity to slip a coin into a pocket or hide a rabbit.

The difficult thing for magicians is that the audience is always out to try and work out how the tricks are performed. The great magicians are so good at their craft that their secrets are almost impossible to detect. Many of Harry Houdini's secrets are yet to be explained, or even repeated, many years after his death.

As discussed earlier in this chapter, change and inattentional blindness are commonly used by magicians to weave their magic. An audience's attention can easily be diverted to avoid detection of a magician's secret, and people enjoy being wowed by magic! Magicians have been way ahead of neuroscientists in understanding the weaknesses of human attention, and have been using this knowledge for centuries. Now neuroscientists are using the knowledge of magicians to try and learn more about human attention and what factors influence human perception.

16.11 INVESTIGATE

The secret of magic

1. In your own words, define the terms 'change blindness' and 'inattentional blindness'.
2. Which of these types of 'mental lapses' are utilised in the 'mind reading' card trick in 16.2 Investigate? Explain your answer.
3. Find out about a specific magic trick. Try to explain how it works. How does it trick people's brains into perceiving something that is not really happening?

REVIEW 16.3

1. What is an illusion?
2. In what ways can a magician manipulate the attention of an audience to create magic?
3. Describe how change blindness and inattentional blindness can be used by magicians to create a sense of illusion or magic.
4. Describe how neuroscientists can learn from magicians to improve their understanding of human perception.
5. Choose two illusions from figures 16.8–16.15.
   a. Describe the visual image.
   b. What is the illusion?
   c. Describe the parts of the image that help to create the illusion.

CHAPTER SUMMARY

- Sensation is the process of our body's senses registering information about the environment.
- Perception is the organisation and interpretation of information from our senses to understand the stimuli coming in from the outside world.
- Magicians utilise our abilities to sense and perceive our environment by manipulating the information that reaches our brain. This enables them to amaze onlookers with supposed magical feats.
- Our brain must be tuned in to the environment to understand the stimuli registered by our senses. If we are not paying attention, our brain is not aware of the stimuli.
- Change blindness occurs when an observer is unaware of a change occurring due to disrupted attention.
- Inattentional blindness is when observers do not notice an event despite it clearly being in their visual field.
- Synaesthesia is a harmless perceptual condition in which the senses become mixed up—synaesthetes can taste colours and shapes, or see music as colours and shapes.
- Rapid growth spurts can influence our coordination as our brain takes time to adjust to the changes associated with height and coordination. This causes a changing perception of our world.
- Babies in the womb can experience sound perception.
- Different cultures create different perceptual experiences that can be acceptable to individuals in one culture but not to people in others.
- Improved hearing in blind musicians may be partly explained by neuroplasticity. Areas of the brain not in use (such as the area responsible for visual processing) may actually be used instead for the processing of other senses (such as hearing).
- Magic and illusions are excellent examples of how our perceptions and understanding of the world are not always a direct reflection of reality.
- Change blindness and inattentional blindness are commonly used by magicians to create their magic.

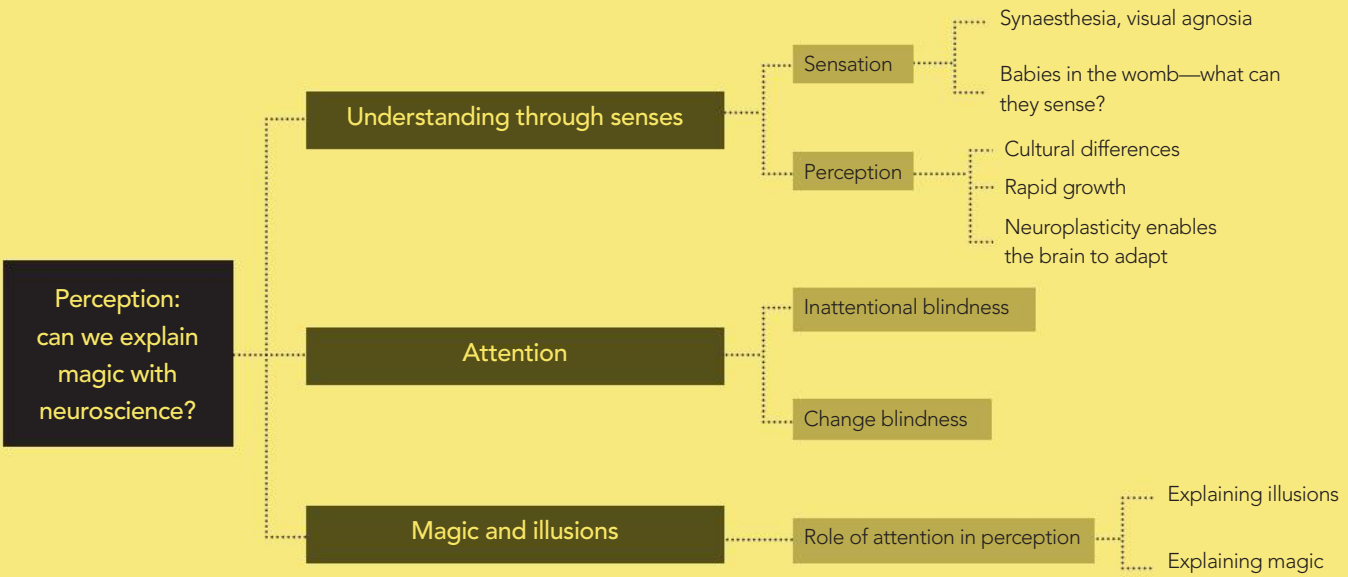


FIG 16.16» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 Sensation is a process that involves:
- **a** detecting information through our senses and having our brain interpret it
- **b** interpretation of sensory information by our brain
- **c** detecting information from our environment through our senses
- **d** feeling through our senses.

2 Perception is a process that involves:
- **a** detecting information through our senses and having our brain interpret it
- **b** interpretation of sensory information by our brain
- **c** detecting information from our environment through our senses
- **d** feeling through our senses.

3 Inattentional blindness can best be illustrated by the following example:
- **a** A blind student did not notice that there was a different teacher in the room.
- **b** A shop assistant did not pay attention to the sales transaction because she was bored.
- **c** A bushwalker did not notice the kangaroo on the path because he was busy looking for his chocolate bar.
- **d** Randi the magician tried to distract his audience from the real secret behind his trick.

4 Change blindness best can be illustrated by the following example:
- **a** A blind student did not notice there was a different teacher in the room.
- **b** A shopper did not realise that a different shop assistant had taken over the sales transaction.
- **c** A basketballer changed positions on the court after time-out.
- **d** Randi the Magician tried to distract his audience from the real secret behind his trick.

5 Tasting shapes and music is a possible symptom of which sensory condition?
- **a** visual agnosia
- **b** synthesis
- **c** perceptual trauma
- **d** synaesthesia

6 The condition caused by the brain not perceiving information accurately is called:
- **a** visual agnosia
- **b** synthesis
- **c** perceptual trauma
- **d** synaesthesia.

7 The measurement used by researchers DeCasper and Fifer (1980) to determine whether newborns recognised their mother's voices from when they were inside the womb was:
- **a** facial expressions such as smiling
- **b** rate of sucking
- **c** orienting eyes towards mother
- **d** recognition of the story *The Cat in the Hat*.

8 Researchers investigating the sensory capabilities of babies in the womb found that:
- **a** babies are unable to make sense of sounds until they are born
- **b** sounds cannot be heard in the womb
- **c** babies can recognise sounds that were heard when in the womb
- **d** a baby's sense of hearing is not fully developed until three months of age.

9 Jose is a blind singer who is a part of a singing group. When asked to vote for the most talented group member, the other members of the group who have normal sight voted for Jose. They believed that he has the best sense of rhythm and timing. Neuroscience can support this vote for Jose by explaining that parts of his brain normally used for sight can also be used for sound. This is called:
- **a** abnormal
- **b** neuroplasticity
- **c** music perception
- **d** musical blindness.

TEST YOUR UNDERSTANDING

10 An illusion can best be described as:
   - **a** a misleading image that occurs when the brain inaccurately interprets sensory stimuli
   - **b** an impossible image that just cannot be explained
   - **c** a direct reflection of reality
   - **d** when sensory stimuli are inaccurately sent to the brain for interpretation.

11 What can neuroscientists learn from magicians?
   - **a** factors involved in attention
   - **b** factors influencing perception
   - **c** how to create card tricks
   - **d** both a and b

12 Describe how cultural background can influence an individual's perception. Use an example to illustrate your answer.

13 Distinguish between the terms 'change blindness' and 'inattentional blindness'. Use examples to clearly illustrate your answer.

14 What evidence has been shown for blind musicians having a better than normal perception of musical sounds?

15 Describe how magic tricks can be explained by the following:
   - **a** focusing attention
   - **b** change blindness
   - **c** inattentional blindness.

Extend yourself

16 Learn to do some magic tricks! These are the best way to understand just how magicians trick an audience's perception. WWW»

17 Learn more about how illusions can be created using a range of forms. Sand sculptures, 3-D chalk drawings, body paint and Google Earth are just some examples. WWW»

18 Learn more about some famous illusions commonly studied by psychologists to learn more about how illusions work: the Müller-Lyer illusion, the Ponzo illusion, the Ames room, the moon illusion, impossible figures.

19 How does art create an illusion of reality and depict three dimensions from a two-dimensional surface? Choose a painting or image that enables you to perceive depth within it. Try to identify the techniques used by the artist to create that depth.

20 M.C. Escher is famous for his artworks that create illusions. Look for examples of them and try to work out the illusions.

21 Famous people with synaesthesia: Musician John Mayer experiences synaesthesia: when he hears music, he associates it with colours. Find out more about other people's experiences of synaesthesia. What is their experience? Go online to blogs and YouTube videos to try and get an understanding of what the experience is like for those living it every day.

DON'T WORRY, BE HAPPY!

IS IT POSSIBLE TO IMPROVE OUR LEVEL OF HAPPINESS? DO RELIGION AND SPIRITUALITY HAVE THE ANSWERS TO MAKING US HAPPY? DOES GETTING WHAT YOU WANT MAKE YOU HAPPY? IS HAPPINESS ALL ABOUT SMILING?

Most people have a goal to be happy. Many spend a great deal of energy striving for what makes them happy— shopping for new clothes, owning a shiny new bike, the latest technology, a bigger television. For some people, this is what Christmas is all about: asking for the things they would love to own, because they imagine it will make them happier. But is this really what makes a person happy in the long term?

WHAT MAKES US HAPPY?

Bhutan is a remote country in the Himalayas with a unique feature. It claims to be the happiest country in the world. Its government even puts happiness at the centre of its major policy decisions by considering what the impact will be on the country's GNH: 'Gross National Happiness'. Bhutan's policies on happiness have led to some decisions that are very different from those of many capitalist countries. Very little advertising is allowed and the government bans plastic bags, tobacco and traffic lights because they believe these items do not contribute to happiness. Bhutan was the last country in the world to introduce television in 1999, but only shows thought to promote happiness are permitted. There are also strict conservation laws aimed at taking care of the environment and achieving sustainability. As Buddhists, the people of Bhutan have a strong focus on inner spiritual development.

So, does Bhutan have it worked out? Is this really what does make people happy?

Many people spend a lifetime searching for what makes them happy, while others do not need to search too far. Many researchers are focused on trying to find the secret to what happiness really means. How can we all access this secret?

FIG 17.1» As Buddhists, the people of Bhutan have a strong focus on inner spiritual development.

17.1 INVESTIGATE

Promoting happiness

1. Think of five things that would make you a happier person. Write them down.
2. Share them with the class. What are the similarities and differences between everybody's ideas?
3. Consider the things that the government of Bhutan believes are important in making its people happy. How different is this from your lifestyle?
4. Choose two of Bhutan's policies to achieve happiness. For each point, explain why you think this is considered to promote happiness among its people.
5. Can you imagine being happy living in Bhutan? Reflect upon the reasons for your answer and explain why or why not.

MEASURING HAPPINESS

A new generation of psychologists is now focusing research on happiness, and neuroscience is unlocking mysteries into what happiness looks like in the brain. **Positive psychology** is the study of ways that enable humans to function in the best way they possibly can. The essential ingredient behind positive psychology is unraveling the secrets of happiness—what it is, why it is important and how it can be achieved.

Many surveys have been conducted on the topic of happiness, and results collated from self-report questionnaires where people indicate their own level of happiness. It is argued that a person's own reflection upon their level of happiness tends to correlate with what a friend might report about them if asked the same question.

17.2 INVESTIGATE

Are you satisfied with life?

This test is called the Satisfaction with Life Scale, and was devised by Edward Diener from the University of Illinois (1980).

1 Read the following five statements. For each statement, rate your level of agreement, using the 1–7 rating scale. Be open and honest in your responses.

2 When you are finished, reflect upon your score. Do you agree with the scoring you obtained for the survey? Explain why or why not.

Rating scale:

7: Strongly agree; 6: Agree; 5: Slightly agree; 4: Neither agree nor disagree; 3: Slightly disagree; 2: Disagree; 1: Strongly disagree.

Statements:

____ In most ways, my life is close to my ideal.
____ The conditions of my life are excellent.
____ I am satisfied with my life.
____ So far, I have got the important things I want in life.
____ If I could live my life over, I would change almost nothing.

Scoring:

31–35: Extremely satisfied; 26–30: Satisfied; 21–25: Slightly satisfied; 20: Neutral; 15–19: Slightly dissatisfied; 10–14 Dissatisfied; 5–9: Extremely dissatisfied.

WHAT DO SURVEYS REVEAL ABOUT HAPPINESS?

People living in Western cultures today are wealthier and healthier, on average, than at any other time in history. It might therefore be expected that people are happier. However, studies suggest that this might not be the case.

According to leading happiness researchers such as Martin Seligman and Edward Diener, results of surveys on happiness reveal consistent results. They have found that:

- age does not affect the level of happiness
- education and IQ do not affect the level of happiness
- wealth does not matter, as long as the basic needs are met.

Wealthier people are not necessarily happier! Interviews with 49 of America's wealthiest, as listed in *Forbes* magazine, found them to be only slightly happier than the average person (Diener, Horowitz & Emmons 1985).

WHAT MAKES US HAPPY?

'Whether one believes in religion or not, whether one believes in this religion or that religion, the very purpose of our life is happiness, the very motion of our life is toward happiness' (The Dalai Lama).

FIG 17.2» His Holiness the Dalai Lama believes the purpose of life is happiness.

The Dalai Lama is considered by many people to have deep insight into the mysteries of happiness. He is the spiritual leader of the Tibetan people and is recognised worldwide as an ambassador for peace and compassion. Drawing upon 2500 years of Buddhist wisdom, he believes that the purpose of life is happiness.

There are many religious traditions that promote wisdom as the purpose of life, and concentrate on the pursuit of happiness and well-being.

The area of positive psychology is a much newer discipline based upon scientific research, but is one of the fastest-growing areas of psychology. **Positive psychology** looks at the conditions that allow communities and individuals to thrive.

Scientific studies in the field of positive psychology (Diener & Seligman 2002) suggest that the things that do make us happy are related to connections with others:

- friends and meaningful relationships
- good relationships with family members
- time spent with family members
- a satisfying spiritual life
- undertaking acts of kindness towards others.

CHASING PLEASURE OR DOING A KIND ACT FOR SOMEONE?

Many of us spend a great deal of energy, time and money chasing activities and things in which we find pleasure. It may be hanging out with friends, going to a movie, buying a new iPod or filling our wardrobe with new clothes. However, while these pleasurable activities might make us happy for a period of time, it appears that the feeling fades quickly. We are soon searching for something else to make us happy.

Debbie was 18 when she volunteered to travel to Fiji as a part of a building program. Over several weeks, she worked with local villagers to build a house in a small village for a Fijian family who had no place to call home. The experience was physically and mentally challenging, but highly rewarding and life-changing. Debbie feels happy that she has been able to contribute to improving life for others in a very significant way. She is now addicted to the feelings of pleasure she gets from helping others.

According to Martin Seligman, a more powerful and long-lasting factor in making us feel happy is to be generous or do something positive for others. Performing a kind act for someone else can leave us feeling happy for a much longer period of time than when doing something for ourselves. The feeling is even more powerful when the act of generosity is spontaneous. The more kind actions performed, the greater the effect on our happiness level. Being kind to both our friends and strangers triggers a chain of effects: it can make us feel generous and capable, as well as giving us a greater sense of connection with others. It can also make us feel good just to make someone smile!

REVIEW 17.1

1. The remote Himalayan country of Bhutan has many of its policies aimed at the GNH. What does this mean?
2. What is positive psychology?
3. According to Diener and Seligman (2002), what factors are thought to be important in making us happy?
4. According to Diener and Seligman (2002), what factors do not affect our level of happiness?
5. What did Seligman find out about the effect of doing something for others as compared to doing something for ourselves?

17.3 INVESTIGATE

Helping others makes us happy

To investigate whether pleasurable activities or acts of kindness toward someone else are more effective at making us happy, try the following activities:

1. Undertake an activity that gives you pleasure. It may be hanging out with friends, eating ice cream, stopping for a hamburger on the way home from school or playing your favourite computer game.
   - **a** Describe how this activity made you feel.
   - **b** How long did the feelings last?
2. Undertake an act of kindness, for example helping an elderly lady load her shopping into the car, mowing a neighbour's lawn, helping a classmate with their homework or doing a chore for your parents without being asked.
   - **a** Describe how this activity made you feel.
   - **b** How long did the feelings last?
3. Compare your results for both activities.
   - **a** Were the feelings you had during and after each activity the same or different? How?
   - **b** Compare the length of time the positive feelings lasted for each activity.
4. Research suggests that acts of kindness towards others give longer-lasting feelings of happiness. Did your results support this research?
5. Share your findings with the class.

Viktor Frankl was a Jewish psychiatrist and Nazi concentration camp survivor. While in the camp, his family all died at the hands of the Nazis. Frankl, however, survived with his sanity intact despite being stripped of all human dignity and hope. Frankl believed that the secret ingredient to his survival in the face of human despair was the focus on helping others to survive—with a reason to live, his survival was more likely. His experiences as a concentration camp survivor led him to write a now-famous book titled *Man's Search for Meaning*.

HOW WE FEEL ABOUT LIFE

Scientific studies by David Lykken have suggested that happiness is 50 per cent determined by our genetic make-up and 50 per cent by our experiences (Wallis 2005). Genes can influence factors such as personality, how we deal with stress and our likelihood of developing anxiety or depression. Major life experiences, such as our upbringing, our relationships and the events that happen in our lives, make up the environmental influences that can have an impact on how we feel about life.

According to Williamson (2000), the key factors influencing how positive we feel about life are:

- our **temperament**—the inborn qualities that determine how well we interact with our environment
- our outlook on life—we learn through experience to be either positive or negative about life
- cultural differences—different cultures place different values on life experiences
- what we value—people with clear values and goals for what they want out of life report feeling more positive about themselves.

Feeling more positive about life leads a person to being more likely to contribute to the community, have better relationships with others and to being a more positive role-model.

17.4 INVESTIGATE

Daily mood journal

It is normal for moods and feelings to vary over time. Events that happen to us can have an impact on our mood, as can diet, sleep and hormones. To assess how positive you feel about life over a period of several days, complete the following mood journal.

Step 1 For three or more days in a row, at approximately the same time each day, rate your mood level according to the scale provided.

Name: _____ Day : _____
Date: _____

Please indicate how much of each emotion you felt in the past 24 hours, using the following scale of 1–7.
1: Not at all; 2 Very slight; 3: Somewhat; 4: Moderate amount; 5: Much; 6: Very; 7: Extremely.

_____ Happy
_____ Joyful
_____ Frustrated
_____ Enjoyment/Fun
_____ Unhappy
_____ Depressed/Blue
_____ Pleased
_____ Angry/Hostile
_____ Worried/Anxious

(Adapted from Bolt, 1998)

Step 2 Using the lists of positive and negative emotions in Table17.1, allocate one point for every positive emotion and one point for every negative emotion you have felt for each day. Use the table to record your positive and negative emotions.

TABLE 17.1» Frequency of positive and negative emotions over three days

Emotions	Day 1	Day 2	Day 3	Total score
Positive emotions: happy, joyful, pleased, enjoying				
Negative emotions: depressed, unhappy, frustrated, angry, worried				

Step 3 To determine whether you have felt more positive or more negative emotion, calculate a Global Daily Mood score: Total positive score – total negative score = _____.

If your Global Daily Mood score is greater than zero, your mood is more positive than negative. If it is less than zero, your mood has been more negative than positive.

My Global Daily Mood Score is: more positive/ more negative (circle one).

Step 4 Reflect on your results.

- **a** Would you agree or disagree that your Global Daily Mood score is what you feel most of the time?
- **b** What factors or experiences from the days you recorded your mood might have influenced your results?
- **c** Do you think this test might be an accurate predictor of whether someone is feeling positive or negative about life in general? Explain your answer.
- **d** In what situations might this type of test be useful? Explain why.

Positive things about me

1. What do you think are four of your most positive characteristics? (These may relate to physical features, skills or personality, for example.)
2. Do you think these characteristics are genetically determined or learnt from experience?
3. Think of an experience you have had that has had a positive effect on you. What is it? What effect did it have in both the short term and long term? Share your answer with the class.

WILL WE BE HAPPY IF WE GET WHAT WE WANT?

How often have you reached that goal you have been aspiring to, only to find that something is missing?

At 15 years of age, Ben decided he wanted to run his own business, manage staff, and be recognised as a leader in the field of technology. These were big goals. By the time he was 20, Ben had achieved all of this, and his business was making money. Ben then decided he wanted to be a millionaire by the time he was 25 years old, a goal he subsequently achieved. However, having as much money as he wanted did not satisfy him as expected. He loved his job and enjoyed being successful, but still he wanted more.

Ben decided that there had to be more to life than being successful and making money, so he decided to volunteer his time at a youth centre on the other side of town, where crime rates and homelessness were high. This was challenging for Ben, but he found that giving his time and energy to people who really needed it was a most worthwhile experience. He found that performing acts of kindness to others was something that did make him feel happy about himself.

Ben's story is not so unusual, in that many of us aspire to big things. Whether our aspirations are large or small, when we achieve a goal, we are ready to aim for our next goal. This is a good thing, as it keeps us motivated and interested in new things.

It is not uncommon for people to tire of what they thought would make them happy. We might want the latest in technology, a new car, to earn a place on the basketball team, achieve the highest score in an online game, own a new sports watch or get an 'A' on a test. However, once we get what we want, the feeling diminishes and we are no longer as excited. How often have you been excited and thrilled by all the presents you receive on your birthday, only to find that in a short time you are thinking about the next lot of presents you will receive? When you achieve a good result on a test you quickly realise there is another test next week! Even when you finish VCE the feeling of having 'finished' and 'succeeded' is short-lived as you think of starting university or a job.

As mentioned previously, doing things for others can be a great way of boosting your happiness levels in the longer term.

17.5 INVESTIGATE

Bring on the holidays

Remember how you looked forward to hanging out for those holidays, only to find out that after three weeks you are bored with watching television and being a couch potato? When have you found that you had aspired to something only to find when you got there the pleasure was short-lived? Share your ideas with the class.

REVIEW 17.2

1. What did Ben originally believe would make him happy?
2. What finally made Ben happy and why?
3. How could positive psychologists explain Ben's new-found feelings of happiness?

FIG 17.3» Does money make you happy? Research suggests it is short-lived happiness.

SHOULD WE AIM FOR CONSTANT HAPPINESS?

It appears that it is not realistic for us to aim for constant happiness. Each person has a particular level of happiness that is characteristic for them. They may increase their level of happiness if something exciting or positive happens, or decrease their happiness level if something negative happens to them. However, they will eventually return to their typical level of happiness in time. This is called a **'set point' for happiness** (Brickman & Campbell 1971).

Many people dream of winning the lottery. However, it has been found that, apart from an initial level of excitement and happiness at winning all that money, the level of happiness in lottery winners does not change in the long term. People tend to adapt to their new circumstances and then look for other happiness boosters.

There appear to be two significant life events that affect a person's long-term happiness level. A person losing a partner or losing a job can take 5–8 years to return to their previous 'set point' for happiness.

FIG 17.4» The loss of a family member or friend may take five years before the previous state of happiness is achieved.

It is possible that happiness is caused by the journey for achieving our goals, rather than the achievement itself. Neuroscientist Richard Davidson from the University of Wisconsin has found that working hard to achieve a goal and anticipating that goal will increase the positive feelings we have. It will also reduce negative feelings such as fear and depression.

17.6 INVESTIGATE

Feeling happy

1 Think of a time when you were exceptionally happy or excited. It may have been going on a big holiday, winning an award, achieving a long-term goal, finally understanding that maths topic or going to a theme park.
   - Describe how this event made you feel.
   - How long did these feelings last?
   - What gave you the greatest sense of excitement: the anticipation of the event, the actual doing, or the feelings afterwards? Explain why.
   - Do you think there is any such thing as constant happiness? Why or why not?

2 A contestant in the ABC show *Extreme Makeover* volunteered to have a number of physical improvements made. She received everything from a new nose to new teeth and breast implants. When asked whether these physical improvements made her happier, she claimed that they did for the first year, but after that life was just back to normal.
   - Explain why this contestant felt happier for the first year following the 'makeover'.
   - What factors may have contributed to this contestant feeling that life was 'back to normal' again after the first year?
   - Explain how this example may be explained in terms of a 'set point' for happiness.

REVIEW 17.3

1 True or false: Happiness is thought to be determined 70 per cent by our genes and 30 per cent by our experiences.

2 According to Williamson (2000), what factors influence how positive we feel about life?

4 Describe what is meant by a 'set point' for happiness.

5 What are two significant life events that can affect a person's long-term happiness?

6 According to neuroscientist Richard Davidson, working hard to achieve a goal can _____ positive feelings and _____ negative feelings.

IS IT BAD TO FEEL SAD?

Feeling sad after a relationship break-up? Feeling down about your exam results, or about how much homework you have to do? Had a fight with your parents and feel lousy about it?

With so much talk about the importance of happiness, you might think that it is not good for us to feel sad. This is not really the case. If we were unable to experience feelings of sadness or frustration, we would not recognise happiness.

FIG 17.5›› There is a great deal that can be done to help when feelings of sadness do not go away. If this happens talk to someone such as a parent, friend or teacher, or seek professional help from a doctor or a counsellor.

When we are feeling sad, we will often reach for a quick fix to make us feel better—maybe a chocolate bar, some fried food or a lounge in front of the television. However, research suggests that while such quick fixes might help in the short term, in the long term they have no impact on our level of happiness. In the longer term, dealing with the issues that made us sad and allowing ourselves to work through our sadness is an important way to build up our skills of resilience. Dealing with the problem allows us to feel better about ourselves and, in the end, makes us feel happier. It also provides us with the skills to deal with sadness in the future, which puts us more in control of our lives.

To live a full and meaningful life, it appears that we need to feel both **negative** and **positive emotions**. It is, however, important to deal with any negative feelings to promote good health. Many studies have shown that happier people live longer than depressed people. Researchers from Carnegie Mellon University (Cohen & Pressman 2006) found that people who express negative emotions such as anxiety, depression and hostility are more likely to suffer from ill health such as colds and flu than those showing more consistent positive emotions such as happiness, joy and excitement. They also suggest that people who consistently express more positive characteristics have a greater chance of living a longer life. To live a longer and healthier life, it is therefore important to focus on trying to be more positive.

Even though we should all experience a wide range of both positive and negative emotions, it is important to deal with sadness to avoid the experience of depression. Everyone feels sad or 'down' from time to time, but **depression** is diagnosed when the feelings of sadness are intense and will not go away. Depression affects an individual's ability to function in their normal day-to-day activities, and makes activities that were once enjoyed no longer pleasurable. Depression is one of the most common mental health problems: one in five people will experience depression at some stage in their lives. The average age of someone experiencing depression today is 15 years. This is in comparison to the average age of 30 years many years ago. Developing skills to deal with sadness can help us to become resilient to depression and depressive symptoms. Find out more by visiting the beyondblue or youthbeyondblue websites. WWW››

17.7 INVESTIGATE

Feeling sad

Think of a time when you felt sad about something. It may have been the loss of a pet, the breakdown in a relationship or something that did not happen as you expected.

- Describe how you felt. What emotions did you experience?
- For how long did you feel sad?
- What did you do in this situation to help deal with your feelings of sadness? How effective was this?
- What do you generally do to help you to feel better when you're feeling sad? What things are most effective at making you feel better? How long do the effects last?
- Feeling sad is normal and an important emotion to experience. However, it is a different feeling from depression. Describe the differences.

DOES LIFE SATISFACTION CHANGE WITH AGE?

There has been some data collected in Britain that has suggested that life satisfaction levels vary according to age. When people were asked how satisfied they were with their lives, it was found that people are unhappiest in their forties and happiest of all when they are older.

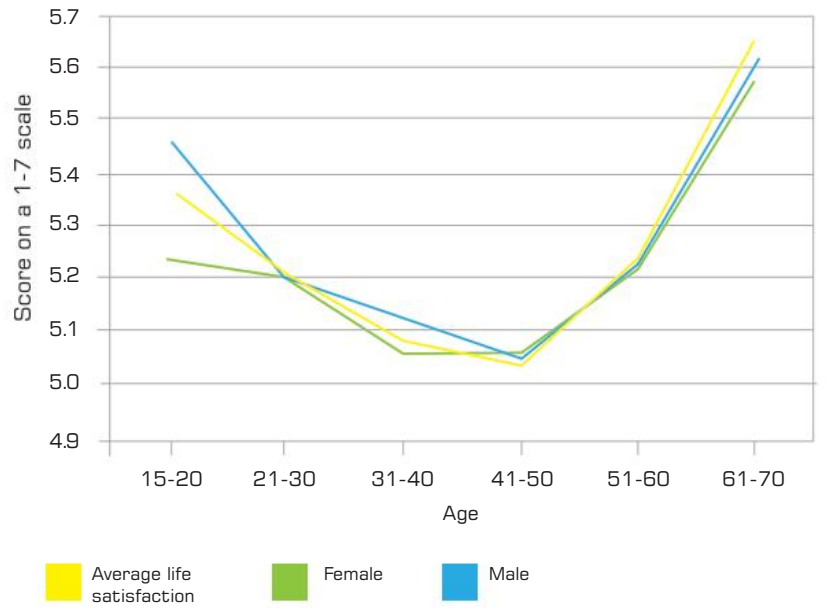


FIG 17.6» Average life satisfaction among British householders

17.8 INVESTIGATE

Average life satisfaction

Refer to the data in the graph 'Average life satisfaction' and answer the following questions:

1. What was the scale of scores that were used to record satisfaction levels?
2. What was the average life satisfaction rating of people aged 15–20 years?
3. Who rated their lives as more satisfying at ages 15–20, males or females?
4. What was the average life satisfaction rating of people aged 41–50 years?
5. What was the average life satisfaction rating of people aged 61–70 years?
6. There can be many life experiences typically associated with different age groups. What possible reasons can you suggest for the average scores for the following age groups?
   - **a** 15–20 years
   - **b** 41–50 years
   - **c** 61–70 years.

REVIEW 17.4

1. Why is it thought to be important for us to experience both positive and negative emotions?
2. Explain why it is important to deal with negative emotions.
3. Can happiness make you live longer? Support your answer with evidence from this chapter.
4. What is depression and in what ways can it affect an individual?
5. What is the difference between sadness and depression?

OPTIMISM AND PESSIMISM

Are you like Tigger—energetic, hopeful, fun and optimistic? Or are you like Eeyore—moping around, complaining, sulking and pessimistic?

Some people are, by nature, **optimists** like the bouncy Pooh character Tigger; they see the world from a positive viewpoint. Others are more like Eeyore, viewing everything from a more pessimistic or negative perspective. To a **pessimist**, bad things always happen, they will last forever, and affect everything that happens. An optimist will tend to think that things will work out and that there is beauty and opportunity in everything. In reality, most people are a combination of both, with a tendency toward one or the other.

According to Professor Martin Seligman, there are also times when it is good to be one rather than the other. When the risk is small, it is good to use optimism. If you are about to fly from Sydney to Fiji, the chances you will get there safely are very high. The planes are reliable and the pilots well-trained at their jobs. It therefore doesn't hurt to be optimistic and look forward to the positive things about the flight, such as the views of the Pacific Ocean, being able to watch a movie or two or read a good book. However, when the risk is great, it is better to be a pessimist. If a pilot is deciding whether or not to stay out all night prior to a long-haul flight, it is better for him to think 'I will put my passengers at risk tomorrow if I don't get enough sleep.' You certainly don't want a pilot being optimistic that he will be just as sharp when functioning on no sleep when he is responsible for 400 passengers!

Does our happiness level depend upon our view of the world as an optimist or a pessimist? It does appear that people who are more optimistic and see the world from a more positive viewpoint are indeed happier.

17.9 INVESTIGATE

Optimistic or pessimistic?

Imagine yourself in each of the following situations. What would be your most likely response for each question?

1 You have just spent some money on a new iPod. Do you think:
   - **a** How exciting to have a new iPod!
   - **b** I shouldn't have spent that money!

2 You are at the 750-metre mark in a 1-kilometre swimming race. Do you think:
   - **a** I am nearly at the end—I've almost made it!
   - **b** I'm never going to make it!

3 You have been invited to a party where you don't know anybody. Do you think:
   - **a** It will be great to meet some new people.
   - **b** No one will talk to me so why bother going?

4 You have been given a maths task that you are finding really difficult. Do you think:
   - **a** I will find someone to explain it to me so I can still get a good grade.
   - **b** I won't bother doing it because I won't do well anyway.

5 You have been voted into a position of responsibility at school. Do you think:
   - **a** I knew I could get the vote!
   - **b** I didn't think anyone would vote for me.

Analysing your responses

Count the number of A and B responses you gave.

'A' responses tend to be more optimistic responses, while 'B' responses tend to be those a pessimist might give. Based on the number of responses for each, are you more likely to be an optimist or a pessimist?

- Do you think this accurately describes you? Explain why or why not.
- How reliable do you think this test is in determining your level of optimism? Explain why.
- A common phrase is to refer to a glass 'half-full or 'half-empty. What does this mean? Are you more of a 'glass half-full' or a 'glass half-empty' sort of person? Explain your answer.
- Do you think there would be a difference in the happiness ratings of an optimist versus a pessimist? Give reasons for your answer.

PROMOTING HAPPINESS

Promoting happiness has become a pursuit for many people. Meditation groups and laughter clubs are used by devotees for the improvement of well-being and happiness. It is possible to increase our 'set point' of happiness due to the plastic nature of our brain, so activities that promote happiness can change the way our brain works on a lasting basis.

Laughter makes us feel better about ourselves. It reduces stress and negative feelings, increases the endorphins in our system and produces a general sense of well-being. Laughter really can be 'the best medicine'—clown doctors make sick children feel better, students are more likely to learn effectively when their teachers use humour, and employees are more likely to rate their job satisfaction as high when there is humour in their workplace. It is not uncommon for people to report feeling happy when they have been out socialising with friends that make them laugh.

EIGHT STEPS TO HAPPINESS

According to researchers there are many ways to increase our happiness 'set point' but it takes a conscious effort to do something about it. Professor Sonja Lyubomirsky, a psychologist from the University of California, has developed 'Eight steps to happiness' as a series of practical strategies to creating a more satisfying life (Wallis 2005):

1. **Count your blessings.** Create a 'gratitude journal' in which you write down 3–5 things each week for which you are grateful.
2. **Practise acts of kindness.** Be kind to others in both planned and spontaneous ways.
3. **Savour life's joys.** Pay attention to life's pleasurable moments such as a beautiful sunset, freshly baked bread or the taste of a fresh strawberry.
4. **Thank a mentor.** Express your appreciation, either in writing or in person, to someone who has guided you or taught you something important.
5. **Learn to forgive.** Let go of anger by forgiving someone who has hurt you.
6. **Invest time and energy in friends and family.** Spend time with people you love and enjoy.
7. **Take care of your body.** Get plenty of sleep, exercise, stretching and laughter. Practise them all regularly. They will all help in the short term!
8. **Develop strategies for coping with stress and hardships.** It is impossible to avoid hard times. Learn to deal with the stress that life brings. Meditation, exercise and positive thinking are just a few strategies that can help.

FIG 17.7» Laughter is a healthy way to relieve stress and reduced negative feelings. Laughter Yoga clubs were started by Indian physician Dr Madan Kataria in 1995 with just five people. Today, the laughter movement is widely accepted and has become a global phenomenon with over 6000 clubs in 60 countries.

THE MINDFULNESS APPROACH

How often is your mind far away from the present? Do you often find yourself thinking about something that has happened in the past, or planning what you might do in the future? Perhaps you spend a lot of time regretting something you did or said or wishing for something to happen. There is a school of thought that this type of thinking may not be the best for your overall happiness or well-being.

Well-being is an experience closely connected to happiness, and can be defined as a state of contentment. It can be achieved by being in a state of **mindfulness**, which is a focus on living in the moment rather than in the past or in the future. Some ways of practising a state of mindfulness are to:

- be playful and enjoy being 'in the moment'
- direct your attention to the present; do not let your mind wander to the past
- focus on your senses—that is, focus on what you are experiencing right now
- not try to judge your present experience as being good or bad but enjoy it for what it is
- be aware of your present experience without reacting to it by thinking or becoming emotional about it.

REVIEW 17.5

1. Describe the different ways an optimist and a pessimist may view the world.
2. In what ways can laughter improve our sense of happiness?
3. In your own words, list the eight steps to a more satisfying life according to Professor Sonja Lyubomirsky.
4. What is meant by the term 'well-being'?
5. What are some ways of practising the mindfulness approach?

17.10 INVESTIGATE

Practise approaches to happiness

1. Use the 'Eight steps to happiness' to create your own guide to happiness. For each point, determine how and when you will act upon them.
2. Practise being 'in the moment' using the suggestions provided above for a mindfulness approach. What is the experience like for you? How did it make you feel? Is it an easy practice?

FIG 17.8» Laughter, having fun and spending time with friends can promote happiness.

17.11 INVESTIGATE

Testing impact on happiness

There are many factors thought to have an impact on happiness. In this activity, you will design a method aimed at scientifically testing the impact of a specific factor on the level of happiness.

Select a variable that you think is likely to have an impact upon happiness. This is the factor you will be testing in a controlled experiment. For example: meditation, humour or using a gratitude journal.

Selecting the subjects

Decide who your subjects will be, and how you will select them. How many subjects will you need to ensure your results are meaningful? You will need to seek your subjects' permission to be involved—subjects must voluntarily participate and be aware of the type of activity they will be involved in, without knowing that you are testing the effect on happiness. The subjects' knowledge about what you are testing for would be likely to bias your results.

Testing the variable

Determine how you will measure your dependent variable. This will form your *method*. It is important that you consider the most effective way of testing your variable. You need to measure your subject's happiness both before and after the variable is introduced. The measurement taken before the variable is introduced will form the *control data*. It will create a baseline measure of 'happiness' for comparison with the measurement taken after the experimental variable is introduced.

For example, to test the effect of humour on happiness levels, you may choose to show your subjects a comedy movie or funny television show. This will be the experimental phase of your experiment. You might give each subject a survey to complete before and after exposure to comedy.

Measuring happiness

Determine how you will measure happiness before and after the condition. This measure must be the same for all of your subjects. This will be used as your *results*.

For example, give your subjects a survey before and after being exposed to the introduced variable. This could be in the form of the daily mood journal (see page 232) or an adapted version of this activity. Keep in mind that you want to determine the subject's level of happiness. The same survey should be given before and after to ensure that the results for both parts can be compared.

Recording your results

Create a data table that will be suitable for entering your results. What information is useful? How will you record it? How will you distinguish results from the before and after surveys?

Carefully record your:

- aim (what are you intending to find out?)
- subjects (Who? How many? How did you select them? What are their characteristics?)
- method and materials (What are the steps you will take to carry out your activity?)
- results (What data will you be collecting? How will you record your results?)

Carry out your testing and collate your data.

Analysing your results

- What did your results show? Describe your findings with reference to the data collected before and after introducing the experimental condition.
- Was your chosen factor shown to have an impact on happiness levels? Explain.
- Why did you take a measure of happiness both before and after your experimental condition?
- What factors may have negatively impacted upon your results to make them less meaningful? These are called *extraneous variables*.
- Was your method a good way to test the factor you chose to test? Explain why or why not.
- Were your results an effective way to measure levels of happiness? Explain why or why not.
- What improvements would you make to your experimental design if you were to redo your experiment? Explain why you would make these changes.
- What conclusions would you make, based upon your results, on the effect of your variable on happiness levels?

CHAPTER SUMMARY

- Many people spend a great deal of energy striving for what makes them happy.
- Positive psychology is the study of ways to improve well-being, and ways to enable humans to function in the best way they can.
- Happiness researchers have found that age, education, IQ and wealth are not required for us to be happy!
- Scientific studies in positive psychology suggest that happiness is related to making and maintaining connections with other people. Meaningful relationships with family and friends, spirituality and showing kindness to others are all seen to be beneficial in making us feel good about ourselves (Seligman & Diener 2002).
- Scientific studies suggest that happiness is 50 per cent determined by our genetic make-up and 50 per cent by our experiences (Lykken 1996).
- Key factors influencing how positive we feel about ourselves include our inherited qualities, our outlook on life and our values (Williamson 2000).
- We are not necessarily happy when we achieve what we want. This encourages us to keep motivated to aspire to new goals and experiences.
- People have a 'set point' for happiness, which is a characteristic level of happiness they keep returning to after both positive and negative experiences.
- To live a meaningful life, we need to feel both positive and negative emotions. It is not bad to feel sad, but we do need to deal with negative feelings to ensure we maintain good health.
- Feeling positive about ourselves is an important aspect in maintaining well-being and reducing negative feelings such as fear and depression.
- It is possible to increase our 'set point' of happiness due to the 'plastic' nature of our brain—we can change the way our brain works on a lasting basis.
- We can promote our feelings of happiness and well-being through achieving a satisfying life and by being mindful of the present.
- Being grateful, being kind to others, savouring life's joys, thanking others, forgiving, spending time with people you enjoy, taking care of your body and coping with stress are all steps to increasing happiness.

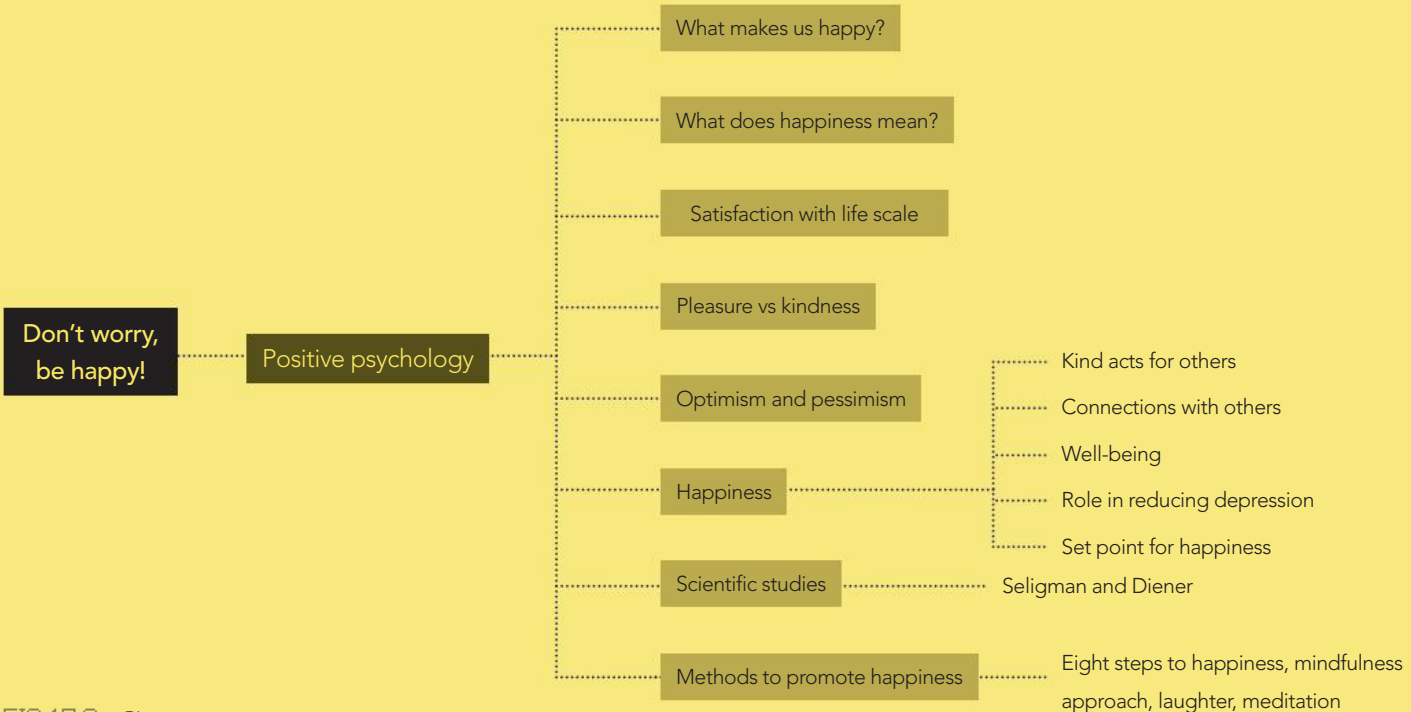


FIG 17.9» Chapter concept map

TEST YOUR UNDERSTANDING

Questions

1 Bhutan is a remote Himalayan country that has its people's happiness as a priority. Government policies are based around the country's GNH which stands for:
   - **a** General National Health
   - **b** Government Never-ending Happiness
   - **c** Gross National Happiness
   - **d** General National Happiness.

2 The aim of positive psychology is to:
   - **a** encourage all people to be positive about life
   - **b** understand how to enable humans to function at their optimum level
   - **c** learn about how people behave and interact with others
   - **d** understand the role of spirituality in the human experience.

3 The following facts about Edward Diener's Satisfaction with Life Scale are true:
   - **a** It is a 1–7 scale people use to rate their satisfaction with life so far.
   - **b** It is a means of measuring mood on a 1–7 scale.
   - **c** It is a survey that measures whether you are happy or sad.
   - **d** It measures people's happiness by rating on a scale of 1–5.

4 Happiness researchers have found that levels of happiness are not necessarily dependent upon:
   - **a** wealth
   - **b** IQ
   - **c** education
   - **d** all of the above.

5 A key factor that has been found to contribute to happiness is:
   - **a** pursuit of wealth
   - **b** worshipping an idol of some sort
   - **c** being kind and generous towards others
   - **d** spending time alone.

6 According to Professor Martin Seligman, there is a place for both optimists and pessimists. He also believes that:
   - **a** when the risk is high, it is good to be a pessimist
   - **b** when the risk is low, it is good to be a pessimist
   - **c** when the risk is high, it is good to be an optimist
   - **d** it is important to be optimistic and pessimistic in all situations.

7 Skills thought to help build resilience against depression are:
   - **a** keeping to yourself until you feel better
   - **b** dealing effectively with sadness and negative thoughts
   - **c** taking medication
   - **d** doing nothing—the symptoms will soon pass.

8 Studies on the effect of laughter on well-being and happiness show that it:
   - **a** increases feelings of negativity
   - **b** reduces endorphins ('feel-good' chemicals) in our body
   - **c** makes learning less effective
   - **d** reduces stress.

9 According to Diener and Seligman (2002), what factors are thought to contribute to happiness?

10 To what extent is the way we feel about life determined by our genetic make-up as compared to our life experiences? Explain your answer.

11 True or false: We will become happy if we get what we want. Justify your answer.

12 Is constant happiness a realistic expectation? Explain why or why not.

13 What is meant by the 'set point' of happiness?

14 Explain how our knowledge of brain plasticity can be used to understand why we can improve our set point of happiness.

15 Explain why it is good to experience a range of positive and negative emotions, and not just positive all the time.

Extend yourself

16 Find out about the facial feedback hypothesis. What is it? Design an experiment to test it out.

17 The movie *Patch Adams* starred Robin Williams, and was based upon the true story of a doctor who believed in laughter as the best medicine for his hospital patients. He would do anything to make patients laugh, and noticed that making patients smile made them heal faster.

- **a** Watch this movie and reflect upon the character of Patch Adams. How did he make a difference to his patients?
- **b** Do you think Robin Williams was a good choice of actor for this role? Give reasons for your answer.
- **c** Find out about the real Patch Adams. What work is he involved in now?
- **d** Patch Adams fostered the Clown Doctor movement which is now active in 40 countries including Australia. Find out about the Clown Doctors. What do they do? Where do they work?

18 What is altruism? Find out about altruistic acts that people have performed. Why do people do them?

19 Some schools are starting to teach about positive psychology. Do you think this is a good idea? What can be some advantages of students understanding about this area? What sort of things do you think would be useful to include in a course about positive psychology for secondary students? What are the benefits to students?

20 Teenage depression is a common mental health disorder. Find out more about this condition and produce a brochure or a PowerPoint presentation that can be used in the promotion of an awareness campaign among teenagers. Include answers to questions such as: What is it? What causes it? What are the symptoms? What treatments are available? What factors can help build resilience to it?

21 The movie *The Pursuit of Happyness* starring Will Smith was an inspiring true story about one man's pursuit for happiness in his life and career. Chris Gardner has big dreams, and his focus on this dream enables him to accomplish what he sets out to do. Find out more about the real Chris Gardner. What hurdles did he have to overcome and what has he achieved? Do you think he is a happy man? Explain why or why not.

GLOSSARY

activation-synthesis theory Hobson–McCarley's theory stating that random activation of neurons in the brain during REM sleep leads to dreaming as the brain tries to make sense of the signals.

adapters hand movements used when communicating a message. Certain adapters may be associated with lying.

affective component of an attitude the feelings or emotional experience behind an attitude.

alpha waves brainwaves during a relaxed waking state.

amygdala a tiny structure deep within the brain that is part of the limbic system and associated with strong emotions such as fear and aggressive behaviour.

Acquired Brain Injury (ABI) injury or damage to the brain caused by accident, trauma, stroke or drug abuse.

Alzheimer's disease a type of dementia caused by degeneration of neurons in the brain, causing a gradual loss of memory and other mental abilities.

anterior cingulate cortex (ACC) a small structure within the brain that is often active when dealing with conflicting information.

anti-oxidants chemicals found in food that help to protect the brain.

association neurons specialised nerve cells found in the central nervous system that connect sensory and motor neurons (also called interneurons).

attention focusing on specific aspects of our environment, while ignoring others.

attitude an evaluation of an item, behaviour or issue that can relate to our beliefs, feelings and behaviours.

audience effect the effect that other people watching has on a person's performance.

auditory stimuli sounds.

autobiographical memory memory of events we have experienced. Also called episodic memory.

autonomic nervous system the part of the nervous system, consisting of the sympathetic and parasympathetic nervous system, that is responsible for involuntary physiological responses.

axon a part of the neuron that transmits messages from the cell body to the axon terminals.

axon terminals the ends of the axon where messages are converted from electrical into chemical messages to communicate with the next neuron.

balance the ability to stand upright.

behavioural component the way a person acts or is predisposed to act because of their attitude.

body language clusters a number of body language cues that must be taken into consideration before interpreting the body language.

brain a complex structure composed of specialised nerve cells enabling us to process information, make decisions and direct actions, giving us our experience of the world.

brain-boosting foods and activities foods and activities that can improve the brain's functioning.

brain stem part of the brain that regulates survival functions such as breathing.

Cannon-Bard theory of emotion a theory of emotion in which physiological arousal and subjective experience occur at the same time.

catastrophic reaction when a person has a severe emotional response to a situation in which damage to the motor area of the left hemisphere has caused paralysis to the right hand side of the body.

cease planning and making decisions stop thinking critically about a situation.

central nervous system (CNS) the brain and spinal cord.

cerebellum a primitive part of the brain responsible for coordination, balance and movement.

cerebral cortex the most visible part of the brain responsible for our conscious thoughts.

cerebrum the largest part of the brain, made up of two hemispheres.

change blindness when we are unaware of a change in our environment due to a lack of attention on the stimulus.

choking failure to perform near optimal levels when under intense pressure.

cognitive component the belief behind an attitude.

cognitive dissonance the tendency to change our attitude or find an excuse for our behaviour to overcome an uneasy feeling when our attitude and behaviour do not match up.

collectivist societies societies where cohesiveness is more important than individual achievements or personal recognition.

complementary factor the tendency for two people to seek different factors from each other in order to fulfil, balance or enhance each other's needs, behaviours or resources.

confidentiality the participant's right to privacy; not being identified or named in the research.

context dependent cues when the recall of memories is dependent on recreating the context or situation.

control question test the traditional lie-detector test in which a number of control questions are asked in order to establish a baseline physiological response before the relevant question (related to the actual crime) is asked. If the physiological responses to relevant questions are higher compared to responses to control questions, it is assumed that the person is lying.

corpus callosum the thick band of nerve fibres connecting the left and right brain hemispheres.

cultural perceptions differences in the way people perceive stimuli, due to their cultural backgrounds.

daydream when a person is awake and paying attention to their own thoughts but ignoring the external world.

debriefing the participant's right to know the results of the study, where they can seek psychological assistance if needed after the study and withdraw their results after the study if desired.

deep brain stimulation a form of treatment for brain disorders that involves sending an electric current deep into brain tissue.

delta waves brainwaves during the deeper stages of sleep.

dementia the loss of memory and other mental abilities due to the degeneration of neurons.

dendrites fine branches surrounding the neuron's cell body that detect messages from nearby neurons and send them down the axon.

depression a common mental health disorder characterised by feelings of hopelessness and sadness.

door-in-the-face technique a sales technique where a person who knocks back a large request is then more likely to commit to a smaller request.

dream symbols symbols in dreams that represent wishes, desires and fantasies.

emotion feelings experienced towards something or someone.

environmental factors factors from the environment that may influence our recall of memories.

ethical considerations measures taken to protect the physical and psychological well-being of the participant in a study.

exercise physical activity that increases blood circulation and has a positive effect on the brain.

exposure a factor of interpersonal attraction that relates to the encounters we have with someone.

expressive behaviour one of three components of an emotion that relates to what others can see about what we are feeling; our overt behaviour.

extrinsic motivation the motivational pull from the outside world, with signs of external reward, that drives our behaviour.

eyewitness testimony evidence given by an eyewitness that is based upon their memory of the event or crime.

facial feedback hypothesis the tendency for changes in facial expressions to produce emotional experiences that match these changes.

familiarity a factor of interpersonal attraction that relates to the degree we are aware of or have seen someone.

foot-in-the-door technique a sales technique where a person who commits to a small request is then more likely to commit to a larger request.

forensic psychology the area of psychology that deals with criminal behaviour.

forewarning a factor that resists persuasion in which the person who is warned about the attempt to change their attitude or behaviour is less likely to do so.

frontal lobe largest lobe of the brain located at the front and responsible for thinking, personality and emotions.

gain–loss theory the tendency to like someone more if they originally did not like us but now they do.

galvanic skin response a measure of the electrical conductivity on the skin, linked to sweating.

glucose simple sugars that provide essential energy for the neurons of the brain.

group processes four stages that a group tends to experience to become a team and complete a project: forming, storming, norming and performing.

guilty knowledge test a lie-detector test in which a person is given a question with a list of possible answers. If a higher physiological response is found when the person sees the correct answer, they are assumed to be guilty.

happiness feeling of contentment and satisfaction.

high-GI foods foods that provide a rapid burst of energy for neurons.

high dream recaller a person who has the tendency to remember many of their dreams.

hippocampus a part of the brain responsible for making new memories.

hormones special chemical messengers within the body having an effect on behaviour and body functions.

hypnosis a special condition of increased suggestibility that a person may experience after being given instructions or procedures that suggest they will enter this condition.

hypnosis susceptibility being open to suggestions or instructions when under hypnosis and a tendency to follow them during (and sometimes after) hypnosis.

hypnotherapist a qualified person who uses hypnosis to help clients with psychological and physiological problems.

hypothalamus: a part of the brain responsible for regulating body temperature, appetite, thirst and hormones.

illusion when a misleading stimulus is presented to our senses causing us to perceive something that does not exist.

impostor phenomenon the feeling experienced by some high achievers that their greatness is due to luck, not skill. It may drive them to be workaholics despite their success.

inattentional blindness when we are unaware of particular stimuli in our environment due to lack of attention on the stimulus.

incentive theory a theory of motivation that considers the external forces that pull us and internal forces that push us to perform a certain behaviour.

indifference reaction when a person is unmoved or indifferent to a situation in which damage to the motor area of the right hemisphere has caused paralysis to the left hand side of the body.

individualistic societies societies (such as Australia) where individual achievement is important.

informed consent condition where the researcher must give details of the study, including the ethical considerations, in order for the volunteer to agree to participate in the study.

inoculation a factor in resisting persuasion, where a person who is first exposed to a weak argument on the unfavoured side is more likely to develop stronger arguments on the favoured side and later resist stronger arguments on the unfavoured side.

interneurons specialised nerve cells found in the central nervous system that connect sensory and motor neurons (also called association neurons).

interpersonal attraction the degree to which we like others.

intimate zone a personal space zone where only people that we feel very close to or small children are allowed.

intrinsic motivation the motivational push from within us, with no sign of external reward, that drives our behaviour.

James–Lange theory of emotion a theory of emotion in which awareness of physiological arousal causes the emotional feeling.

latent content the hidden meaning of a dream.

learning the ability to gain new skills and knowledge through experiences.

learning curve the pattern that occurs between practice and performance, typically graphed as the number of trials versus a measure of performance.

left hemisphere the left side of the brain, responsible for verbal and logical skills.

limbic system a number of structures in the brain that interact and are involved in emotional experiences and behaviours.

low-ball technique a sales technique in which once you commit to a request, the conditions change and you then have to commit further to fulfil the function of the request.

low-GI foods foods that provide a steady supply of energy for neurons to function.

low dream recaller a person who has the tendency to remember very few dreams, if any.

lucid dreaming when a person is aware they are dreaming and are able to control their dreams.

magic the art of making supposedly impossible things happen, by manipulating our perception.

manifest content the storyline of a dream.

matching hypothesis the tendency to be more attracted to people who are of similar physical attractiveness to us.

meditation a process of relaxing the mind that can have a positive effect on the brain's functioning.

melatonin a sleep hormone regulating our sleep wake cycles.

memory the ability to store and recall information.

memory encoding the process of converting experiences into a form that the neurons of the brain can understand.

memory retrieval the recall of memories that have been stored.

memory storage retaining memories for use at a later stage.

mental practice the use of mental imagery to allow a person to visually rehearse a performance in their mind.

microexpressions small, fleeting facial expressions that occur involuntarily when a person is trying to conceal their true emotions.

mindfulness a focus on living in the present.

misleading questions a line of questioning by police that may mislead the witness and therefore alter their memory of the event.

mnemonic technique a memory trick or aid.

motivation the internal processes that activate, guide and maintain observable behaviours.

motor neurons the specialised nerve cells that send messages from the brain to different parts of our body.

myelin sheath the white fatty coating surrounding a neuron's axon.

Name Letter Effect the tendency to gravitate or be attracted towards people with the same initials as ourselves.

narrow attention thinking closely on one object, voice or thought while being less aware of other external and internal happenings.

need for achievement (nAch) the desire to compete with a standard of excellence.

negative emotions feelings we have that make us feel negative about life.

neuromarketing brain scans and brain recordings that are used in advertising research.

neurons the cells making up our brain and nervous system.

neuroplasticity the brain's ability to change and reorganise itself.

neuropsychology the study of psychology concerned with understanding the structure and function of the brain.

neuroscience the scientific study of the brain and the nervous systems.

neurosurgery surgery on the brain.

neurotransmitter a special chemical that enables neurons to communicate with each other.

no lasting harm the overall goal of ethical considerations—to protect the participant from psychological and physical harm—that must be considered at all times.

non-rapid eye movement (NREM) sleep a period of sleep when eyes move very slowly, if at all.

non-state theory a theory that explains hypnosis in terms of a person being influenced by the social setting rather than there being a separate state of consciousness for hypnosis.

non-verbal cues all cues, except for verbal cues, that relate to communicating and understanding a message.

nucleus accumbens a tiny brain structure that is linked to self-reward, pleasure and lust.

occipital lobes the area of the brain, located at the back, that enables the processing of visual information.

omega-3 fats the essential fats required for building healthy neurons.

open to suggestion being more likely to follow instructions; occurs under hypnosis.

optimal level of arousal the level of alertness and readiness to respond that is needed to achieve peak performance in a given situation.

optimistic the tendency to look at the world from a positive point of view.

P300 brainwave pattern a characteristic brainwave pattern that exists when a person recognises something familiar. May be used as a lie detector in conjunction with the Guilty Knowledge Test.

paralinguistic cues the cues related to how words are spoken, such as tone of voice, length of pauses, stuttering and sighing (and excluding the actual content or literal meaning of what is said or written).

parasympathetic nervous system the part of the autonomic nervous system that is responsible for reversing or calming physiological arousal. It is involved in conserving and maintaining the body's energy resources.

parietal lobes areas of the brain enabling the processing of sensations from our skin such as touch, temperature and pressure.

perception the understanding of our environment based upon information registered by the senses.

peripheral nervous system (PNS) the neurons outside the central nervous system (CNS) that deliver messages between the CNS and sensory receptors and organs.

personal space the amount of area or space that we need between us and another person in order to feel comfortable.

personal zone a personal space zone where only good friends or people that we like are allowed.

persuasion the deliberate effort to change a person's attitude or behaviour.

pessimistic the tendency to look at the world from a negative point of view.

photo identification the identification of a suspect involved in a crime based on photos presented to the eyewitness.

physical attractiveness a factor of attraction that relates to the degree to which a person is considered to be good-looking based on physical characteristics.

physiological arousal one of three components of an emotion that relates to the physiological changes in our bodily systems that are controlled by the autonomic nervous system.

pineal gland a small gland in our brain that controls our sleep wake cycles and internal body clock.

placebo effect the tendency for a treatment to be effective because the person believes that the treatment will work.

Plutchik's primary emotions a theory that identifies eight emotions that are universal across all cultures: fear, anger, joy, disgust, anticipation, surprise, sadness and acceptance.

police line-up a line-up of possible suspects involved in a crime from which an eyewitness can attempt to make an identification.

polygraph the recordings of a number of physiological measures such as blood pressure, heart rate and galvanic skin response. It has been used as a lie detector.

positive emotions feelings we have that make us feel good about life.

positive psychology the study of the ways in which humans attain a level of happiness and function most effectively.

primary motor cortex the area of the brain controlling voluntary body movement.

problem-solving theory the theory that the purpose of dreaming is to help us solve problems and cope with emotional issues.

proteins the essential food chemicals required for the healthy functioning of neurons.

proximity a factor of attraction that relates to the degree to which we are physically or functionally close to someone.

pseudoscience a fake science that has well-established beliefs that have not changed over the centuries.

psychiatrist a medical doctor who specialises in the management of people with mental illness.

psychoanalysis theory Sigmund Freud's theory that the storyline of a dream contains hidden meanings.

psychological attractiveness a factor of attraction that relates to the degree to which a person is considered to have favourable personality characteristics.

psychological factors factors such as prejudices, beliefs and expectations that may influence our recall of memories.

psychology the scientific study of thoughts, feelings and behaviours.

public zone a personal space zone where people we barely know or who are strangers are allowed.

rapid eye movement (REM) sleep a period of sleep when eyes move rapidly for short bursts of time.

reactance a factor of resisting persuasion in which there is a desire to do the exact opposite of what is being asked.

reciprocity a factor of attraction that relates to the tendency to like someone if they like you.

reconstructive memory the reconstruction of an event based on memory.

regression returning to behaviours, thoughts and feelings that were typical when you were younger.

retrieval cues stimuli that assist our recall of memories.

reward centres of the brain areas of the brain responsible for creating feelings of pleasure.

right hemisphere the right side of the brain, responsible for creativity, solving puzzles, fantasy and map reading.

right to withdraw the participant's right to remove themselves or their data from the study at any time, including after the event.

role playing a type of social influence where a person may follow instructions because they know how they are expected to behave and that the audience is expecting them to behave this way. They are playing the social role.

satisfaction with life scale a test enabling an individual to determine their overall level of satisfaction with life; created by Diener (1980).

saturated fats 'bad' fats for our brain when consumed in large amounts.

scientific method a set of procedures for collecting and interpreting data.

sensation what we feel when our body's sense organs register information from the environment.

sensation seekers thrill-seeking personalities who tend to look for new and exhilarating experiences.

senses specialised organs (eyes, ears, nose, tongue and skin) that detect information from our environment and send it to the brain to give us an understanding of our world.

sensory neurons specialised nerve cells that send messages from the sensory receptors throughout our body to the brain.

set point for happiness our 'typical' level of happiness that we tend to keep returning to.

similarity a factor of attraction that relates to how close our likes, dislikes, backgrounds and social status are to another person.

sleep unique state of awareness that enables our body to restore energy and process the events of the day.

sleep debt the amount of accumulated missed sleep time.

sleep deprivation lack of sleep.

sleep wake cycles repeating periods of sleep and wakefulness occurring within a 24-hour period.

social influence situations when one person directly influences the thoughts, feelings and behaviours of another person.

social loafers those individuals within a group that tend to perform little work.

social suckers those individuals within a group that tend to take over and perform most of the work.

social zone a personal space zone where those we work with or acquaintances are allowed.

soma the cell body of a neuron that regulates the cell's activities.

sound perception giving meaning to sound stimuli.

spin doctors public relations professionals that actively promote a client. They put forward positive messages designed to capture people's attention and put the client or the message in a favourable and flattering light.

Stanford Suggestibility Scale the most common scale that is used to measure how deeply a person is hypnotised.

state theory the theory to explain hypnosis stating that a hypnotic state of consciousness does exist and is separate from the normal waking state of consciousness.

subjective experience one of the three components of an emotion that relates to how we feel.

subliminal advertising advertising messages that are 'flashed' or displayed quickly as an attempt to influence behaviour without the conscious awareness of the viewer.

sympathetic nervous system the part of the autonomic nervous system that is responsible for physiological arousal.

synaesthesia a harmless condition where an individual has mixed senses, enabling them to 'see' sounds or 'taste' shapes.

synapse the tiny gap between neurons.

team cohesion the degree to which members of a team are working effectively as a team.

technology devices and applications used for easier communication and entertainment.

temporal lobes areas of the brain responsible for processing auditory information.

thalamus an area of the brain that receives sensory information and relays it to specific parts of the brain for processing.

that's-not-all technique a sales technique in which adding extra items is more likely to lead to an impulse buy.

'third person' effect the belief that advertisements and other forms of persuasive techniques do not work on you, they only work on others despite evidence showing that we can all be influenced.

two-factor theory of emotion Schachter's theory of emotion that states an emotion cannot be felt until there is physiological arousal and cognitive appraisal as to why the arousal occurs.

universal facial expressions six facial expressions that are made and recognised around the world: happiness, sadness, anger, fear, disgust and surprise.

use it or lose it a phrase used to describe the necessity to practise mental skills or risk losing the ability over time.

verbal cues the actual content or literal meaning of what is said or written.

visual agnosia a condition where the brain does not interpret visual information accurately.

volunteers people who are willing to take part in a study. They cannot be coerced with bribes or pressure.

water an essential chemical for life, including brain functioning.

well-being a person's overall level of happiness and their ability to function effectively.

wish fulfilment dreaming of unacceptable wishes, desires and fantasies in order to reduce anxiety levels.

Yerkes-Dodson Law the relationship between levels of arousal and performance that tends to take a U shape when plotted on a graph.

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