Oxford Resources for OxfordAQA

International GCSE

Psychology

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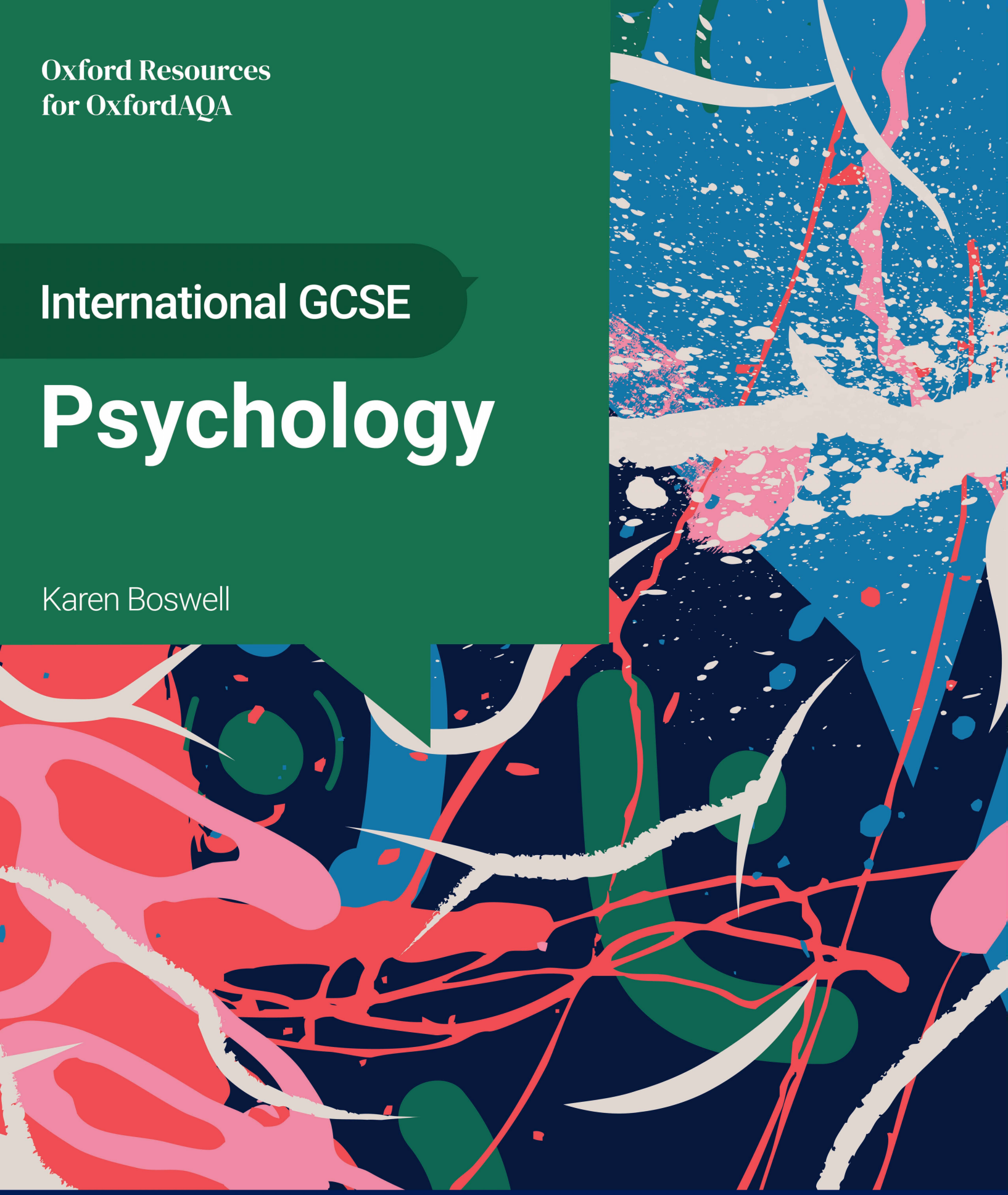

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Contents

Chapter 1: Memory

1.1 What are the processes of memory?

Objectives

You will be able to:

- understand the processes of memory: encoding, storage, and retrieval
- understand how memories are encoded and stored
- understand the different types of memory: episodic, semantic, and procedural memory.

Getting started

How good is your memory? Take a minute to complete this quiz. On a separate piece of paper, write down each answer that is correct for you. Be honest!

How often do you forget each of these? Choose from Never, Sometimes, Often, and Always.

a) Birthdays

b) People's names

c) Returning things you borrowed

d) Where you put something

e) What you went into a room for

f) Telephone numbers

g) Information for tests

h) Doing homework

Use this scoring system: Never = 0, Sometimes = 1, Often = 2, Always = 3. What is your total score? It should be between 0 and 24. The higher your score, the worse you think your memory is.

Key terms

Encoding: taking information into memory and changing it into a form that can be stored

Storage: holding information in the memory system

Retrieval: recovering information from storage

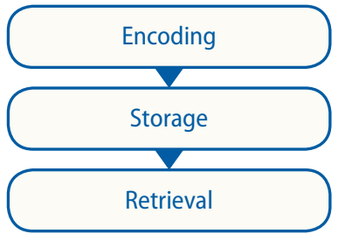
▲ Figure 1.1: Memory is like a computer.

The processes of memory

Encoding, storage, and retrieval

Our memory is a bit like a computer. There are three basic processes involved with using computers: we put information into the computer (**encoding**), we keep it there until we need it (**storage**), and we get it back when we want it (**retrieval**). Our memory works in a similar way:

- We encode information into our memory.
- We store it there until we need it.
- We then retrieve it when we want it.



▲ Figure 1.2: The flow of information in memory

Building skills 1 — A

Here is a list of the planets, starting nearest the Sun and working outwards through the Solar System:

Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune

a) Copy out the list. Then find someone who does not know the correct order and give them 30 seconds to learn the list.

Wait for another 60 seconds and ask them to recall the list. How did they do?

b) Now find someone else who doesn't know the correct order. Copy out the list again but this time copy the phrase below it as well. Show them the information for 30 seconds.

Mercury Venus Earth Mars Jupiter Saturn Uranus Neptune

My Very Easy Method Just Speeds Up Naming

Wait 60 seconds and ask them to recall the list of planets in the correct order. How did they do?

c) This activity is about encoding, storage, and retrieval. Can you identify the encoding method? How long was the information stored for? Who had the best retrieval? Why?

d) Choose some information you have to learn. Devise a mnemonic to help encode the information.

How are memories encoded and stored?

Information enters our memory through one or more of our senses. This information has to be changed into a language or code that the brain will understand. Some information is encoded automatically without us being aware of it. Most people probably can **recall** what they had for breakfast yesterday, even though they haven't tried to remember it. Other information will only become encoded if you pay attention to it. You are unlikely to be able to remember everything you learn in your Psychology lessons unless you make an effort to encode the information.

There are different ways of encoding written information. You can focus on it:

- visually: what the words look like
- acoustically: what the words sound like
- semantically: what the words mean.

How would you encode an address you have looked up? If you picture it you will be encoding it visually. If you repeat it to yourself you will be encoding it acoustically.

Task b) in Building skills 1 uses a mnemonic (a memory aid) to encode the information on the planets. You should have found your second **participant** recalled more of the planets in the correct order than your first participant. This is because the sentence was easier to encode as it has meaning to it. Encoding information semantically (by its meaning) leads to better storage and retrieval.

Key terms

Recall: to bring a memory back into one's mind (similar to 'retrieval')

Participant: someone who takes part in a study and, by taking part, provides data for the researcher to analyse

Going further

If you recall information at set points after you have learned it, then there is a much better chance of making the memory permanent. To remember a new piece of information, you should recall it at these times after you first learn it: five minutes, thirty minutes, one hour, one day, one week, one month, and one year. Choose some information you have to learn for an exam and try this out.

Did you know?

Psychologists believe that our memories consolidate while we sleep. Consolidation means that the memories become permanent. This suggests that you should review what you learned during the day before you go to bed.

Exam tip

Make sure that you can explain the difference between encoding, storage, and retrieval. An exam question could ask you to demonstrate understanding of the different processes.

Key terms

Episodic memory: unique memories that are concerned with personal experiences or events

Semantic memory: memories that are concerned with general knowledge rather than personal experience

Procedural memory: our memory for carrying out complex skills

Different types of memory

Building skills 2 — E

Answer the following questions.

a) Where did you go on your last holiday?
b) What is the largest continent in the world?
c) What colour is the sky?
d) Can you describe your first day at school?
e) Can you name an animal that has wings?
f) What did you have for breakfast this morning?

With a partner, discuss what you notice about these questions. Can you place the questions into groups?

Episodic memory, semantic memory, and procedural memory

Psychologists believe that there are three different types of long-term memory. These are called **episodic memory, semantic memory**, and **procedural memory**.

Episodic memory refers to the memory of personal events and experiences in your life. These memories are personal to you, such as places you have visited and events that have happened. Remembering your first day at school and where you went on holiday last summer are examples of episodic memory.

Semantic memory is the memory for facts and general knowledge. This includes knowledge about the meaning of words. Knowing that Asia is the largest continent in the world, that elephants have trunks, and that a school is where students go to learn are all examples of semantic memory.

Did you know?

When people are asked to think about an episodic or a semantic memory, different parts of the brain are active. Semantic memories involve areas towards the back of the cortex. The cortex is the outer layer of the brain where more complex cognitive functions take place, e.g. speech. Episodic memories cause more activity in the frontal cortex.

Building skills 3 — A

Work in small groups. You will need someone with trainers or lace-up shoes in each group.

The person with laces should sit with their laces undone. Ask someone else in the group to give them instructions on how to tie their laces. The person giving the instructions should not use their hands at all. The person with the laces should follow the instructions they are given exactly. Let each person in the group have a go at giving the instructions.

How successful was each person at explaining how to tie the laces? Why was this task difficult?

Procedural memory is the memory for complex skills. Examples of procedural memory include how to tie shoelaces, how to swim, and how to ride a bike. They are action-based memories. In Building skills 3, you probably found it difficult to explain to someone how to

tie shoelaces. This is because procedural memories are difficult to put into words. Procedural memories are stored using a motor code instead of a verbal code. This is why when children are taught to tie their laces, ride a bike, or swim, they have to be shown what to do instead of just being told what to do.

▲ **Figure 1.3: Episodic memory: last summer's holiday**

▲ **Figure 1.4: Semantic memory: elephants have long trunks**

▲ **Figure 1.5: Procedural memory: how to ride a bike**

Semantic memories and episodic memories can be described to another person because they are easy to put into words. Procedural memories are not easy to describe to another person because they are hard to verbalise. It is very difficult to explain to someone how to swim without showing the actions.

Building skills 4 — K

Semantic memory and episodic memory are described as 'knowing that'. Procedural memory is described as 'knowing how'.

Why do you think they are described like this? Discuss this with a partner and share your ideas with your class.

Practice exam questions

1. Which one of these is a description of storage? *(1 mark)*
   - **A** Retrieving information from memory
   - **B** Holding information in memory
   - **C** Changing information so that it can be stored
2. Identify the three processes of memory. *(3 marks)*
3. Explain what is meant by the term episodic memory. Give an example of an episodic memory. *(2 marks)*
4. Explain one difference between semantic memory and procedural memory. *(2 marks)*

Going further

Another type of memory is called flashbulb memory. Research what is meant by flashbulb memory. How is it different from episodic memory?

Exam tip

If you are asked to describe episodic, semantic, or procedural memory, give an example to support your description.

1.2 What are the models of memory?

Objectives

You will be able to:

- understand the multi-store model of memory
- understand the components of: sensory register, short-term memory, and long-term memory
- recognise the features of coding, capacity, and duration
- know what is meant by primacy effect and recency effect in recall
- understand Murdock's serial position curve study.

Key terms

Sensory register (SR): memory store that holds information received from the senses for a very short period of time

Short-term memory store (STM): memory store that holds approximately seven bits of information for a limited amount of time

Capacity: how much information can be stored

Long-term memory store (LTM): memory store that holds a vast amount of information for a very long period of time

Getting started

Find a partner and ask them to repeat some information back to you. Give them one single-digit number to begin with and include one more item each time. For example:

- Say, '7, recall.'
- Say, '6, 3, recall.'
- Say, '8, 4, 9, recall.'

How far can they go before they make a mistake? Remember, they have to get the list of digits in the correct order.

The multi-store model of memory

Sensory register, short-term memory, and long-term memory

Psychologists believe that information passes through a series of memory stores. Information that arrives at our senses is held briefly in the **sensory register (SR)**. It only stays here for a very short period. It will fade away quickly unless we pay attention to it.

The second memory store is the **short-term memory store (STM)**. Experiments have shown that it has a small **capacity**. It can hold approximately seven items of information. New information pushes old information out. That is why your partner probably had trouble recalling more than seven digits in the Getting started activity (above). If the information in the STM is not rehearsed (repeated), it is likely to be forgotten very quickly.

The final store is the **long-term memory store (LTM)**. Information enters this store through rehearsal. Experiments have shown that this store has a very large capacity and information can stay there indefinitely.

Building skills 1 — A

a) Find someone who does not study Psychology and show them the following list for 30 seconds.

1 0 8 6 1 7 8 9 1 9 1 4 1 9 6

Then ask them to recall as many numbers as they can in the correct order.

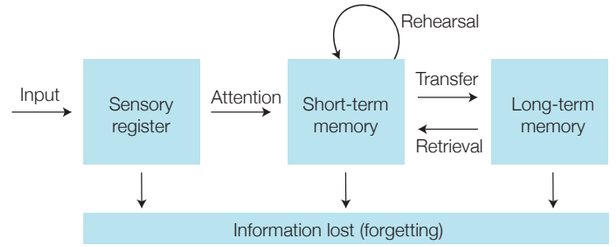
b) Find someone else and show them the following list for 30 seconds. Then ask them to recall as much as they can in the correct order.

108 617 891 914 196

What do you notice? You should find that the second person was able to recall more numbers in the correct order, even though both people were presented with exactly the same digits in the same order. This is because the first list contains too many items for the STM to hold, as the numbers were all separate bits of information. The second list is in chunks, and because each chunk counts as an item, the capacity of the STM is increased.

Features of each store: coding, capacity, and duration

Studies have shown that **coding** in the SR occurs in the same way as the information is received. For example, visual information will be coded visually. Experiments have also shown that the STM codes information acoustically (based on its sound). If a person is given a list to remember, they will try to hold it in the STM by repeating it to themselves. The LTM mainly codes information semantically (based on its meaning).



◀ **Figure 1.6: The flow of information through the multi-store model of memory**

Research has shown that the capacity of the SR is very limited. The STM can hold approximately seven bits of information. This can be increased by putting a few items together to make one chunk (see Building skills 1). The LTM can hold an unlimited amount of information.

The **duration** of the SR is less than one second. The duration of the STM is 18–30 seconds. The duration of the LTM is unlimited.

▼ **Table 1.1: Coding, capacity, and duration of each memory store**

Memory store	Coding	Capacity	Duration
Sensory register	The same way in which it is received from the senses	Very limited	Less than 1 second
Short-term memory	Mainly acoustic	Approximately 7 bits of information	Up to 30 seconds
Long-term memory	Mainly semantic	Unlimited	Unlimited

Evaluation of the multi-store model

According to the **multi-store model of memory**, all information has to be rehearsed to enter the LTM. We know this isn't true because you can remember lots of things that you probably have never rehearsed. For example, you are likely to be able to recall what you did last weekend, but you are unlikely to have rehearsed it. However, you probably cannot always remember things that you have rehearsed, such as information for a Maths test.

Saying things over and over again does not necessarily make them easier to recall. It is more important to understand the meaning of information so that you can say it in your own words. Other

Key terms

Coding: the way that information is represented to be stored

Duration: how long information can be stored for

Multi-store model of memory: the theory of memory that suggests information passes through a series of memory stores

Going further

With a partner, design your own study to investigate the STM or the LTM of the multi-store model of memory.

You could make up your own version of Building skills 1.

See Chapter 4 for advice on how to create an effective study.

Exam tip

Make sure you can describe how information passes from the SR to the STM, and from the STM to the LTM.

Key terms

Primacy effect: more of the first information received is recalled than later information

Recency effect: more of the information received later is recalled than earlier information

Serial position effect: the chances of recalling any item depend on its position in the list

studies have shown that rehearsal involving an elaboration of the information (such as turning it into a story) is more effective than simple repetition.

Some psychologists disagree with the idea that the STM is one single store. Baddeley and Hitch believe STM consists of a number of different components, each with different roles (see page XX).

Information recall

Building skills 2 — A

Select 20 five-letter words from a dictionary and then write each one on a separate piece of card. Find a few willing volunteers and show them the words one at a time, for about one second for each card.

Once they have seen all the words, ask your volunteers to write down as many words as they can remember, in any order that they like. Give them no more than two minutes to do this.

- Which words did they recall?
- Which section of the list were the words from: the beginning, the middle, or the end?
- Why do you think this might have been?

Keep your results for Building skills 3 (see page XX).

Primacy effect and recency effect in recall

The study you conducted for Building skills 2 is used to support the idea that separate short-term and long-term memory stores exist. This fits the multi-store model of memory. This study was conducted originally by a psychologist called Murdock (see Key study on page XX).

If the last activity went according to plan, the prediction is that your participants are likely to have recalled the most words from both the start of your list and the end of your list. They are less likely to have recalled the words from the middle of the list. The words from the start of the list are recalled due to the **primacy effect**. The words from the end of the list are recalled due to the **recency effect**.

The effects of serial position

When we hear the words from the start of the list, we start to rehearse them in our head so that we can recall them later on. This transfers the words to our long-term memory store. However, as we are rehearsing the first few words, we miss the words from the middle of the list. We are able to recall words from the end of the list as they are still in our short-term memory store and so are available to be recalled, if we recall them straight away. The **serial position effect** means that the chances of recalling any item depend on its position in the list. Therefore, items (words) at the start of a word list and at the end of a word list have the highest chances of being recalled in a free recall test.

▲ **Figure 1.7: The chances of recalling any item depend on its position in the list.**

Key study

Murdock's serial position curve study (1962)

Aim: to provide evidence for the existence of separate short-term and long-term stores in the multi-store model of memory.

Method: participants were presented with 20 words at the rate of 1 word per second. They were then asked to recall as many words as they could in 90 seconds, in any order. This is called free recall. The test was repeated with the same participants over a few days. A different list of 20 words was used each time.

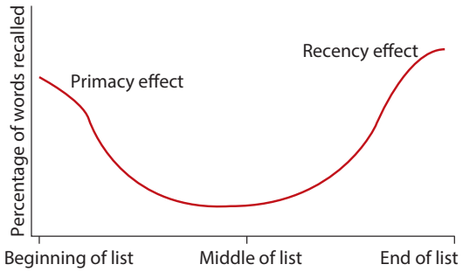
Results: words at the end of the list were recalled first (the recency effect). Words from the beginning of the list were also recalled quite well (the primacy effect), but words in the middle were not recalled very well at all. Murdock displayed his results in a graph called a **serial position curve.**

Conclusion: Murdock concluded that this provides evidence for separate short-term and long-term memory stores, which supports the multi-store model of memory. The first words were rehearsed and passed into long-term storage, while the last words were readily available in short-term storage. The middle words were not in the long- or short-term storage, and were therefore not recalled well.

Source: Murdock, B.B. (1962) 'The serial position effect in free recall', Journal of Experimental Psychology, 64(5), 482–488.

Key terms

Serial position curve: the name given to the graph that displays the results of a serial position experiment



▲ **Figure 1.8: Murdock's serial position curve**

Support for Murdock's findings

In further studies, Murdock varied the number of words and the presentation time, and found that the primacy and recency effects occurred in all variations. This provided more support for the existence of separate short-term and long-term memory stores.

Evaluation

Why the study is important

- Murdock's study provided evidence for the existence of separate short-term and long-term stores in the multi-store model of memory.

Limitations of the study

- Remembering word lists is not the type of memory task that people do in their everyday lives (i.e. revising, for work). It could therefore be argued that the study lacks ecological validity (see page XX).
- Murdock's participants were all a similar age and were all studying Psychology. If the participants had been of different ages and from different professions or cultures, they may have produced different results.

- Some psychologists believe it is too simplistic to view memory as having separate long- and short-term stores. They suggest there are many types of long-term store (episodic, semantic, and procedural), and short-term memory could be an active part of long-term memory.

Going further

In a study similar to Murdock's, participants were given a distractor task to do (count backwards from 100 in threes) before recalling the words they could remember from the list. With a partner, answer the following:

- What do you think happened to the words at the start of the list? Why?
- What do you think happened to the words at the end of the list? Why?

The study found that the words from the start of the list were recalled well (the primacy effect) but participants were not able to recall the words from the end of the list.

How would the multi-store model explain these results?

Building skills 3 — A

Using the results you collected in Building skills 2, produce a serial position curve like the one in Figure 1.8 on page XX. Label the *x*-axis 'position of word in the list', and number it from 1 to 20. Label the *y*-axis 'number of people who recalled the word'.

Count up the number of people that recalled each word. Plot this against the position of the word.

How does your serial position curve compare to Murdock's?

Building skills 4 — A

Working with a partner, try to replicate Murdock's study using different variations. For example, you could use word lists of different lengths, such as 15, 30, or 40 words. Or you could use words that are all three letters long, or all six letters long.

In the Murdock study, words were presented at a rate of one second per word, but you could try two or three seconds per word. Does this make a difference? Choose a suitable way to present your findings to your class.

End of key study

Exam tip

If a question asks for the results of a study, make sure you describe the results only. If the question asks for a description of a study, then the aim, method, results, and conclusion are required.

Practice exam questions

1. **a)** Which one of these is a description of duration? *(1 mark)*

A The way information is represented to be stored

B How much information can be stored

C How long information can be stored for

b) Which one of these best describes the capacity of the short-term memory store? *(1 mark)*

A About 3 items

B About 12 items

C About 7 items

2. Explain the difference in duration between the short-term memory store and the long-term memory store. *(2 marks)*

3. Describe the results of Murdock's serial position curve study. *(2 marks)*

4. Evaluate the multi-store model of memory. *(3 marks)*

1.3 What is the working memory model of memory?

Getting started

Find a page in a book that you have not read before. Say the word 'the' repeatedly while you read the page.

Tell a partner how much you can remember from the page. Why do you think this is?

Objectives

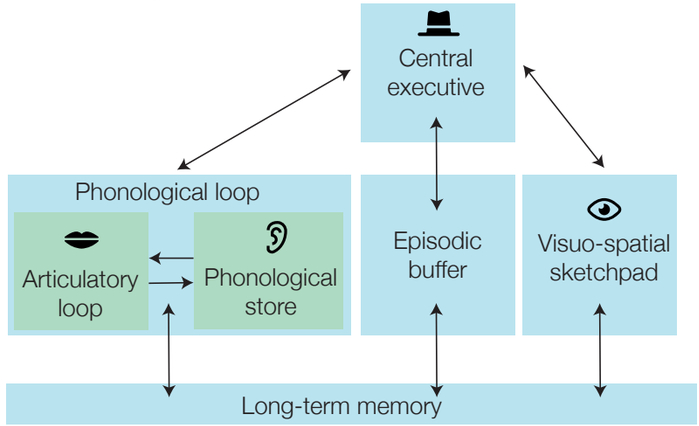
You will be able to:

- understand the working memory model of memory
- understand the components of: central executive, phonological loop, visuo-spatial sketchpad, and episodic buffer
- recognise the features of coding and capacity
- understand dual processing tasks as investigated by Baddeley and Hitch.

The working memory model

What is the working memory model?

The **working memory model (WMM)** of memory was developed by Baddeley and Hitch (1974) as a result of criticisms of the multi-store model of memory. They argued that the short-term memory store (STM) was too simplistic, and so they developed their own theory of how STM works.



▲ **Figure 1.9: The working memory model**

The **central executive (CE)** is the 'boss' of the system, and it decides which of the incoming information to pay attention to. It then allocates this information to two sub-systems: the **phonological loop (PL)** and the **visuo-spatial sketchpad (VSS)**.

The PL is responsible for processing sound-based information. It is essentially how we hear, and produce speech. It is split into two sub-components: the **phonological store (PS)** and the **articulatory loop (AL)**.

The PS stores the words we hear for one to two seconds, and is known as the inner ear. The AL allows us to repeat verbal information in a continuous loop; as long as we keep repeating it, it will stay there. The AL is known as the inner voice.

The VSS stores and processes visual and spatial information. It helps us to keep track of where we are in relation to other objects, for example where tables and chairs are as we walk around a classroom.

Key terms

Working memory model (WMM): a theory that explains how short-term memory works

Central executive (CE): the 'boss', or controller of the components of the working memory model

Phonological loop (PL): the component of the working memory model responsible for sound-based information

Visuo-spatial sketchpad (VSS): the component of the working memory model responsible for visual and spatial information

Phonological store (PS): part of the phonological loop responsible for storing the words we hear for one to two seconds

Articulatory loop (AL): part of the phonological loop that allows us to rehearse verbal information

Key terms

Episodic buffer (EB): a component of the working memory model that integrates information from the other components and from the long-term memory store

The VSS also manipulates visual and spatial information held in the LTM. If you are asked how many windows your home has, probably you will picture your home to count the windows. This image has been retrieved from your LTM. The VSS is known as the inner eye.

The **episodic buffer (EB)** was added to the model later to explain how working memory communicates with the LTM. It integrates information from the other components and from the LTM. Examples include remembering a special event from a long time ago, or trying to form an image of someone's face. It also maintains a sense of time, so that events occur in the right sequence.

Features of each component: coding and capacity

Building skills 1 — A

Write one list of ten one-syllable words, and a second list of ten three-syllable words. Give your partner a short amount of time to learn and then recall each list. What did you find?

Information enters our memory in the form of a 'code'. This code can be held in the form of images (visual code), sounds (acoustic code), or meaning (semantic code).

The capacity refers to how much information each component can hold. The PL holds the amount that you can say in two seconds, and its capacity is therefore determined by how long it takes to say something, not by the number of items. This means that you should be able to remember more one-syllable words than three-syllable words in the same amount of time.

▼ **Table 1.2: Coding and capacity of each component of the working memory model**

	Central executive	Phonological loop	Visuo-spatial sketchpad	Episodic buffer
Coding	Deals with information from all the senses and then allocates the information to the appropriate component	Acoustic	Visual	Acoustic and visual
Capacity	Limited	Limited 1–2 seconds	Limited	Limited. About four chunks of information

Evaluation of the working memory model

The WMM explains a lot more about STM than the multi-store model. It portrays memory as an active process and not purely as a set of passive stores. This model also helps to explain why multitasking is sometimes possible (two tasks using different components can be completed at the same time).

However, not much is known about how the CE works, or what it does. Some psychologists believe that it is not necessary, and only the visual and verbal components are required. Other psychologists believe that there could be several components to the CE. There are few studies that investigate the CE because it is difficult to design tasks that only make use of the CE and not the other components.

The WMM only explains STM, not the SR or LTM, and so it cannot offer a full explanation of how human memory works. Also, the studies to support the WMM are conducted in labs using artificial tasks that may not represent how people use their STM in real life. Therefore, these studies lack ecological validity.

The WMM has been useful in understanding disorders such as post traumatic stress disorder. It has also been found that the PL plays an important role in children learning to read, and that the PL may not be working fully in children with dyslexia.

Dual processing tasks

Baddeley and Hitch used **dual processing tasks** (DPTs) to demonstrate the existence of the separate components of the WMM. Participants do two activities at once, where each activity uses a different component or the same component of the model.

Key terms

Dual processing tasks: more than one activity or task is completed at the same time

Key study

Baddeley and Hitch's dual processing tasks (1976)

Visuo-spatial sketchpad

Aim: to provide evidence for the existence of the VSS in the WMM.

Method: participants were asked to do two tasks.

Task 1: participants followed a spot of moving light with a pointer. The amount of time they were on target was measured.

Task 2: participants were shown a capital letter with a star on the bottom left-hand corner. After the letter was removed, they were told to imagine the letter and go clockwise around it starting at the star, saying 'yes' if the corner was at the top or bottom of the letter, and 'no' if not.

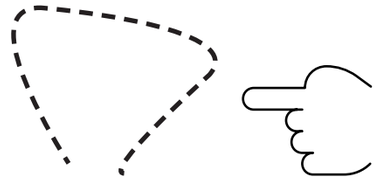
Participants completed each task separately, and then both tasks at the same time. They were then given a verbal task to do at the same time as each of the two visual tasks. The verbal task involved repeating the word 'the' over and over again.

Results: participants easily completed each visual task separately, but struggled to complete both visual tasks at the same time.

However, participants were able to complete a visual task and a verbal task at the same time with no effect on their performance.

Conclusion: Baddeley and Hitch concluded that this provides evidence for the VSS. Each of the visual tasks competed for the limited resources of the VSS, therefore performance was impaired when visual tasks were completed at the same time. A visual task and a verbal task can be completed at the same time because they use different components.

Source: Baddeley, A.D. & Hitch, G.J. (1974) Working memory. In G.A. Bower (ed.) Recent Advances in Learning and Motivation*, Volume 8, Academic Press, pp. 47–89.*



▲ **Figure 1.10: Participants had to follow the spot of light with a pointer.**

▲ **Figure 1.11: An example of a block capital letter used in the study**

4

6, 3

7, 4, 8

7, 3, 9, 5

▲ **Figure 1.12: An example of a digit span task**

A follows B.	B, A	Is it true or false?
B does not follow A.	A, B	Is it true or false?

▲ **Figure 1.13: An example of a verbal reasoning task**

Phonological loop

Aim: to provide evidence for the existence of the PL in the WMM.

Method: participants were asked to do two tasks at the same time.

Digit span task: participants repeated a list of numbers back to the researcher. The list increased by a digit each time.

Verbal reasoning task: participants had to say if statements were true or false.

Results: as the number of digits increased, participants took slightly longer to answer the questions. They didn't make any more errors in the verbal reasoning task as the number of digits increased.

Conclusion: Baddeley and Hitch concluded that this provides evidence for the PL. The verbal reasoning task made use of the CE and the digit span task made use of the PL.

Source: Baddeley, A.D. (1986) Working Memory, *Oxford University Press; Baddeley, A.D. (2000) The episodic buffer: a new component of working memory?* Trends in Cognitive Sciences*, 4(11), 417–423.*

Support for Baddeley and Hitch's findings

Paulesu et al. (1993) also found evidence for the different components of the WMM. They asked participants to complete a verbal task or a visual task, and used positron emission tomography (PET) scans to measure the blood flow in their heads while completing each task. They found that different areas of the brain were active during each task, providing evidence for the PL and VSS being two separate components.

The case study of KF also supports the working memory model. KF suffered brain damage in a motorbike accident. After the accident, he had problems with his memory for verbal information, but his memory for visual information was not affected noticeably. This provides evidence for separate visual and verbal components in short-term memory.

Other psychologists conducting similar dual processing experiments to Baddeley and Hitch have also found similar results, mainly that participants can perform a verbal task and a visual task at the same time, but not two verbal tasks or two visual tasks. In other studies, it has also been found that participants can do a verbal reasoning task and a digit span task at the same time without one being impaired. Therefore, there is support for the idea that working memory is made up of separate components.

Evaluation

Why the studies are important

- DPTs provide evidence for the STM being more than just a single store, suggesting the multi-store model was incorrect.
- The DPTs used by Baddeley and Hitch provide evidence for the existence of separate components for verbal and visual information, and problem solving, in the STM.
- DPTs explain why we can do a visual task and verbal task at the same time, without one being impaired, as they use different components. It also explains why we cannot do two visual tasks or two verbal tasks at the same time, as they use the same component.

Limitations

Most of the tasks used in the dual processing studies are experiments carried out in artificial environments. Therefore, it may be difficult to generalise the findings to how memory works in real life. However, for the study on the VSS described above, Baddeley tried to replicate a real-life experience of his own, in a laboratory setting.

Building skills 2 — E

With a partner, design your own study to investigate components of the working memory model. Choose which component/s you want to investigate. Design two tasks you could use: two visual, two verbal, or one of each. A verbal task could be saying a word over and over again, or counting from one to ten repeatedly. A visual task could be completing a maze, a spot the difference puzzle, or similar.

Try your study on a few willing participants if possible. Don't forget to use standardised procedures and follow all the ethical guidelines. You might want to analyse your results and present your findings to your class.

Synoptic link

See pages XX for more information on standardised procedures and ethics.

Going further

The WMM has been used to help people with certain disorders. Research which disorders it has helped, and how it has helped.

End of key study

Practice exam questions

1. Identify two components of the working memory model (WMM). *(2 marks)*
2. Explain the role of the visuo-spatial sketchpad (VSS) in the WMM. *(2 marks)*
3. Evaluate the working memory model of memory. *(4 marks)*
4. Describe what is meant by a dual processing task (DPT). *(2 marks)*

Exam tip

Make sure you can name the main components of the WMM (CE, EB, VSS, and PL), and give at least one fact about each one.

1.4 Why is memory an active process?

Objectives

You will be able to:

- understand the theory of reconstructive memory
- understand the concept of 'effort after meaning'
- understand Bartlett's 'War of the Ghosts' study.

Key terms

Reconstructive memory: altering our recollection of things so that they make more sense to us

Getting started

Get a few of your class to stand in a line about one metre apart. Ask your teacher to think of a short message to whisper into the ear of the first person in the line. This person then whispers it to the next person, and so on until the message reaches the last person, who says the message out loud.

How does it compare with the original message?

The theory of reconstructive memory

What is reconstructive memory?

Bartlett thought that memory was not just a stored copy of facts. He said that we change our memories to fit in with what we already know, even though we think we are remembering exactly what happened. This is known as **reconstructive memory**.

When you did the Getting started activity, the people in the line probably thought they were passing on the message accurately. Without realising, they actually changed it so that it made more sense to them. Bartlett believed that this happens because if you are trying to recall information and you cannot remember the small details, your mind will fill in the gaps with details that make sense and fit in with the rest of the information.

Bartlett investigated his theory of reconstructive memory in a study called 'War of the Ghosts' (see page XX). He used a method called serial reproduction. Serial reproduction is meant to replicate the process by which stories are passed down through generations, and how gossip and rumours are spread.

The 'War of the Ghosts' story is very confusing to most people. You can read the full text of the story on the next page. Would you be able to recall the story in detail for another person? Would you recall the events that took place in the correct order?

Building skills 1 — A

Have a few more goes at the Getting started activity. You could try it with a longer, more complicated sentence, or with a short story.

Building skills 2 — K

Read the story 'War of the Ghosts'. Then, without looking at the story again:

- Write down what you can remember about the story. Include as much detail as you can.
- Read your notes to your partner, then listen as they read their notes to you.
- What do you notice about your recollections? Are they the same or are they different? Why?

War of the Ghosts

One night two young men from Egulac went to the river to hunt seals and while they were there it became foggy. Then they heard war-cries, and they thought: 'Maybe this is a war-party.' They escaped to the shore, and hid behind a log. Now canoes came up, and they heard paddles, and saw one canoe coming up to them. There were five men in the canoe, and they said: 'What do you think? We wish to take you along. We are going up the river to make war on the people.'

One of the young men said, 'I have no arrows.' 'Arrows are in the canoe,' they said.

'I will not go along. I might be killed. My relatives do not know where I have gone. But you', he said, turning to the other, 'may go with them.' So one of the young men went, but the other returned home.

And the warriors went up the river to a town on the other side of Kalama. The people came down to the water and began to fight, and many were killed. But presently the young man heard one of the warriors say, 'Quick, let us go home: that Indian has been hit.' Now he thought: 'Oh, they are ghosts.' He did not feel sick, but they said he had been shot.

So the canoes went back to Egulac and the young man went ashore to his house and made a fire. And he told everybody and said: 'Behold, I accompanied the ghosts, and we went to fight. Many of our fellows were killed, and many of those who attacked us were killed. They said I was hit, and I did not feel sick.'

He told it all, and then he became quiet. When the Sun rose he fell down. Something black came out of his mouth. His face became contorted. The people jumped up and cried. He was dead.

Key terms

Effort after meaning: making sense of something unfamiliar after it has happened

Effort after meaning

In the 'War of the Ghosts' study, Bartlett showed that memory is not an accurate recording of what has happened. He said that memory is an active process that involves **effort after meaning**. This means that we make sense of something unfamiliar after it has happened. We try to fit what we remember with what we already know and understand about the world.

As a result, we often change our memories so that they become more sensible to us. This process involves making assumptions, or guesses, about what could or should have happened. For example, if you try to remember what your dentist's waiting area looks like, you will probably find that your memory is influenced by what a typical waiting area should look like. You are more likely to recall this, rather than what it actually looks like. Therefore, we may remember mistakenly things that aren't really there, because they make sense within the situation.

▲ **Figure 1.14: Do you remember what your dentist's waiting room looks like?**

Building skills 3 A

Write down five things you remember about your very first GCSE Psychology lesson. Share your notes with your partner.

- Are they the same? Are they different? Why?
- Can you find any examples of 'effort after meaning' in either of your lists?

Going further

With a partner, try to think of some examples where 'effort after meaning' has been used in your daily lives.

Exam tip

If you are being asked to define 'effort after meaning', try to give an example to support your definition.

Evaluation of the theory of reconstructive memory

The theory of reconstructive memory is important because it emphasises the influence of people's previous knowledge and background on the way they remember things. The theory has many benefits for everyday life. It teaches us that we must be very careful when giving, or listening to, eyewitness accounts of events such as accidents or crimes. Witnesses might think that they are being accurate but, in trying to make sense of what they saw, they may alter the facts unconsciously.

It also helps us to understand why two people who are recalling the same event might have completely different versions of the story. It does not mean necessarily that one of them is lying. They each might believe genuinely that their version of the story is accurate.

Despite the theory being developed during the early 1900s, the idea that memory is reconstructive is still very popular today.

Key study

Bartlett's 'War of the Ghosts' study (1932)

▲ **Figure 1.15: Bartlett's participants read a story called 'War of the Ghosts'.**

Aim: to see if people alter the information in an unfamiliar story, so that it makes more sense to them.

Method: each participant was asked to read 'War of the Ghosts' (see page XX) twice through to themselves. They were then asked to retell the story to another person. The second person then retold the story to another person, and so on. A record was made of the story that each person reported, allowing Bartlett to note the changes made from one person to the next.

Results: after the story was passed on ten times:

- the passages became much shorter
- there were lots of omissions
- details were changed
- the order of events was changed.

All mention of ghosts disappeared despite the title being emphasised by Bartlett to the first participant. Unfamiliar names were changed into familiar ones. Despite the complex nature of the story, the final version of it was a clear story of a fight and death.

Conclusion: Bartlett concluded that our memory is not an exact copy of what we hear, and it is distorted by what we already know. Therefore, memory is influenced by beliefs and stereotypes.

Source: Bartlett, F.C. (1932) Remembering*, Cambridge University Press.*

Support for Bartlett's findings

Other psychologists have since replicated Bartlett's study and found similar results.

Evaluation

Why the study is important

- Before Bartlett's research, memory had been tested mainly using meaningless material such as nonsense word lists.
- Using a story as opposed to word lists makes Bartlett's study more relevant to the way we use memory in everyday life: we often tell people about what others have said to us, and this will often be passed on.

Limitations of the study

- Many people disagree that Bartlett's study tested memory in a meaningful way, and argue that the story is deliberately confusing and unfamiliar.
- Bartlett recorded the stories at each 'retelling' to see how they had changed, but written data are difficult to score.
- Bartlett used students who were studying English at Cambridge University. Some psychologists argued these participants were likely to be better at reading and verbalising than those not studying English.

Building skills 4 E

Working with a partner, think of at least two evaluations of Bartlett's study.

Going further

Working with a partner, try to replicate Bartlett's study using a few participants.

Design a study to see how the telling of a story changes from person to person.

You will have to think carefully about how you can measure the amount of information recalled at each telling of the story. You will need to devise a clever scoring technique.

See Chapter 4 for advice on how to design an effective study.

Exam tip

If you are asked to evaluate a study or theory, remember that you can include why it is important as well as any limitations it might have.

End of key study

Practice exam questions

1. Which of the following is the correct definition of reconstructive memory? *(1 mark)*

A Making sense of something unfamiliar after it has happened

B Altering our recollection of things so they make more sense to other people

C Altering our recollection of things so they make more sense to us

2. Decide whether each of the following statements is true or false. *(2 marks)*

a) Bartlett believed that memory is an active process that involves effort after meaning.

b) Bartlett's theory helps us to understand why two people who are recalling the same event might have completely different versions of the story.

3. Describe the results of Bartlett's 'War of the Ghosts' study. *(2 marks)*

4. Briefly evaluate research into the theory of reconstructive memory. *(4 marks)*

1.5 What factors affect the accuracy of memory?

Objectives

You will be able to:

- recognise factors that affect the accuracy of memory: interference, context, and false memories.

Key terms

Interference: the difficulty in recalling information when other memories get in the way

Context: the general setting or environment in which activities happen

False memories: remembering something that has never happened

Standardised procedures: a set order of carrying out a study that is applied to all participants when necessary

▲ **Figure 1.16: Why do people forget what they were looking for when they enter a new room?**

Getting started

What affects your memory?

Try to think of an occasion when you just could not recall something that you thought you knew.

What do you think might have caused that to happen?

Factors affecting the accuracy of memory

Interference

Interference occurs when one set of information competes with another, causing it to be forgotten. Interference is more likely to happen if the two bits of information are similar to each other. Interference can occur in two ways:

- Things that we already know can cause problems when we try to take in new information. For example, you know your old home address, but cannot remember your new one.
- New things that we learn can cause problems when we try to recall information that we learned before. For example, you can remember your new home address, but not your old one.

Interference is often tested by giving one group of participants a list of words to learn, followed by another list of words to learn. A second group of participants is given only the first list to learn. All participants are then asked to recall the first list of words. The recall of the first group is usually much lower than the recall of the second group. This is because the second list of words acts as interference.

Context

Have you ever gone to another room for something and then, when you got there, forgotten why you were there? This happens to a lot of people. Why do you think this happens?

Building skills 1 — A

Working with a partner, choose 20 words, and write them as a list on a sheet of paper. Make ten copies of the list.

Find ten participants and give them two minutes to learn the list. After that, collect the lists and divide the group into two smaller groups. Take one group to another room or out into the corridor. Give them two minutes to write down, in silence, all the words they can recall. At the same time, your partner should ask the other group, who are still in the room, to do the same thing.

Did one group recall more words than the other?

The prediction is that the group that stays in the room will have recalled more words on average. Why do you think this happens?

Studies on **context** have shown that recall of information is higher if learning and recall take place in the same context. Therefore, in Building skills 1, the participants who stayed in the room should have had a higher recall than those who recalled in a different context.

One study on context used deep-sea divers as participants. They were asked to learn a list of words. Some learned and recalled in the same contexts (on shore or underwater), whereas others learned and recalled in different contexts (learned underwater and were tested on shore). The recall of words was higher when both learning and recall took place in the same context.

False memories

How well can you trust your memory? How certain can you be that a memory you have from a childhood event is accurate? Remembering things that actually have not happened is known as having **false memories**. Research on false memories has shown that it is very easy for a false memory to be planted in someone's mind.

In one study, participants were questioned about their childhood. The researcher used information from their parents to describe some true events, as well as a false event about getting lost in a shopping centre. About 25 per cent of participants believed that they actually had been lost, and they could also give some detail about what had happened while they were 'lost'.

Evaluation

Research on interference and context involves giving participants lists of words to learn. This is not really how we use our memory in everyday life, so these studies lack ecological validity.

Learning underwater is also quite an unusual context, and unlikely to be one that most people experience. However, the results do show clearly that a change in context between learning and recall does affect recall.

A lot of studies into false memories can be criticised for the lack of **standardised procedures**. The 'lost in the shopping centre' study involved each participant having events from their own childhood described to them, before being introduced to the false event. As the events in their childhood were different for each participant, the information they were given (the false memory) was also different. This means that the study was not standardised fully. See page XX for more detail on standardised procedures.

Practice exam questions

1. What is meant by a false memory? *(1 mark)*
2. Identify one factor, other than context, that has been shown to affect the accuracy of memory. *(1 mark)*
3. Explain one problem with the research into factors that affect the accuracy of memory. *(2 marks)*

Did you know?

Using a second language can reduce false memories. A study conducted on native Mandarin Chinese speakers, who had English as a second language, found that they had fewer false memories in their second language than in their native language. When you use a second language, it activates the mind to be more careful with your judgements and decision making.

Source: Grant, L.H. et al. (2023) Foreign language reduces false memories by increasing memory monitoring. Journal of Experimental Psychology: General, *152(7), 1967–1977.*

Going further

Do you think the lost in the shopping centre study was ethical? Why or why not? How else could false memories be investigated? See if you can come up with a more ethical way of testing this factor.

▲ **Figure 1.17: Research has shown that it is easy to plant a false memory in someone's mind, such as getting lost in a shopping centre as a child.**

Chapter 1

Revision and exam practice

Revision checklist

Can you do the following?

Processes of memory (see pages XX)

- ☐ Explain how memories are encoded and stored.
- ☐ Explain the processes of encoding, storage, and retrieval.
- ☐ Explain the differences between these three types of memory: episodic memory, semantic memory, and procedural memory.

Models of memory (see pages XX)

- ☐ Describe and evaluate the multi-store model of memory (referring to sensory register, short-term memory, and long-term memory).
- ☐ Explain the features of each memory store (coding, capacity, and duration.
- ☐ Know what is meant by primacy effects and recency effects (in relation to memory recall).
- ☐ Explain the effects of serial position.
- ☐ **Key study:** Describe and evaluate Murdock's serial position curve study.
- ☐ Describe and evaluate the working memory model of memory (referring to central executive, phonological loop, visuo-spatial sketchpad, and episodic buffer).
- ☐ Explain the features of each component (coding and capacity).
- ☐ Describe and evaluate dual processing tasks as investigated by Baddeley and Hitch.

Memory as an active process (see pages XX)

- ☐ Describe and evaluate the theory of reconstructive memory, including the concept of 'effort after meaning'.
- ☐ Explain how different factors affect the accuracy of memory, including interference, context, and false memories.
- ☐ **Key study:** Describe and evaluate Bartlett's 'War of the Ghosts' study.

Practice exam questions

1. What is meant by the term 'encoding'? *(2 marks)*

Question 1 is worth 2 marks. It means there are two separate ideas that need to be covered in the answer. For the term 'encoding', the two ideas are about information being *changed* and *stored*.

2. Anil and Rajesh are brothers. Anil was talking about a birthday party he had when he was younger.

Anil: 'My favourite party was when I had a clown and he made balloon animals.'

Rajesh: 'That wasn't your party, that was mine.'

Mother: 'Rajesh is right, that happened at his party, not yours, Anil.'

a) Use your knowledge of one factor that affects memory to explain what has happened to Anil's memory in the situation above. *(2 marks)*

b) Identify and briefly outline one other factor that might affect the accuracy of memory. *(2 marks)*

3. Testing the duration and capacity of short-term memory often involves using laboratory experiments. Outline one advantage and one disadvantage of using laboratory experiments in memory research. *(4 marks)*

Question 3 is worth 4 marks and has two different parts. This means that the part of your answer about 'one advantage' will be worth up to 2 marks, and the part about 'one disadvantage' will also be worth up to 2 marks. It is therefore important to write about both an advantage and a disadvantage, rather than focusing a lot of time and effort on only one of these things.

4. Two students were talking about a Psychology test they had to revise for.

Anika: 'I've been trying to revise for the Psychology test this week by saying the information over and over again. I still don't remember it though.'

Sunita: 'You need to do something with the information, turn it into a story or understand what it really means.'

Describe and evaluate the multi-store model of memory. Refer to the conversation above in your answer. *(12 marks)*

Question 4 asks for a reference to a conversation, so it is important to use a reference that is relevant to the question being asked.

5. Describe one study in which the working memory model of memory has been investigated. Include in your answer the method used, the results obtained, and the conclusion drawn. *(4 marks)*

When you describe a study in your answer to Question 5, make sure you describe all sections asked for. It's easy to miss one out.

6. Which one of these is a description of the capacity of memory? *(1 mark)*

A It is how long information can be stored for.

B It is how much information can be stored.

C It is the way in which information is stored.

Chapter 4: Research methods

Objectives

You will be able to:

- understand variables and formulate testable hypotheses
- understand different experimental designs that can be used in research
- understand the strengths and weaknesses of different experimental designs
- understand what is meant by a standardised procedure
- understand extraneous variables, their possible effect, and how to control for them
- understand randomisation and allocation to conditions
- understand counterbalancing.

Key terms

Experiment: a research method in which the researcher tries to control all variables other than the independent variable (IV) and dependent variable (DV); this allows the researcher to identify a cause-and-effect relationship between the IV and DV

Hypothesis: a testable statement about the relationship between two variables: the independent variable (IV) and the dependent variable (DV)

Null hypothesis: a hypothesis that exists and states that no variables affect any other variables

Variables: factors or things that vary: they can change

Independent variable (IV): the factor that will be varied or changed in an experiment to look for an effect on the other variable

4.1 What is the experimental method?

Getting started

Find out from your class how many people listen to music when they are doing their exam revision or homework.

Find out how many people think that listening to music makes them work better.

The experimental method

The null hypothesis and the alternative hypothesis

Psychologists believe that studies of human behaviour should be carried out in scientific settings whenever possible. The most common method used in science is to conduct **experiments**. The following sections show how psychologists do this.

A **hypothesis** is a testable statement that makes it very clear what the researcher is investigating. A **null hypothesis** is a general statement that no 'things' affect each other or 'nothing is happening', for example: 'What you watch before bed has no effect on how well you sleep.' Scientists produce alternative hypotheses about events that they think are happening and then test these ideas.

Formulating hypotheses

Most research in psychology starts with an idea about how human behaviour is affected by factors like personality, time, or noise. Psychologists want to test these ideas in a scientific way. Sometimes an idea can be quite vague, such as:

Does listening to music affect how well students learn?

The researcher will then try to rewrite the vague idea into a more precise hypothesis. For the question about students who listen to music while learning, we need to identify the two variables that we are interested in studying. As the researcher is going to conduct an experiment, the two **variables** have special names. These are called the **independent variable (IV)** and the **dependent variable (DV)**.

The two variables are:

- something to do with whether or not there is music playing while the studying is happening (IV)
- something to do with how well the students learn (DV).

Probably you have realised that the IV, DV, hypothesis, and experiment are all related to each other. When you design an experiment you need to identify the IV and DV so that you can then write these in the hypothesis. You can do this if you complete the following:

This experiment is looking at the effect of _____ (the IV) on _____ (the DV).

The first gap in the sentence is filled in with the IV, or two **conditions** of the experiment that are being altered or manipulated by the researcher. The second gap will be filled in with the DV, or the performance of the participants that the researcher plans to measure.

In the 'Music study' experiment, the answer would be:

This experiment is looking at the effect of the presence or absence of music on the score in a learning test. The IV has to have conditions that can be compared: music is present compared with music is absent. The DV has to be a behaviour that is measured, so a test of some sort with a score.

For this experiment, the IV is the presence or absence of music and the DV is the score on a learning test.

Once you have identified the IV and DV it is easy to write the hypothesis. A suitable hypothesis for this experiment would be:

The presence or absence of music has an effect on the score in a learning test.

The hypothesis produced for the experiment above about the effect of music on learning is called an **alternative hypothesis**. This is because it is what the psychologist is interested in investigating. The null version of this hypothesis would be:

*The presence or absence of music has **no** effect on the score in a learning test.* (This states the idea that 'nothing is happening'.)

Different kinds of experimental method: laboratory, field, and natural

All researchers try to carry out experiments in controlled settings so that they can be sure that the only variable that affects the DV is the IV. However, it is not always easy to control every other thing that could affect the DV.

A laboratory experiment is an experiment carried out in highly controlled environments like a laboratory. In this case the setting is often artificial, or not where people would usually produce this behaviour.

A field experiment is a setting in which the behaviour would normally occur. If the research is looking at the possibility that the clothes someone is wearing affect whether they are helped or not when they fall over, then the researcher might have confederates (people working for them) who follow a scripted behaviour of falling down when wearing clean or dirty clothes.

Key terms

Dependent variable (DV): the factor that will be measured in an experiment to see if changing the IV has had an effect

Condition: usually an experiment is organised so there are two trials, after which the performances of the participants are compared; these trials are the conditions of the experiment

Alternative hypothesis: the hypothesis the researcher tests by conducting a study and collecting data. It attempts to show the null hypothesis is not supported

Synoptic link

You should look back through your notes and any studies you have come across so far, and try to identify the IV and DV in any experiments you have studied.

Key terms

Experimental design: how the participants are used in the conditions of an experiment

Independent groups: where two or more separate groups of participants are used in an experiment; each group takes part in one of the conditions

Repeated measures: where only one group of participants is used in an experiment; this group takes part in both conditions

Matched pairs: where people with similar qualities are grouped into pairs; each member of the pair takes part in a different condition

Order effect: when a participant's performance in the second condition of an experiment is affected because they have already done the first condition. They may do better because of practice or worse because of tiredness. This may happen in a repeated-measures design

Participant variables: the differences between the people who take part in the study. These may affect the results of an experiment that uses an independent-groups design

The pedestrians who are around when the person 'falls' are just shopping. Their responses to the 'fall' will be their normal behaviour. The IV, whether the person needing help is dressed smartly or not, is still controlled by the researcher (see Key study: Piliavin, page XX).

A natural experiment is one in which the IV is not under the control of the researcher. This occurs when the conditions of the experiment are already fixed, such as studies looking at gender or age differences. When the behaviour of males and females, or younger and older people, is compared, the researcher does not determine which participants are in the different age or gender groups. This is determined by the age or sex of the person.

How experimental design varies

Building skills 1 — A

Imagine that you were asked to carry out the 'Music study' experiment from pages XX to see if learning is affected.

Would you use the same people to learn something while listening to music and then without music? What might be the advantages of doing this?

Can you think of any problems if you did have the same people doing the two different tasks?

There are different ways of using people in an experiment. The researcher has to decide which **experimental design** would be most suitable to test their alternative hypothesis. Sometimes the design chosen is determined by the hypothesis being tested. For example, if the researcher is comparing the self-esteem of males and females, then there would be all males in one group and all females in the other group. In other investigations the researcher could decide to have the same people in both conditions or to use different people.

The three types of experimental design are called **independent groups**, **repeated measures**, and **matched pairs**.

Independent groups

In this design, the people who are available to take part in the experiment usually are divided into two groups. One group takes part in one of the conditions of the experiment and the other group takes part in the remaining condition of the experiment. In the 'Music study' experiment, one group of people would learn with music present and the other group of different people would learn without music present.

Repeated measures

In this design, there is one group of participants. These participants take part in both conditions of the experiment. For the 'Music study' experiment, all the participants would learn some material with music present and they would also learn some material without music present.

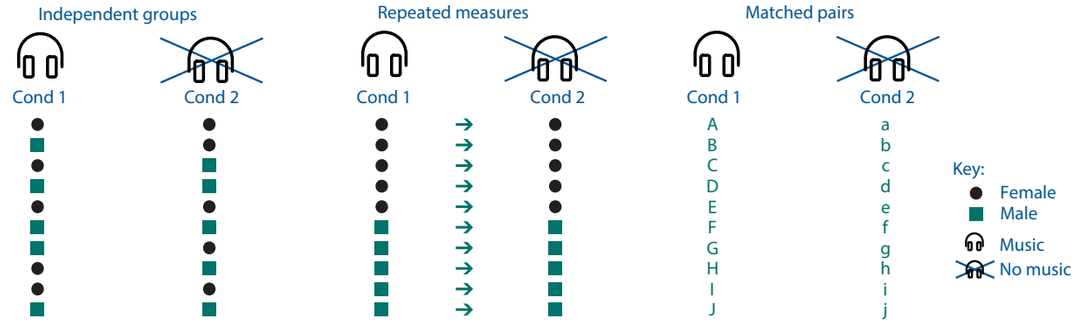
Matched pairs

In this design, the people who are available for the experiment are tested before they take part. The test is used to match people into pairs. Each pair is made up of two people who both have very similar qualities that are important in the study. They could be identified as Pair Aa, Pair Bb, and so on. One member of the pair takes part in one condition of the study (that group comprises A, B, C, and so on). The other member takes part in the other condition (that group comprises a, b, c, and so on).

Even though the people in the two groups are different people, the researcher treats the data collected as if each pair of scores came from one person. Identical twins are often considered to be perfect matched pairs in psychology research.

Building skills 2 — A E

In groups, look at Table 4.1 and discuss the different types of experimental design. Think of an experiment that might suit each different type and explain your choice. To get you thinking about experimental designs, you could use the experiment above about how listening to music or working in silence might affect scores on a learning test.



▲ **Figure 4.1: Three possible experimental designs**

	Strengths	Weaknesses
Independent groups	• There are no **order effects** because people only take part in one condition. • Often, the same material can be used for the task in both conditions. • Participants cannot work out the aim of the study because they only take part in one condition.	• There are different people (**participant variables**) in the two conditions so that may be why the results are different. • You need more people for the study. To get 10 in each group you need 20 people.
Repeated measures	• The people in both conditions are the same, so there are no participant variables. • You only need 10 people to get 20 results because each person produces 2 'scores'.	• There are order effects as people have to do two tasks. • You may need two different tasks (they cannot learn the same word list twice). • Participants may work out the aim of the study if they take part in both conditions.
Matched pairs	• Participant variables are reduced. • There are no order effects. • Often the same material can be used for the task in both conditions.	• Matching is difficult, time-consuming, and not always successful. • Some participant variables are still present.

▲ **Table 4.1: Strengths and weaknesses of each design**

Key terms

Standardised procedures: a set order of carrying out a study that is applied to all participants when necessary

Extraneous variable (EV): a variable that is not the IV but which might affect the DV if it is not controlled

Standardised procedures in experiments

Building skills 3 — K

Imagine you are trying to find out whether the presence or absence of music does affect the learning score a student might obtain.

What other things might affect the learning score of the student? Anything that might have an effect would need to be controlled. Discuss your ideas with the rest of your class.

As you have seen, an experiment is a carefully organised procedure. With **standardised procedures**, a set sequence applies to all the participants when necessary. This makes the experiment unbiased. It means that the researcher is trying to control all the variables and events so that the results of the experiment can be related only to the IV.

Extraneous variables, their possible effects, and how these can be controlled

Extraneous variables (EVs) are variables other than the IV that might affect the DV if they are not controlled. If we go back to the 'Music study' experiment then EVs are things other than the presence or absence of music (IV) that might affect the learning score (DV). Here are some possible problems:

- Time allowed to do the test. If participants in the 'music present condition' have more time than those in the 'music absent condition', that could affect the scores on the test. The results would be due to the fact that people in one condition had higher learning scores because they had more time than people in the other condition. The solution would be to allocate the same amount of time for doing the test to both conditions.
- Difficulty of the questions in the test. If participants in the 'music present condition' have easier questions than those in the 'music absent condition', then that could affect the scores on the test. One solution would be to use the same questions in both conditions. Another would be to have two learning tests of equal difficulty.

▲ **Figure 4.2: Are my questions harder?**

Building skills 4 — A

In Building Skills 3, you came up with ideas for EVs that needed to be controlled. Now think of ways in which you could control these EVs.

Instructions to participants

Another issue that a researcher must consider when standardising procedures concerns the **instructions** given to participants to make sure they know what to do. This includes verbal information (what is said to participants) and written information.

The information that is said or written for participants might affect the way they participate in the study and, therefore, their scores or performances. That could be an EV. The usual practice is to write as much of this information as possible and ensure that each participant receives the same information. Usually this is done in sections:

- Briefing: this is what is said/written to encourage a person to agree to participate. It contains ethical information about consent, anonymity, the right to withdraw, and so on.
- Standardised instructions: these are clear instructions about exactly what the participant will have to do in the experiment.
- Debriefing: this explains the study in detail so that each participant is absolutely sure of the aim of the study, that is, why they were doing what they were doing in the condition(s). Ethical issues are addressed again, especially the opportunity for the participant to withdraw their data if they feel unhappy about their performance.

Randomisation

Randomisation means making sure that there are no biases in procedures.

For example, this might be used when the researcher has constructed a list of 20 words for participants to learn. These words are of equal difficulty because they are all everyday nouns with six letters. The researcher has to decide the order in which they should be presented to the participants. Instead of the researcher choosing the order, randomisation is used.

All 20 words are written on separate pieces of paper and put in a bag. The first word is pulled out of the bag and written down at the top of the list. This is repeated until all 20 words have been put on the list. The order of words has now been randomised. Each word had an equal chance of being selected first for the list and the researcher left the final order of the words to chance. Then the researcher has to be sure that all participants are presented with the words in that same order.

Key terms

Instructions: the written (or verbal) information given to participants during an experiment

Randomisation: using chance to provide an order for a procedure

▲ **Figure 4.3: Participants must be debriefed fully to make sure they understand their role in the study.**

Synoptic link

See pages XX for more information on ethical considerations.

Going further

Can you think of any other EVs that would need to be controlled if you were to carry out the 'Music study'?

In pairs, work out why having the same learning task in both the 'music present' and 'music absent' conditions would not be appropriate in a repeated-measures design. What solution(s) can you think of for this problem?

Key terms

Random allocation to conditions: a way of avoiding bias when allocating participants to the conditions of the IV. Each participant must have an equal chance of being in either condition (e.g. each participant randomly chooses from numbers 1–20; participants who select an odd number do Condition 1 and participants who select an even number do Condition 2)

Counterbalancing: an arrangement in which half of the participants in an experiment are given the conditions in one order (A followed by B) while the other half are given them in the opposite order (B followed by A)

Ecological validity: the results of the investigation can be said to apply to real-life behaviour; they are an accurate account of behaviour in the real world

Allocation of participants to conditions

Random allocation

An important issue is how participants in a study are put into the conditions of the experiment. The researcher should not have any influence over which participants go into which condition of a study. If the researcher chose which participants were in which condition it would be a form of bias. The results might be due to this bias rather than the IV.

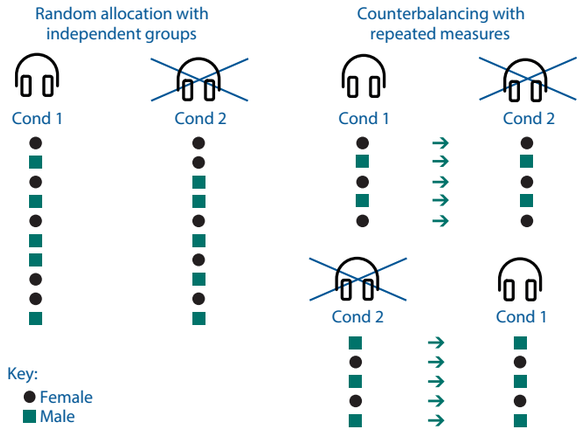
When the design is independent groups, the researcher can use **random allocation to conditions** to achieve this. If 20 people are available for the study, the researcher can put ten pieces of paper with 'A' on them and ten with 'B' into a bag. Each participant takes a piece of paper from the bag and that determines the condition they take part in.

In a similar way, using matched-pairs design, the researcher will allocate the people in each pair randomly. This could be achieved by putting the two letters for a pair in a bag (A and a) and getting one participant to select a letter. This is then repeated for every pair. All those who select the capital letters could do Condition 1 and the rest could do Condition 2.

Of course, with repeated-measures design, there is no random allocation to one of the conditions because each participant has to complete both conditions. There is another procedure that is used to try to make this experimental design less biased.

Counterbalancing

When the experimental design is repeated measures, all the participants have to take part in both conditions. We have seen that this might cause order effects. In order to even these out, a procedure called **counterbalancing** is used. This means half of the participants complete Condition 1 then Condition 2; the other half complete Condition 2 then Condition 1. This will not get rid of order effects but it will share the effects equally between the two conditions.



▶ **Figure 4.4: Two possible ways of putting the participants of a study into the conditions of the experiment**

Building skills 5 — A

It is possible to use a computer program to allocate participants to the conditions of an experiment. Use the internet to research how to do this.

Strengths and weaknesses of the experimental method

It is important to remember that there are many strengths, as well as weaknesses, to the experimental method. There is no best way of finding out about human behaviour, so researchers choose the most appropriate method for their investigations.

▼ **Table 4.2: Strengths and weaknesses of the experimental method**

	Laboratory experiments	Field experiments	Natural experiments
Strengths	Lots of control of EVs means it is easier to establish cause and effect, so the researcher can be sure that the IV affected the DV. The high levels of control and standardisation mean the experiment can be replicated and the results confirmed. There is high objectivity because opportunities for bias are reduced in the standardised procedures.	The setting is natural with realistic tasks, so there is high **ecological validity**. There is still control of the IV and even some EVs. Replication is possible. Participants are unaware they are in a study so their behaviour will not be affected. The results will be valid because it was their real behaviour.	When the IV is naturally occurring, such as language spoken or age, this is the only type of experiment that can be conducted. The high levels of control (of all variables except the IV) and standardisation mean the experiment can be replicated and the results confirmed. There is high objectivity because opportunities for bias are reduced in the standardised procedures.
Weaknesses	The settings can be artificial, with unrealistic tasks, so there is a lack of ecological validity. Participants are aware they are in a study so their behaviour can be affected. So the results may be misleading or lack validity because their behaviour might not reflect their usual actions.	Reduced control of EVs means it is harder to establish cause and effect, so the researcher is less sure that the IV affected the DV.	There is no random allocation of participants to conditions of the experiment, as the IV is not under the control of the researcher. The settings can be artificial, with unrealistic tasks, so there is a lack of ecological validity. Participants are aware they are in a study so their behaviour can be affected, and the results may be misleading or lack validity.

Practice exam questions

1. Write a suitable hypothesis for the experiment outlined in Question 1. *(3 marks)*
2. Briefly discuss the strengths and weaknesses of using the experimental method to investigate the effects of the presence and absence of an audience on a card-sorting task. *(6 marks)*
3. Describe how a researcher could use repeated measures in a study where participants are all timed sorting cards:
   - in the presence of an audience (Condition A)
   - in the absence of an audience (Condition B). *(2 marks)*

Exam tip

When a question asks you, 'How might the researcher allocate the participants in the study randomly to the conditions?', you must give a practical description like those described on this page. You will not get any credit if you just suggest a method such as, 'Use a computer program.' Your answer must state how such a program would be used.

4.2 What are sampling methods?

Objectives

You will be able to:

- understand sampling methods
- understand the strengths and weaknesses of sampling methods
- understand the principles of sampling as applied to scientific data.

Key terms

Target population: the large group of people the researcher wishes to study

Sample: the small group of people who represent the target population and who are studied

Representative: when the sample of participants is made up of people who have the same characteristics and abilities as the target population

Sampling methods: strategies used by researchers to obtain people from the target population to take part in their studies

Random sample: every member of the target population has an equal chance of being selected for the sample

Getting started

Consider where it is possible to find people who might take part in an experiment. What factors might be important when identifying people who might take part? Think about:

- the types of people you might need
- who might be more or less willing to participate and why.

Discuss this in small groups in your class and then share your ideas with the other groups.

Sampling

Target populations and samples

When psychologists conduct research, they are interested in finding out how people behave in certain situations. The **target population** is the group of people the researcher wants to study. What a researcher cannot do is to test every person to find this out. Instead, research is carried out using small groups of people. The people who take part in an investigation are the participants and as a group they are the **sample** for the study. The small sample of participants will be selected from the much larger group called the target population.

The important issue for the researcher is that the sample of people in a study is **representative** of the target population. If they are, then the researcher can assume that the behaviour of the sample matches the behaviour of the target population. This means that the results of the study can be generalised; that is, the results can be said to apply to not just the sample but the target population as a whole.

Sampling methods

Sampling methods refer to the strategies that are used by researchers to obtain people who will take part in their studies. Four different types of sampling methods are discussed below.

Random

In a **random sample** every member of the target population has an equal chance of being selected for the sample. This means that the researcher must identify all the members of the target population, number each person, and then draw out the required number of people. If the target population is small, then all the numbers can go into a hat to be drawn out. If it is large, then a computer program can be used to do this. This sampling method is fair and not biased because the researcher cannot choose the individual participants.

Opportunity

Opportunity sampling means choosing people who are members of the target population and are available and suitable to take part. Often, these people are known to the researcher so they may not represent the target population very well. This could produce a biased sample. The chosen participants may also try to 'help' the researcher by behaving in ways that support the hypothesis being tested, so their results could be unreliable. However, it is a quick, easy way to collect people for a study.

Systematic

Systematic sampling involves selecting every *n*th member of the target population. For example, if the researcher decides that '*n*' will be 'seven', every seventh person in the target population is selected. This is unbiased because the researcher cannot choose the individuals but it is not random because the people who are first to sixth in the population do not get a chance to be selected.

Stratified

Stratified sampling is the most complex sampling method. The researcher must identify the subgroups in the target population and work out what proportion of that target population each group represents. For example, in a school there are several subgroups: teachers, other staff, students in each year, and so on. If the teachers make up 10 per cent of the whole school target population then 10 per cent of the sample must be teachers. This is repeated for each subgroup. Once the researcher knows what proportions need to be selected, a random sample of each subgroup is taken. This is very time consuming. However, it will provide an unbiased and very representative sample of people for the study.

Key terms

Opportunity sampling: people who are members of the target population and are available and willing to take part in research are selected

Systematic sampling: every '*n*th' member of the target population is selected for the sample

Stratified sampling: different subgroups in the target population are identified; then people are selected randomly from these subgroups in proportion to their numbers within the target population

Sampling method	Strengths	Weaknesses
Random	No researcher bias; likely to be representative	Time consuming
Opportunity	Quick and easy	Not likely to be representative; may have researcher bias
Systematic	Simple procedure with no researcher bias	Sample may not be representative
Stratified	Very representative	Very time consuming

▲ **Table 4.3: Summary of the strengths and weaknesses of sampling methods**

Building skills 1

E

Imagine you have been asked to design a study to investigate whether listening to music or working in silence affects scores on a learning test.

Which sampling method would you choose to use in the study? Why would you choose this method? Discuss your choice with others in your class.

Practice exam questions

1. A researcher used an opportunity sample to collect participants for an investigation. Identify one problem with this method and explain how it could be overcome. *(3 marks)*
2. Outline what is meant by random sampling and give a practical example of how a random sample could be obtained. *(4 marks)*

4.3 What are non-experimental methods?

Objectives

You will be able to:

- understand the survey methods of questionnaires and interviews
- understand closed and open questions, and structured and unstructured interviews
- understand the strengths and weaknesses of questionnaires and interviews, including ecological validity.

Key terms

Survey: a method used for collecting information from a large number of people by asking them questions, either by using a questionnaire or in an interview

Questionnaire: a set of standard questions about a topic that is given to all the participants in the survey

Closed question: a question where the possible responses are fixed, often as 'yes' or 'no' options

Getting started

Many people believe that video games and many television programmes are violent and that they have increased aggressive behaviour in young people. Your task is to design a questionnaire about this issue. You should work in small groups of three or four people. The questionnaire needs to have six questions in total. Your group should try to answer each question, to make sure that it will collect the information that you need.

When you have finished, you should present your questionnaire to the other groups to see if there are many different questions or whether the questions are similar. You should consider whether the questions that have been written are all clear. If not, try to suggest how to change ambiguous questions to make them clearer.

Survey methods

In this section we will look at methods used by researchers that are not experiments. The sampling methods we have seen already also apply to these non-experimental methods. Researchers are also still interested in trying to find possible connections between variables, but in non-experimental methods these are just referred to as variables and not the IV and DV. In a **survey** about aggressive behaviour and the media, a researcher could be looking for a possible connection between Variable 1: aggressive behaviour, and possibly Variable 2: types of video games played.

Questionnaires

A **questionnaire** is an example of a survey method that is used to collect large amounts of information from a group of people who are often spread out across a country. The researcher must design a set of questions that the people who take part in the survey will answer. The participants in surveys are often called 'respondents' because their behaviour is a response to a question. All the respondents will answer all the questions and the researcher must try to make sure that the answers given provide information that is needed for the investigation.

There are different types of questions that can be used on a questionnaire. Each type produces a different type of information.

Closed questions

Closed questions are questions where the range of possible answers is determined by the researcher. The respondents are required to tick a box or underline/circle the answer that fits their response. Examples of three closed questions are shown below.

For each of these questions, circle the answer that most closely applies to you.

1. Are you female? Yes/No
2. Do you watch TV? Never/Sometimes/Often
3. Do you play video games? Never/Sometimes/Often

Closed questions provide the researcher with data that are easy to collate or put together. The researcher can work out quite quickly the percentages of people who responded 'Yes' or 'No', or who chose 'Never' , 'Sometimes', or 'Often'. Then a bar chart can display the responses.

However, these answers give little detail. Also, because the respondents do not have the opportunity to explain their answers, the researcher does not know why they chose that particular response. Another problem can be that the respondents are not sure exactly what the difference between 'Sometimes' and 'Often' might be, so they may choose 'Sometimes' as a safe answer. The same thing often happens when people are given 'Don't know' as an option. They may pick it because they do not want to give a definite answer of either 'Yes' or 'No'.

Exam tip

If you are asked to write a suitable closed question, make sure that your answer includes not only the question you have written but also the options for the respondent to complete.

Going further

In pairs, each write an answer to the following question: 'How do you feel when you play a video game?' Explain your answer.

Check your partner's response to this question, and then the responses from the rest of the class. What do you notice?

▲ **Figure 4.5:** Answering a questionnaire containing closed questions

Key terms

Open question: a question where the person answering can give any response they like. It is designed to encourage the respondent to give detail in their answer.

Open questions

Open questions are questions where the respondent can write an individual answer and they are given space to do so. The answers to these questions generally provide lots of detail. The respondents are able to explain their answers, so they feel less frustrated than when they have to choose an answer from restricted options that might not fit exactly what they want to say. These questions provide the researcher with lots of information about behaviour, often with explanations for why a person has behaved in a particular way.

However, problems can occur when open questions are used on a questionnaire. It is very hard to collate, or group together, all the individual responses into an overall pattern because each response is different. Sometimes researchers have to produce categories of responses and fit the individual answers into these categories. However, this will mean that the detail and depth of information in the individual responses might be lost because the researcher has tried to summarise the findings.

Here are some examples of open questions. Answer each of these questions as clearly as you can.

1. What kinds of TV programmes do you watch and why do you choose these?
2. Why do you enjoy playing video games?
3. How would you answer someone who says video games are too violent?

Building skills 1 K

Compare the responses to the video game question in Going further on page XX with the types of responses given to closed questions.

What do you notice about these two types of questions?

▲ **Figure 4.6: How would you design a questionnaire to find out if video games are too violent?**

Writing questions for a questionnaire

It is very important for the researcher writing a questionnaire to be sure that the questions are clear and unambiguous. The words used in the questions should not be emotive because this might upset the person filling in the questionnaire and affect the honesty of their answers. Also, the meaning of each question must be obvious to the reader. When questions are unambiguous their meaning is absolutely clear. This means that the respondents are sure of exactly what a question is asking and exactly how to give an answer to it. Researchers must make sure that 'closed' questions do not have more than one question in them. It would not be easy for the respondent to work out whether they should answer both questions or just focus on one. Taking all this into consideration is likely to increase the ecological validity of the questionnaire. The researcher can be more confident that the answers given are a true account of the behaviour of the respondents.

Building skills 2 K

Look at the following questions. What might be the problems with the way they have been written?

a) How many hours a week do you spend playing video games?

Up to 1 hour 2–3 hours More than 5 hours

b) Playing video games is a waste of time and makes people aggressive.

Agree Disagree

▲ **Figure 4.7: 'How do I feel when …?'**

Strengths and weaknesses of questionnaires

The main strength of using questionnaires to find out about behaviour and attitudes is that a great deal of data can be collected quickly. That is why large organisations often use questionnaires to get feedback quickly from their customers. Closed and open questions both have strengths and weaknesses, so it is often useful to have both types in a questionnaire. Closed questions are easy to score and open questions provide detailed information. Open questions also allow people to explain their answers so the researcher knows why a particular answer has been given. Questionnaires are ethical because people are fully aware that they are filling in the questionnaire and they know what the questions are asking.

However, there are some weaknesses. Questionnaires provide the answers respondents want to give and there is no way of checking that the answers are actually true. This means that the results of the questionnaire could be misleading for the researcher. When closed questions are used, the researcher does not know why a particular answer was chosen.

Did you know?

Lots of questionnaires are posted out and the return rate can vary between 5 and 54 per cent. The results of such a questionnaire might reflect the answers of a very small group of people who do not represent the target population, and therefore the results cannot be generalised to that population.

Exam tip

When writing about the strengths and limitations of a questionnaire, make it clear what type of questions you are referring to in your answer: *One strength of a questionnaire with open questions is …*

Key terms

Interview: a research method in which a researcher collects data by asking questions directly

Structured interview: an interview in which all the questions are pre-set, given in a fixed order, and every interviewee is asked the same questions

Unstructured interview: an interview in which only the first question is set and all other questions are determined by the answers of the interviewee

▲ **Figure 4.8: In an unstructured interview, the interviewee will direct the discussion.**

Interviews

Building skills 3 — A

A researcher wanted to find out students' feelings about the use of mobile phones both in and outside school. She decided to write some questions to collect the information she required.

1. Write one open question that might be used to find out about a student's use of a mobile phone in school.
2. Write one closed question that might be used to find out about a student's use of a mobile phone in school.

Interviews involve the researcher being in direct contact with the respondent, who in this case is called the interviewee. This is often face-to-face contact in a room, but could be over the telephone or online. The vast majority of interviews involve a questionnaire and the researcher can record the answers at the time of the interview. Alternatively, they can record the interview itself and then play back the content later to analyse the responses. Interviews are not just a 'chat', even though they usually involve two people talking to each other. They are focused on a particular topic.

There are two types of interview:

- **Structured interview:** in this type of interview the questions are all pre-set and every interviewee will be asked exactly the same questions in the same order. The researcher cannot ask an extra question based on an interesting point made by the interviewee. It is often the case that the questions are closed but some may be open.
- **Unstructured interview:** in this type of interview the researcher will have decided on the topic and may have a starter question, but the next question will be based on the response made by the interviewee. This means that each person interviewed will answer a different set of questions and it is the interviewee who directs the discussion. Generally there will be a mixture of both open and closed questions.

Strengths and weaknesses of interviews

In general, interviews produce large amounts of data, which is considered to be a strength of this method. They also provide information about people's thoughts and feelings that cannot be found by just watching behaviour. The data from structured interviews can be collated and analysed easily. The data from unstructured interviews are detailed and have ecological validity.

The weaknesses of the interview method are similar to those of the questionnaire method. The researcher cannot be sure the interviewee is telling the truth, so the data may not be accurate.

Structured interviews lack detail and may be frustrating for:

- the interviewer, who wants to ask another question
- the interviewee, who cannot explain the answer they have given.

Data from unstructured interviews may be difficult to collate and analyse.

Building skills 4 — K A E

1. Try to interview someone about the use of mobile phones by students in your school or college. If you work in small groups you need to decide whether your group will use either a structured or an unstructured interview.

   Make sure each person in the group has a copy of the questions. Those who decide to use an unstructured interview will need to keep a record of the questions that were asked. Each person in the group should interview one person and bring the results back to the group. Each group should analyse the results and present their findings to the class.
2. What did you discover:
   - about mobile phone use
   - about interviewing people?

Remember to be sensitive when you ask your questions. If an interviewee seems uncomfortable about answering a question, just move on.

Practice exam questions

1. What is a survey? *(2 marks)*
2. Distinguish between each of the following:
   a) closed questions and open questions *(3 marks)*
   b) structured interviews and unstructured interviews. *(3 marks)*
3. Outline one strength and one weakness of conducting a survey using questionnaires. *(4 marks)*

Synoptic link

Which of the studies you have learned about so far have used interviews or questionnaires as part of their method?

▲ **Figure 4.9: Interviews often involve face-to-face contact.**

Exam tip

When you are answering questions about the strengths or weaknesses of questionnaires and interviews, you must make it clear whether you are referring to open or closed questions in a questionnaire, or to structured or unstructured interviews with either open and/or closed questions.

4.4 What are case studies?

Objectives

You will be able to:

- understand the method of case studies
- understand the strengths and weaknesses of case studies.

Key terms

Case study: an in-depth investigation of an individual, a small group, or an organisation

Exam tip

Remember that case studies are carried out by professional psychologists, so you should not attempt to conduct a case study of your own. However, in the examination you may be asked how or why a psychologist might carry out a case study, so make sure you have investigated this.

Getting started

So far, the methods you have looked at have involved studying the behaviour of groups of people. This is because researchers often want to find explanations of behaviour that can be applied to all people. However, there are times when researchers focus their attention on unique individuals whose behaviour is not usual.

In small groups of three or four, discuss what kinds of behaviours produced by individual people or a distinct group of people might be of interest to psychologists.

Case study method

A **case study** is an in-depth investigation of an individual or of a unique group. Case studies are carried out by professional psychologists who work in environments such as hospitals, prisons, or therapy centres. The information in a case study can be from a number of sources. Sources include interview details about the person's life; these are biographical details. There might also be work records, or school records if the person is a child. The psychologist might carry out observations of the person or test the person, often using some kind of scale, such as a personality test.

The case study is written up as a description of the individual or group. The psychologist will then interpret the information using psychological theory to decide how to use the information collected. If the case study is of a single person this usually will involve what treatment should be offered. Otherwise it will be used to support or challenge a theory.

Strengths and weaknesses of the case study method

These are some of the main strengths of the case study method:

- Case studies provide detailed information about individuals rather than collecting just a score on a test from a person.
- Case studies record behaviour over time, so changes in behaviour can be seen.
- A single case study that shows us that a theory is not correct is very useful. It will encourage researchers to change the theory and make it more accurate.

There are some weaknesses too:

- The data collected can be very subjective. The method relies on the individual who is being studied remembering events, and these memories might not be accurate or reliable (see page XX). Also, the interpretations made by the psychologist could be biased and therefore the content of the case study might be unreliable.

- The information from the case study cannot be applied to anyone else because it is unique to the individual, group, or organisation studied.
- There are ethical issues, especially of confidentiality, right to withdraw, and protection from harm. The last might occur because very often the person being studied is someone who is suffering from psychological problems. This means they could have anxiety and the psychologist must take extra care when studying the person.

Building skills 1 K A

Choose a famous psychologist whose work you have enjoyed studying while you have been taking your GCSE course. Think about the theories and/or the research this person produced and why you were interested in the information. Imagine you have the opportunity to meet with that psychologist. What questions would you ask him or her? What kinds of information would you want to get from this meeting? Write down some examples of:

- the personal (biographical) information you might ask about
- the questions about the work of the psychologist that you might ask
- any other information you would require, such as how their work affected their life.

Do you think you would enjoy the opportunity to do this kind of research? Discuss this with your group.

Sometimes a case study will be carried out to add to our understanding of human behaviour in general rather than our understanding of a particular person. Gregory and Wallace famously investigated a man who had been blind from infancy, but whose sight was restored by an operation when he was an adult. Gregory and Wallace discovered that the man was not affected by visual illusions.

They found that the man whose sight was restored did not think the horizontal lines in the Ponzo illusion were of different lengths, whereas most people who look at the illusion believe the horizontal line at the top is longer than the horizontal line at the bottom. Gregory used this information to support his theory that visual perception in humans is affected by experience of the world.

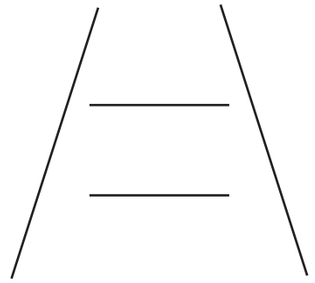
Practice exam questions

1. Give two reasons why a psychologist might choose to investigate behaviour using the case study method. *(2 marks)*
2. Outline one weakness that might occur when a researcher uses the case study method. *(2 marks)*
3. Explain how the weakness you identified in Question 2 could be dealt with by the researcher. *(2 marks)*

Going further

There are some famous studies of individuals in psychology. Sigmund Freud wrote accounts of many people, including 'Little Hans', the 'Rat Man', 'Dora', and the 'Wolf Man'. Other famous investigations have been carried out studying 'Genie' and 'HM'.

Use the internet and other library resources to research at least one of these individuals and any others you might discover. You can then present your findings about these people to the rest of your class.



▲ **Figure 4.10: The Ponzo illusion**

Synoptic link

You could apply this discovery by Gregory and Wallace to your work on visual illusions and perception in Topic 2.4. Think about why it was also important to Gregory's constructivist theory of perception as outlined in Topic 2.5.

4.5 What are observation studies?

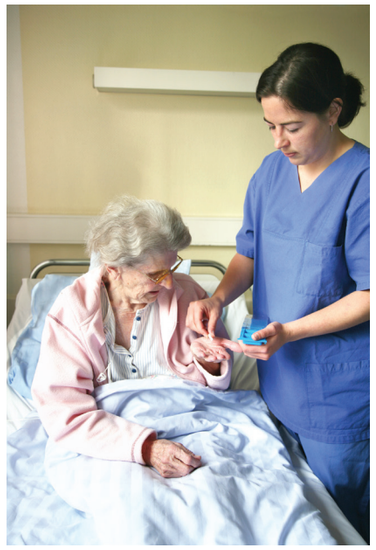
Objectives

You will be able to:

- understand observation studies, including categories of behaviour
- understand inter-observer reliability and how to establish it
- understand the strengths and weaknesses of observation studies.

Key terms

Observation study: a method of collecting information about behaviour by watching and recording people's actions as they happen



▲ **Figure 4.11: A nurse giving medicine**

Getting started

Imagine you want to know how people behave when they are going to cross a busy road. You might be interested in differences in the way males and females cross the road. You could carry out a survey and ask people what they do.

a) What problems might there be if you did this?

b) Can you think of another way that you might be able to collect data about the 'road-crossing' behaviour of people?

The observational method

Observation is a way of collecting data. When we call a study an '**observation study**', this means the data collected have been observed and recorded. An observer identifies the behaviour and then decides how to record that behaviour. With this method, the researcher usually decides to watch behaviour as people produce it. Researchers want to be certain that the behaviour they are recording is 'normal' behaviour, and seeing the behaviour occur naturally is one way of making sure of this. In most natural observations, people are observed in their usual environments and the researcher does not interfere with the location at all. Sometimes, researchers do make something happen so that the natural responses of people can be recorded. One example of this is as follows.

While on duty, a nurse received a telephone call from a 'doctor' in psychiatry who instructed the nurse to give medicine to a patient on the ward. The researchers watched the nurse to see if she obeyed the illegal instruction or refused. (Nurses are not allowed to give medicine if the instruction comes from a phone call.) As far as the nurses in the study were concerned, the setting was their normal place of work, so their behaviour was natural, but the researchers had changed a very small part of the environment (they introduced the phone call), so they could be there to watch what happened.

Imagine you had decided to conduct an observation of bystander behaviour. Suppose you wanted to find out whether people help when someone drops their shopping. There are several possibilities:

- You could stand in the street hoping someone might drop their shopping, which is not very likely to happen.
- You could bump into someone and hope that their shopping drops, which is not acceptable/ethical.
- You could ask a confederate or co-researcher to drop some shopping near to where you are in the street. Then you could record the actions of the people who are there when this happens.

There are some occasions when data are collected by conducting an observation study in a 'laboratory setting'. This is not necessarily an actual laboratory. It just means that the place where the observation is carried out has been organised by the researcher to make it easy for the observation to be conducted. Therefore, the people being observed are brought into a special room where they can be seen and recorded. This would mean the experiment has been conducted using an observational technique to collect the behaviour. This kind of observation might lack some ecological validity because the people being observed would know that the study is taking place.

Categories of behaviour

In order to make sure that an accurate record of behaviour can be made, researchers use a **categories of behaviour** system. In an observation of children playing, the target behaviour is 'playing'. However, the observers would not know what they were to look for if that was the only information they had. Behaviour categories are used to make it clear exactly how to record the actions that have been seen. For this study, suitable categories would be as shown in Table 4.4.

	Categories of behaviour			
	Running	**Hopping**	**Skipping**	**Standing**
Boys	𝍸 𝍸 𝍸	𝍸	𝍸	𝍸
Girls	𝍸	𝍸 𝍸	𝍸 𝍸	𝍸

▲ **Table 4.4: A tally chart showing categories of behaviour for observation of playground behaviours in boys and girls**

Building skills 1

K A

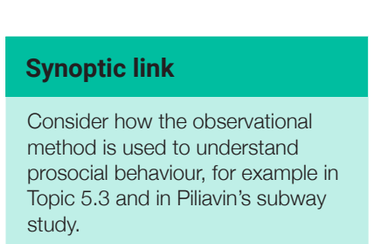
In pairs, design a record sheet containing behavioural categories that you could use to record the behaviour of people at a road crossing. You need to think of all the ways in which people could use the crossing, and then create categories for the behaviours you want to record such as: alone/in groups, child/adult, and so on.

Compare your record sheet with those of other pairs.

◀ **Figure 4.13: A pedestrian crossing**

Key terms

Categories of behaviour: the separate actions that are recorded as examples of the target behaviour



▲ **Figure 4.12: Skipping**

Exam tip

Remember, if a question asks you to explain a term, you cannot use that term in your answer. Students often write, 'Observation studies are studies in which the behaviour of people is observed.' This will not gain credit. You need to write about 'investigations in which the behaviour of people is watched and recorded'.

Synoptic link

Consider how the observational method is used to understand prosocial behaviour, for example in Topic 5.3 and in Piliavin's subway study.

▲ **Figure 4.14: Is one of the group observing the non-verbal communication of the others?**

Strengths and weaknesses of the observational method

Strengths of the observational method

The observational method is usually very high in ecological validity. For many of the behaviours that humans produce, especially social behaviours, this method is the most sensible and reliable way of finding out about what people really do. When researchers ask people what they think they would do, the answers are often misleading. This is either because people are not sure or because they do not want to give an honest answer in case they 'look bad'.

Observation studies record real behaviours that are full actions. Many people criticise research like memory research because the participants learn lists of words. They argue that this is a very small behaviour that hardly relates to the person at all, or how people use their memories in everyday life. Observation studies record whole behaviours that people really do produce regularly.

Weaknesses of the observational method

There are still some weaknesses because, although researchers can see and record the behaviour, they do not know why it occurred. This means the researcher must make a judgement about the reason for the behaviour and that judgement could be incorrect.

An observer might make a mistake when recording the behaviour, or the people who are being watched might become aware of being watched and change their behaviour. Either of these events would affect the accuracy of the results.

Finally, there are often ethical issues involved in studies where people are not aware that they are being watched. If a researcher wants to record natural behaviour, then they cannot inform the people involved, so there will be an invasion of privacy and a lack of consent.

Synoptic link

The ethical issues raised in Topic 4.7 can help you assess the strengths and weaknesses of the observational method.

Building skills 2 E

There is a possible problem with the data that a researcher has collected at the end of the observation period in a study. It may not be an accurate record. Can you think of any reasons why this might be the case? Discuss this with the rest of your group.

Researchers have to find a solution to this problem. What could they do to make sure their record of the observation period is accurate?

Did you know?

'Non-participant observation' is where a researcher does not participate in the behaviour of the study but watches from a distance or in a separate location. 'Participant observation' is when the researcher becomes a member of the group or institution they are observing. For example, one researcher became a teacher in a school for many months so that he could observe the relationships between pupils and teachers.

Inter-observer reliability

When an observation study has been conducted, the record of the behaviours that have been watched has to be an accurate record. The researcher needs to be sure that a behaviour that fits the behavioural categories is recorded every time it occurs. This can be a major problem because in many observation studies the actual behaviour will have passed, so it cannot be seen again.

A solution to this problem is to use the following procedure:

- The researcher designs a record sheet with suitable behaviour categories for the observation they wish to conduct.
- Two observers each have a copy of the same record sheet and watch the same behaviour/location at the same time for the same period of time, recording what they see on their own individual record sheet.
- At the end of the observation period the observers compare their record sheets.

If they have been recording consistently, they will have matching or very similar records of their observations. This means that they will have established **inter-observer reliability**. If the two record sheets are very different, then both will have to be discarded. This is because it would not be possible to work out which observer's record is accurate.

Building skills 3 K A

Design a study that uses the observational method, which is appropriate for your local environment. This could involve watching people in a shopping centre where you observe whether males and females carry their shopping bags differently, or whether or not they hold the door open for people following them into and out of shops. You might look at non-verbal behaviour in cafes. You could even design a study to watch the behaviour of characters in a TV programme.

Use what you now know about carrying out an observation study, categories of behaviour, and how to establish inter-observer reliability. Design a record sheet that is appropriate for your observation study.

Practice exam questions

1. Explain one reason why observation studies often have ecological validity. *(3 marks)*
2. Two psychologists conducted an observation study of males and females parking their cars in a car park. Explain why the psychologists decided that they should both record the behaviours of the same drivers at the same time. *(3 marks)*
3. Briefly discuss one ethical issue that might occur in an observation study and explain how this issue might be dealt with. *(3 marks)*
4. Discuss one strength and one weakness of observation studies in psychology. Use an example of a study to support your answer. *(6 marks)*

Key terms

Inter-observer reliability: how closely the record sheets of two or more people match (when the records do match, they are considered to be accurate; if they do not match, they are inaccurate)

Exam tip

Sometimes students think that having two observers means that, if one observer misses a behaviour, the other will spot it and that would be a 'good thing'. In fact, that would not make the observation reliable. In order to achieve high inter-observer reliability, both observers should record consistently the behaviours every time they occur.

Going further

1. Conduct an observation study you have planned, using materials that you have designed. Then prepare a short report on what you did, what your findings were, and what patterns of behaviour (if any) you discovered.
2. When you have heard the reports of other students who carried out an observation similar to yours, discuss the results together. Consider the data collected overall. Look for similar patterns of behaviour and discuss why any differences might have occurred.
3. Did the observations of your class on the record sheets show any inter-observer reliability?

4.6 What is correlation?

Objectives

You will be able to:

- understand what is meant by 'correlation'
- draw appropriate scatter diagrams
- understand the strengths and weaknesses of correlations.

Key terms

Relationship: a connection or association between two or more variables

Correlation: a technique used by researchers to establish the strength of a relationship between two variables

Scatter diagram: a type of graph for representing correlations

Positive correlation: a relationship between two variables in which, as the value of one variable increases, the value of the other variable also increases

Getting started

Every member of your group should write their height and their hand length in centimetres on a piece of paper. (You can measure everyone against a wall in the room to get their heights and each person can draw around their hand on a piece of paper and measure the distance from wrist to tip of longest finger.)

Hand in the pieces of paper; there is no need for names. Write the pairs of measurements for each person on the board. Do you notice any pattern in the data you have collected? How could you display the data using a graph or diagram?

Correlations in psychology

Sometimes, researchers are interested in seeing if there is a particular kind of **relationship** between two variables. In an experiment the relationship is a 'cause and effect' one. Changing one variable, such as the amount of noise (IV), has an effect on the other variable, such as the number of words someone recalls (DV). Remember, in experiments other EVs are controlled so that we can say with more certainty that the IV did affect the DV (see Topic 4.1).

There are times when the researcher does not change or manipulate a variable. Instead, two variables are just measured and the researcher looks at how they are related to each other. These variables could be behaviours that people produce, such as the number of films watched in a year and the number of colds those people had in the same year. They could also be qualities, such as how happy a person rates themselves to be and how motivated they are at work. Psychologists use **correlation** to try to establish whether or not there is a pattern in the connection between the two variables.

Correlation is not a research method; it is a statistical technique that is used to analyse and display the possible association or relationship between two variables. Each variable has to be measured as a score or value of some sort. These scores can then be plotted on a special graph called a **scatter diagram** (see Figure 4.17 as an example). To produce a scatter diagram the data have to be collected in pairs. Usually each person in the study provides a pair of scores, one score for each variable being measured. Sometimes, researchers correlate data that come from two separate people. For example, in research into depression, pairs of twins each provide a score on a test, such as an anxiety scale, and the data from each twin are plotted as a pair of scores.

In the Getting started activity, each member of your group provided two measurements: their height and hand length. These data can be displayed in a scatter diagram.

How to plot a scatter diagram

To draw a scatter diagram, the horizontal axis (*x*-axis) represents the scale for one variable, such as hand length in centimetres, and the vertical axis (*y*-axis) represents the scale for the other variable, such as height in centimetres. For each pair of scores, you find the point on the *x*-axis that represents the hand length and find the point on the *y*-axis that represents the height. Where the lines intersect, put a dot or cross on the diagram. This means that each dot or cross on the diagram represents a pair of measurements.

Building skills 1 **K**

Plot a scatter diagram to display the data collected in the Getting started activity. Remember to give your diagram a title that refers to the relationship between both of the variables.

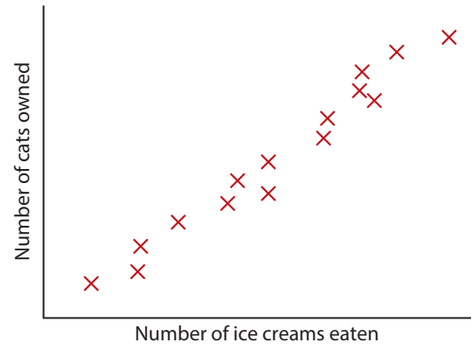
▲ **Figure 4.15:** People are different heights.

▲ **Figure 4.16:** Hand lengths are different.

Positive correlation

Figure 4.17 shows a **positive correlation**. In a positive correlation, as the value of one variable increases so does the value of the other variable. The scatter diagram shows that, as the number of cats owned increases, the number of ice creams eaten also increases. These two patterns are found to occur at the same time.

Remember, the positive correlation does not tell us what causes this relationship, only that the relationship can be identified.



◀ **Figure 4.17:** Scatter diagram showing positive correlation

Key terms

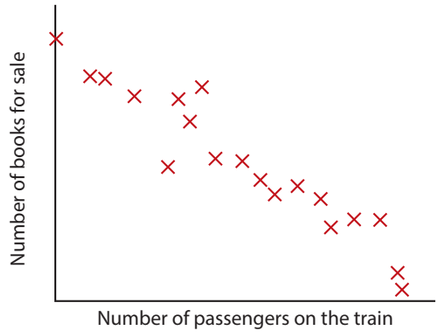
Negative correlation: a relationship between two variables in which, as the value of one variable increases, the value of the other variable decreases

No correlation: there is no relationship between two variables

Prediction: a statement about what will happen, made before the event occurs

Negative correlation

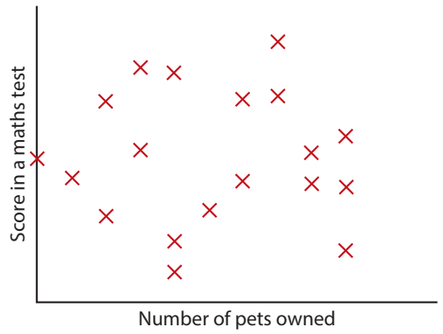
Figure 4.18 shows a **negative correlation**. In a negative correlation, as the value of one variable increases, the value of the other variable decreases. The scatter diagram shows how, as the number of passengers on a train increases, the number of books for sale on the train journey decreases.



◀ **Figure 4.18: Scatter diagram showing negative correlation**

No correlation

Figure 4.19 shows **no correlation** between the number of pets owned and the score in a maths test.



◀ **Figure 4.19: Scatter diagram showing no correlation**

Building skills 2 — K

Look at the scatter diagram you drew displaying your heights and hand lengths. Did you find a positive correlation? Usually, most correlations for these two variables would result in a positive relationship. What does the relationship you found indicate about height and hand length in your group?

You should make sure your title for the scatter diagram includes a reference to the type of correlation you have found. If necessary, rewrite it now.

Prediction

If you look at the scatter diagram in Figure 4.18, you can see that when there are lots of books for sale there are not many passengers on the train. This allows us to make a **prediction** based on the type of correlation we have found. When we have identified a particular kind of relationship between two variables, we only need to measure one of the variables to predict, or 'guess', the likely measurement of the second variable. We can predict that when just a few books are for sale on a train journey, the number of passengers on the train will be high. What we cannot say is that the train journey is busy because there are few books for sale.

The only method that can establish a cause-and-effect relationship is an experiment. This is because the experimental method controls the EVs that could also be causes. In a study where the variables are just measured, it may be something else that has caused the negative relationship, as in the case of the numbers of books for sale and passengers on the train. Maybe there are fewer books for sale because the person selling the books prefers to sell other items when the train is busy!

Strengths and weaknesses of correlation

Correlation is a very useful technique for research in psychology. Here are some of the strengths:

- Correlation allows a researcher to see if two variables are connected in some way. This means that once a relationship has been found, the researcher can use a different method, such as an experiment, to try to find the cause of the results.
- Correlation can be used when it would be impossible or unethical to carry out an experiment. Researchers cannot force people to smoke in order to see if they then develop lung cancer. However, plotting the rates of smoking against lung cancer does tell us that they are related. This knowledge can influence behaviour and further research.

There are also weaknesses in the use of correlation:

- Correlation does not indicate which of the two variables measured caused the relationship to occur. It is sometimes the case that other variables are the cause of the pattern seen on a scatter diagram.
- In order for a correlation to be informative, there does need to be a large amount of data for each variable so that the possible pattern can be seen. This means that the researcher needs to take lots of measurements of both variables so that the pattern in the data can be identified reliably. Correlations based on small populations are not very reliable.

Practice exam questions

1. What is meant by the term positive correlation? *(2 marks)*
2. Explain why correlation can be useful in psychology. *(2 marks)*
3. Explain one difference between an experiment and a correlation study. *(2 marks)*

Exam tip

Remember, the heading for a scatter diagram:

- must always use the phrase 'relationship between …' or 'association between …' rather than 'the effect of …'
- should not seem to suggest one variable has caused the other
- should not be a question such as, 'Is height related to hand length?'
- must contain the correct relationship phrase (positive correlation, negative correlation, or no correlation).

Did you know?

One researcher discovered that when pets such as hamsters, snakes, and rats were kept in rooms by hospital wards, patients often said they had lower stress levels.

Going further

See if you can find some examples of research studies that have used correlation. To get you started, one study investigated the relationship between eye movements and dreaming. Use the internet, textbooks, and the studies in your Psychology course to help you find examples.

4.7 What are ethics in psychology?

Objectives

You will be able to:

- understand ethical issues as outlined by the British Psychological Society Codes
- consider ways of dealing with ethical issues.

Key terms

Ethical issues: points of concern about what is morally right

British Psychological Society (BPS) guidelines: the ethical guidelines produced by the British Psychological Society in its Code of Ethics and Conduct (2021) and Code of Human Research Ethics (2021), which govern the work of all practising and research psychologists

Going further

There are some studies in psychology that have caused a great deal of concern because of the way participants were treated. Research them on the internet. Some names to get you started are Philip Zimbardo, Stanley Milgram, and Mary Ainsworth. Find out what they did and then discuss whether you think the research was justified or not.

Getting started

Imagine you are being asked to take part in a psychology experiment.

- What would you want to know about the study before you participate?
- How would you like to be treated during the experiment?
- Would you be willing to experience something unpleasant for a psychologist?
- What would you want to know about the data collected in the experiment?

In groups of three or four, discuss these issues. Make notes of your discussion so that you can contribute to a whole-class discussion.

If you have studied any particular research that you would not like to have participated in, explain why you feel this way.

Codes of Ethics: The British Psychological Society (BPS)

The Code of Ethics and Conduct (2021) and Code of Human Research Ethics (2021) of the British Psychological Society underpin the activities of all practising psychologists. When you conduct any practical work for your GCSE course, you too are covered by this code so you must ensure that whatever research you do, it is ethical. This means you need to understand the **ethical issues** that relate to your practical work and make sure that you follow the **British Psychological Society (BPS) guidelines** in everything that you do, to the best of your ability and under the supervision of your teacher.

Respect

Psychologists should respect people as individuals and avoid unfair or prejudiced practices. The data collected should be confidential and anonymised so that people cannot be identified in the research. This can be especially important in case studies where individuals might be identified more easily because of the amount of information given about them.

Participants should give informed consent. This means that they should know fully what they are consenting to and that they must be told what the study is about before they agree to take part. Psychologists should avoid deception, which means people should not be misled about the research. However, the BPS does recognise that some research would be impossible if everything was revealed at the start. Researchers must inform participants as soon as possible about any minor deception that has taken place. It would be acceptable to ask people to take part in a 'memory study' and tell them later that it was to investigate the effect of organised and randomised word lists on the number of words recalled.

There are special issues when participants are under 16. They should be asked to give their own consent, if that is appropriate. It is important to note that consent from parents, guardians, or someone acting in the place of a parent, such as a teacher at school, is also required. If people are being observed in public places their privacy should be respected, so there should be no secret filming on mobile phones, for example.

Finally, participants have the right to withdraw from the research at any time and can withdraw their data too. They must be made aware of this right.

Competence

Psychologists should give advice only if they are qualified to do so. Certainly, GCSE students must recognise that they have no qualification for giving advice.

Responsibility

Researchers must protect the participants from harm. The risk of harm from participation in psychology research should be no greater than the risk from everyday life. The psychological and physical health of participants should not be at risk.

Participants should be debriefed at the end of the investigation to ensure they understand fully the true aim of the research. Only then can they make an informed decision about withdrawing their results.

Integrity

Psychologists should behave with honesty and fairness in all their interactions, with all people. It is essential that psychologists consider whether the benefits of the research can be said to outweigh the possible costs to participants in that research.

▲ **Figure 4.20: Guards are in a position of power.**

Did you know?

University students took part in a prison experiment, in which one group of students were guards and the other group were prisoners. The experiment had to be stopped after six days because the 'guards' became cruel and the 'prisoners' became quiet and depressed. Look up the Stanford Prison Study.

Building skills 1 — A

You need to start thinking about ethical issues and how these occur in all research. Look at the studies that have been mentioned in this chapter. For each study, list the possible ethical issues that you think would need to be addressed.

Practice exam questions

1. Identify one ethical issue that might occur in a study of perceptual set. Explain why it is an issue and how it could be dealt with. *(4 marks)*
2. Explain why researchers have to take special care when they wish to investigate the behaviour of young children. *(4 marks)*

Exam tip

In an examination question, make sure that an ethical issue you identify is appropriate for the study described. You should identify the issue, such as 'having the right to withdraw', then explain why it is an issue in that particular study, and how it could be dealt with.

Synoptic link

Consider the importance of ethics in the design of the studies carried out in Social influence and Mental health when you have learned these parts of your course.

4.8 What is data handling?

Objectives

You will be able to:

- distinguish between quantitative and qualitative data
- distinguish between primary and secondary data
- use appropriate statistics to present and analyse data collected in a study
- interpret and display quantitative data
- understand the basic characteristics of normal distribution.

Key terms

Quantitative data: data in numerical form, such as scores or times taken to do a task

Qualitative data: data in descriptive (non-numerical) form, such as verbal or written answers to questions, or observed behaviour

Primary data: data collected firsthand from the source (participants), by the researcher

Secondary data: data that are already published/available and just used, rather than gathered by the researcher

Getting started

A researcher gave participants two memory tests: one in silent conditions and another in noisy conditions (listening to music). For each condition the participants had a score out of 20.

Another researcher asked each participant to explain how they felt their memory was affected when they tried to recall information when it was quiet, and also when it was noisy because music was playing.

Think about the data collected by the two researchers. What advantages can you see for collecting data in these ways? What problems could there be with the data? Discuss your ideas with the rest of your class.

Quantitative and qualitative data

We have looked at the different methods used by researchers to find out about human behaviour. These include experiments, observations, and survey methods. No matter what the method is, the researcher will collect data that are either in a numerical form or in a non-numerical form.

Quantitative data are data in numerical form, such as scores on a test or times taken to do a task. This type of data is usually easy to display as percentages or averages, and in graphs, but usually there will not be an explanation for why a particular score was achieved.

Qualitative data are data in descriptive (non-numerical) form, such as verbal or written answers to questions, or records of observed behaviour. This type of data is usually rich in detail and there might be an explanation for why the behaviour occurred. However, it is often hard to collate or put together lots of individual responses, so these data can be difficult to summarise.

The methods used by researchers are never only quantitative or only qualitative. If a researcher carried out an observation study and rated the happiness of the person observed on a scale of 1–10, then the observation study collected quantitative data and the study could be described as a quantitative study. However, if the researcher had observed the person and written a description of their 'happy behaviours', then the study could be described as using a qualitative method. We cannot say all experiments are quantitative and all observations are qualitative. How the method is described will be determined by the type of data collected.

Primary data and secondary data

Primary data are data that have been collected firsthand from the source (participants) by the researcher. **Secondary data** are data that are already published/available and simply used by the researcher. The majority of data collected in psychological research are primary data.

Descriptive statistics

The data in Building skills 1 are in the form of times taken to solve a puzzle (in seconds). This is called the raw data. However, researchers usually want to identify patterns in behaviour rather than concentrate on individual performances. The various ways of summarising data are outlined below.

Calculating averages

There are three types of average that can be calculated: **mean** (or arithmetic mean), **median**, and **mode**. Each of these averages will be calculated using the data from Building skills 1.

Mean

The mean is calculated by adding together all the values in a set of scores and then dividing the total by the number of values in the set.

Condition A:	Condition B:
mean = 23 + 19 + 24 + 47 + 23 + 20 = 156 (total number of seconds) ÷ 6 (number of values) = 26	mean = 45 + 44 + 43 + 44 + 46 + 48 = 270 (total number of seconds) ÷ 6 (number of values) = 45

A mean can be distorted/affected by a very high or low value in the set of scores. Look at the Condition A scores. What do you notice? What effect does this have?

Median

The median is the middle value in a set of scores. To find the median you must arrange all the values in order from lowest to highest. Then you must find the middle value. If there is no middle value because you have an even number of values, then find the midpoint of the two middle values.

Condition A:	Condition B:
23, 19, 24, 47, 23, 20, arranged in order, becomes: 19, 20, 23, 23, 24, 47. The midpoint of 23 and 23 is 23 so the median is 23.	45, 44, 43, 44, 46, 48, arranged in order, becomes: 43, 44, 44, 45, 46, 48. The midpoint of 44 and 45 is 44.5 so the median is 44.5.

A median is not affected by a high or low score.

Key terms

Mean: a statistic calculated by adding all the scores in a set of values and dividing the total by the number of values in the set; this is sometimes called the arithmetic mean

Median: the middle value in a set of values when the values have been arranged in ascending order

Mode: the most frequently occurring value in a set of values

Building skills 1 E

A researcher set up a study in which six people each solved a puzzle in a room alone and a different group of six people each solved the same puzzle in front of an audience.

The following data were collected in this experiment:

- Condition A times taken to solve the puzzle without an audience (in seconds): 23, 19, 24, 47, 23, 20
- Condition B times taken to solve the puzzle with an audience (in seconds): 45, 44, 43, 44, 46, 48.

What do you notice about the times in the two conditions? Discuss ways of analysing the data from the experiment so that any patterns in the data can be seen.

Key terms

Range: the difference between the lowest and highest values in a set of values

Fraction: a part of a whole number

Decimal: numbers where a point is used to separate whole numbers from parts

Significant figures: the number of figures chosen to display data

Mode

The mode is the most frequently occurring value in a set of scores. Sometimes there is no mode and sometimes there is more than one mode.

Condition A:	Condition B:
23, 19, 24, 47, 23, 20: the mode is 23.	45, 44, 43, 44, 46, 48: the mode is 44.

Note that in Condition B, if the last score had been 45 instead of 48 we would say there were two modes: 44 and 45. The mode is a simple average that does not use all the data in the set when it is calculated.

Calculating the range

Another statistic that can be calculated and used to describe data is the **range**. This is the numerical difference between the highest and lowest values in a set of scores.

Condition A:	Condition B:
the range is 47 – 19 = 28	the range is 48 – 43 = 5

You can see how the range is also affected by the high score in Condition A.

Ways of expressing data

There are lots of ways of expressing, or presenting, numerical data. Probably you have met these in your GCSE Maths course. You should always choose a way of presenting data so that the information is most appropriate for the study that has been conducted.

Fractions, decimals, percentages, and ratios

A **fraction** is a way of expressing a part of a whole number. We can see in Table 4.4 (page XX) that there are 20 boys, each producing an action. Overall, 15 of those actions are running so the fraction of running is 15/20 or ¾ as a fraction. The same number could be expressed as a **decimal**: 0.75 of their actions would be running.

Many results in numerical form in psychology are expressed as decimals. For example: the time taken for Sarah to sort a pack of cards was 61.7 seconds, but it took Chen 73.2 seconds to sort the same pack of cards. It would be appropriate to keep these numbers rather than rounding them up and down, as rounding means that we lose the exact time difference between Sarah and Chen. If you had timed Sarah and Chen and were asked to give your answers to 2 **significant figures**, Sarah's time would be 62 seconds (the number 7 after the decimal point is bigger than '4' so you round up to 62). Chen's time would be 73 seconds (as the number 2 after the decimal point is smaller than '5' it is ignored). You might be instructed to use a particular number of significant figures or decimal places to express an answer that you have calculated.

Exam tip

When you are asked to describe the results of a study, you should look for patterns in the data. For example, the participants in Condition A (without an audience) solved the puzzle faster than those in Condition B (with an audience). We can see this because the mean time for Condition A was much lower than that for Condition B.

Sometimes it is useful to round up (or down) figures, especially if we want to **estimate** something. This might be useful if a researcher knows that one interview took 26 minutes and they have 8 more interviews to complete. They could estimate that they would need approximately 4 more hours to finish the study as 8 × 30 minutes = 4 hours.

A **percentage** is a way of expressing a fraction of a hundred, so 45/100 is 45 per cent. In psychology the frequency of events (the number of times something happens) is sometimes shown as a percentage. So the data in Table 4.4 on page XX could be presented as a table of percentages.

We would calculate those percentages in the following way:

$$\text{Boys running: } \frac{\text{Number of observations in category} \times 100}{\text{Total number of observations}}$$

$$\text{Boys running: } \frac{15 \times 100}{20} = 75\%$$

When all the other percentages are calculated, the table would be as in Table 4.5.

	Percentages for each category of behaviour			
	Running (%)	Hopping (%)	Skipping (%)	Standing (%)
Boys	75	10	5	10
Girls	15	40	40	5

▲ **Table 4.5: Play behaviour in young children (expressed as percentages)**

A **ratio** is a way to compare amounts of something and usually is expressed in its simplest form. If there were 15 boys and 12 girls in a class, the ratio would be 15 : 12 and, in its simplest form, 5 : 4 (divide both sides by 3).

Graphs

The data collected in investigations can often be presented as a graph. Remember, graphs should summarise data, so you should not draw graphs that contain the raw data or individual scores from a study. We have already looked at scatter diagrams, which are a type of graph, in Topic 4.6.

Bar charts

A **bar chart** can be used to display data that are in categories. Each bar represents a separate category and the categories are labelled on the *x*-axis (horizontal). The frequency or amount for each category is on the *y*-axis (vertical). Each bar should be drawn separated from the next bar; they should not touch.

Key terms

Estimate: when figures are rounded to make the calculation simpler, which makes the answer roughly, but not exactly, right

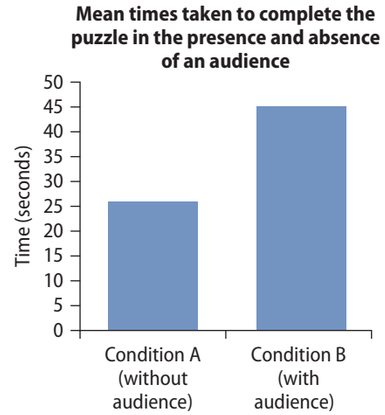
Percentage: a proportion expressed as a fraction of 100

Ratio: the relationship between two amounts showing the number of times one value contains, or is contained within, the other

Bar chart: a type of graph that is used to display data from different categories

Building skills 2 — A

Draw a bar chart to represent the percentage data collected in the observation of children playing (Table 4.5). Remember to label the axes correctly and provide a suitable heading for your chart.



▲ **Figure 4.21: A bar chart**

Key terms

Frequency table: a way of displaying data that shows how often something occurs

Histogram: a type of graph that is used to display continuous data

Normal distribution: an arrangement of data in which most values group in the middle of the range and the rest taper off symmetrically towards each end

Frequency tables

A **frequency table** is a way of organising raw data into sensible groups of data. If we were to measure the heights of 30 people, it would be sensible to present the data in a summarised form as shown in Table 4.6.

Histograms

Histograms are used to present data that are continuous measurements, such as test scores. The continuous scores are put on the *x*-axis and the frequency of these scores is put on the *y*-axis. There are no spaces between the bars as the data are continuous. We can draw a histogram of the frequency data in Table 4.6: see Figure 4.22.

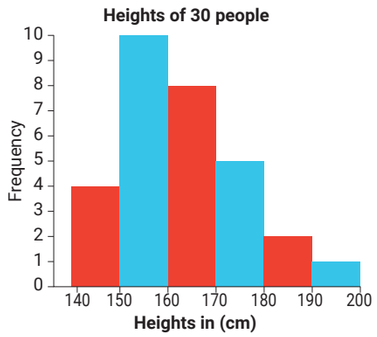
Normal distribution

The idea of **normal distribution** is that for any characteristic or quality that can be measured in human behaviour, for example in memory ability or IQ score, most scores of the whole population would be around the mean with decreasing numbers of scores away from the mean. In a normal distribution the mean, median, and mode scores for the data set are all very similar values. When the data set is plotted, this produces a distinctive curve shape called a normal distribution curve.

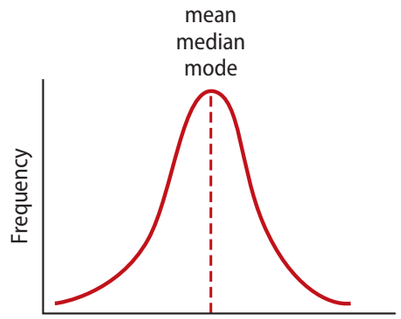
If a researcher has collected data from a sample of participants in a memory experiment and then calculates the mean, median, and mode values for their scores, finding that the mean, median, and mode were all very similar values might suggest that the sample of people has been drawn from a normally distributed population. The researcher might then conclude that the sample is representative of the larger target population.

Height (cm)	Frequency
140–149	4
150–159	10
160–169	8
170–179	5
180–189	2
190–199	1

▲ **Table 4.6:** Frequency table showing heights of 30 people



▲ **Figure 4.22:** Histogram showing heights of 30 people



▲ **Figure 4.23:** A normal distribution curve

Planning and conducting research: some issues to consider

Researchers have to be sure that the way they have planned and conducted their studies means that other psychologists will believe their results are valuable to our understanding of human behaviour. They must always consider the issues of **reliability** and **validity**, and how these might affect their data and conclusions.

If a study is reliable, then when it is replicated or redone in a very similar way, the same results will be found. Some sampling methods are more likely to produce reliable results than others. Random sampling removes possible researcher biases and this increases the reliability of the data collected. Also, using repeated measures might increase reliability of the data because participant variables of intelligence are eliminated. Similarly, collecting quantitative data that have been measured accurately might be more reliable than asking people what they would do.

Researchers must always try to ensure that their studies are valid too. Any questionnaire that is written by the researcher must measure what it says it is measuring. A questionnaire measuring intelligence should not be focused on general knowledge, because everyone has different general knowledge. A memory study has to be a realistic investigation into memory; for example, learning word lists might be too artificial to tell us about memory ability.

Building skills 3 K E

Think about how the issues of reliability and validity might be relevant to the key research studies you must learn for this course. Remember, the choice of sampling method, experimental design, and whether to collect qualitative or quantitative data might all affect the reliability and/or validity of the study. Keep a record of your ideas for your final revision.

Practice exam questions

1. Calculate the mean, mode, and median for the following set of values: 21, 17, 6, 16, 14, 17, 15, 20. *(3 marks)*
2. Draw a table of results to represent the answers to Question 1 above. *(3 marks)*
3. Explain one difference between a bar chart and a histogram. *(2 marks)*

Key terms

Reliability: the consistency of a study or some measuring device such as a test or scale used in a study

Validity: the extent to which a study or measuring device actually does what it claims to be doing

Did you know?

Sometimes, when psychologists look at the data they have collected, an anomalous result (one that is very different from all other results) can be very interesting. The participant producing the result might have an unusual ability or behaviour. The researchers might conduct a case study to look for an explanation of the behaviour.

Synoptic link

Look at all of the key research studies and consider how the issues of reliability and validity may have affected the data collected. Draw up a table of your answers and compare them with the answers of others in your class.

Exam tip

Take as many opportunities as you can to get involved in practical activities such as conducting research and designing tasks. This will help you to understand the studies you are presented with on the exam paper.

Chapter 4

Revision and exam practice

Revision checklist

Can you do the following?

The experimental method (see pages XX)

- ☐ Formulate testable hypotheses.
- ☐ Explain the difference between the null hypothesis and the alternative hypothesis.
- ☐ Explain the difference between the independent variable, the dependent variable, and extraneous variables.
- ☐ Understand how and when to use the following experimental designs, including the strengths and weaknesses of each:
  - ☐ independent groups
  - ☐ repeated measures
  - ☐ matched pairs.
- ☐ Explain how standardised procedures are used in research, including:
  - ☐ giving instructions to participants
  - ☐ using randomisation
  - ☐ allocation of participants to conditions, including counterbalancing
  - ☐ controlling extraneous variables.

Non-experimental methods (see pages XX)

- ☐ Understand how and when to use the following research methods, including the strengths and weaknesses of each, and the types of research for which they are suitable:
  - ☐ laboratory experiments
  - ☐ field and natural experiments
  - ☐ interviews
  - ☐ questionnaires
  - ☐ case studies
  - ☐ observation studies (including categories of behaviour and inter-observer reliability).
- ☐ Understand how to plan research so it is reliable and valid.

Sampling methods (see pages XX)

- ☐ Explain what the sample and the target population are.
- ☐ Understand how and when to select samples using these methods, including the strengths and weaknesses of each:
  - ☐ random
  - ☐ opportunity
  - ☐ systematic
  - ☐ stratified.

Correlation (see pages XX)

- ☐ Understand the differences between positive correlation, negative correlation, and no correlation.
- ☐ Understand how to use scatter diagrams to show correlation.
- ☐ Explain the strengths and weaknesses of using correlation.

Ethical considerations (see pages XX)

- ☐ Understand the ethical issues outlined in the British Psychological Society guidelines.
- ☐ Understand how to deal with these issues in psychological research.

Data handling (see pages XX)

- ☐ Explain the difference between quantitative and qualitative data.
- ☐ Explain the difference between primary and secondary data.
- ☐ Recognise and use:
  - ☐ decimals
  - ☐ percentages
  - ☐ ratios
  - ☐ estimates
  - ☐ fractions.
- ☐ Understand how to calculate the following:
  - ☐ mean
  - ☐ mode
  - ☐ median
  - ☐ range.
- ☐ Construct and interpret quantitative data:
  - ☐ frequency tables
  - ☐ histograms
  - ☐ bar charts
  - ☐ scatter diagrams.
- ☐ Explain the characteristics of normal distribution.

Practice exam questions

1. A teacher wanted to know whether her students were more likely to remember information if they were asked to recall it in the same place that they had first learned it, compared to a different place. She decided to conduct an experiment.

Each student in her class was a participant in her study. Each participant was shown a list of 20 words in their usual classroom. The class was then divided into two equal groups. One half stayed in the classroom while the other half was taken to the hall. Each participant was then given two minutes to write down as many of the words on the list as they could remember.

a) Write a suitable null hypothesis for this experiment. *(2 marks)*

b) What was the independent variable in this experiment? *(1 mark)*

c) What is meant by 'extraneous variables'? Identify one extraneous variable in the experiment above. *(3 marks)*

d) Identify the experimental design that was used in this study. *(1 mark)*

e) Give one strength of the experimental design used in this study. *(2 marks)*

Question 1 e) is worth 2 marks so it is not enough simply to state a strength (such as 'no order effects'); you also need to explain why it is a strength in the context of this study.

f) Outline how the teacher could have allocated the participants to each condition of the experiment. *(2 marks)*

2. Look at the following table. It shows the number of words that were recalled by each participant in each condition for the experiment described in Question 1.

	Condition 1: classroom	Condition 2: playground
Number of words recalled by each participant	10	7
	12	11
	8	14
	13	6
	12	3
	15	11
	12	13
	16	7
	9	10
	11	6
Range	8	
Mean	11.8	8.8

a) Calculate the range for Condition 2. Show your workings. *(2 marks)*

b) Using the table above, explain what the teacher might conclude from this experiment. *(3 marks)*

c) Draw a bar chart to represent the mean for each condition. Your answer should include the following:

- an appropriate scale
- an appropriate label on each axis
- a suitable title. *(4 marks)*

Providing an accurate working out of your calculations when you are asked to do so, like you are in Question 2 a), can earn you marks, so make sure you show your workings and that they are clear and easy to follow.

For Question 2 c), your title needs to be detailed and accurate. It should reference all conditions of the IV and the DV.

3. For the experiment described in Question 1, the teacher wanted to make sure that each of the students was given the same instructions. Write a short briefing that the teacher could have read out to the students at the beginning of the experiment. Include reference to the task. *(4 marks)*

4. a) For the experiment described in Question 1, identify and briefly explain one ethical issue that the teacher should have considered. *(2 marks)*

Some questions are connected, like 4 a) and 4 b) here. Read them both before answering, because how well you know the answer to the second part could affect what you give as an answer to the first part.

b) Describe how the teacher could have dealt with the ethical issue you have outlined in your answer to 4 a). *(2 marks)*

5. A psychologist wanted to know whether young boys or young girls were more likely to share their toys. He decided to carry out observations of children at a local nursery. He also interviewed four members of staff. While he was there, he put a sign up in the reception asking for parents who would be happy to be interviewed.

a) Explain one strength and one weakness of using interviews in this situation. *(4 marks)*

b) Identify which sampling method the psychologist used to obtain the parents he interviewed. *(1 marks)*

c) Give one strength of the sampling method used to obtain the parents in this study. *(2 marks)*

6. a) In observation studies, what is meant by a category of behaviour? *(2 marks)*

b) Outline one reason why it would be useful to have more than one observer in the study described in Question 5. *(2 marks)*

7. Outline the difference between primary and secondary data. *(2 marks)*

8. Describe and evaluate the experimental method as it is used in psychology. As part of your answer, refer to one or more experiments that you have studied. *(9 marks)*