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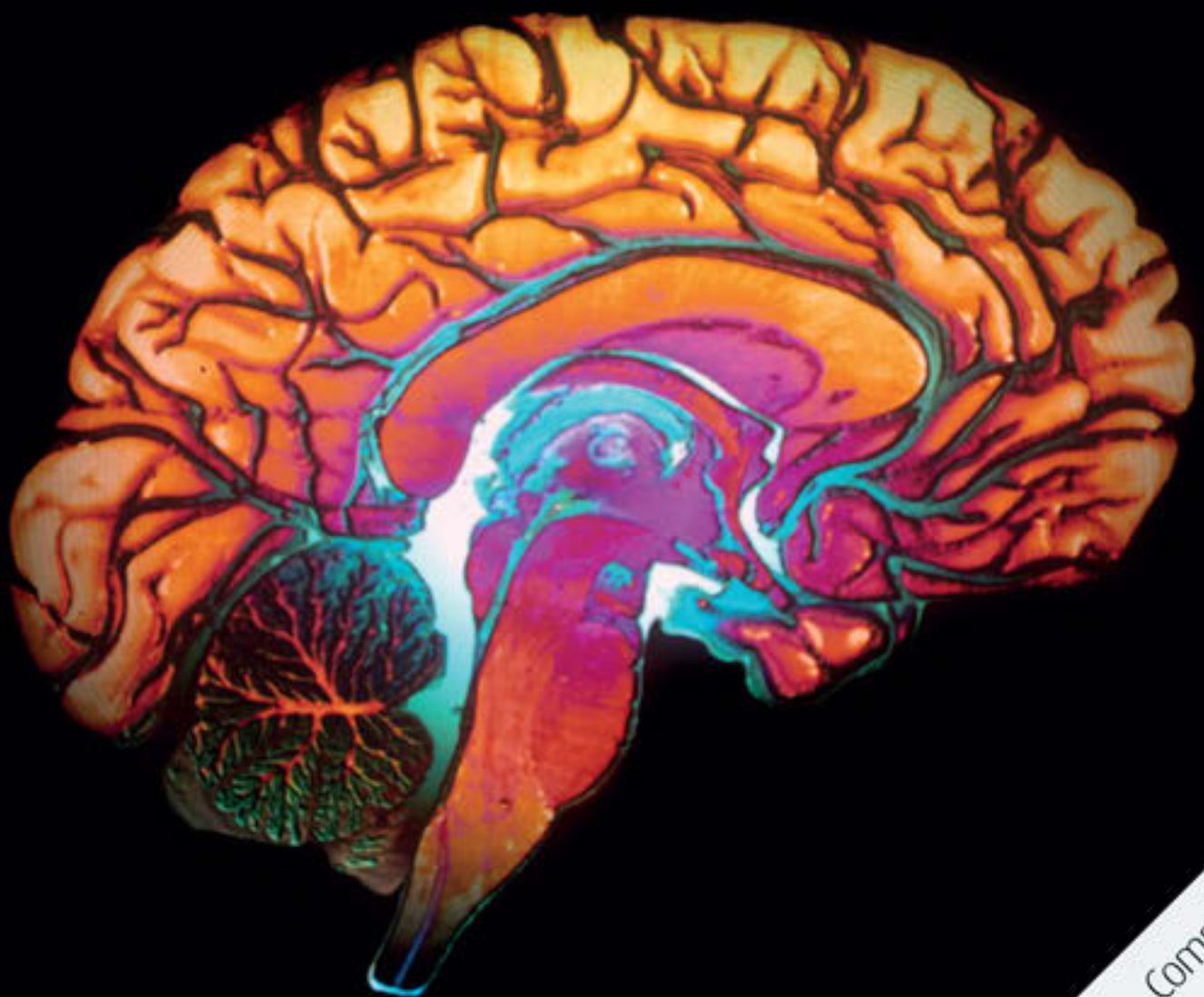
Cambridge International AS and A Level

Psychology

Coursebook



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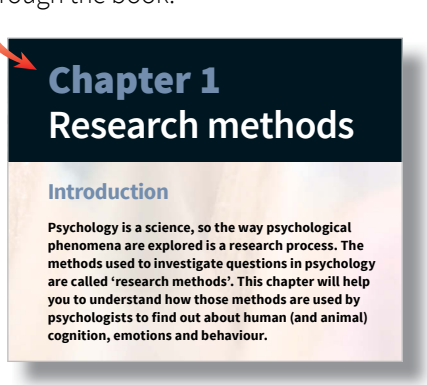
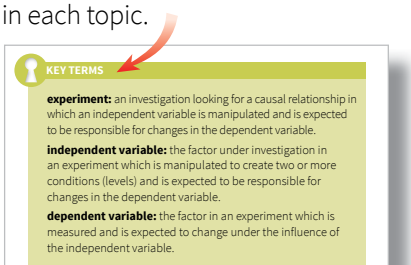
How to use this book

Introduction – A brief overview of each chapter to set the scene and help with navigation through the book.

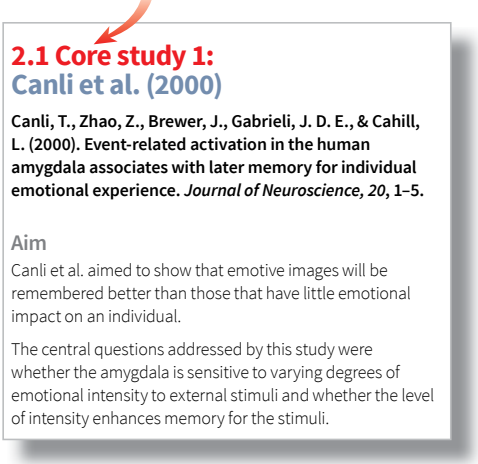


Opening discussion – An engaging discussion to bring each chapter topic to life, encouraging students to read around the topic and sparking discussion in class.

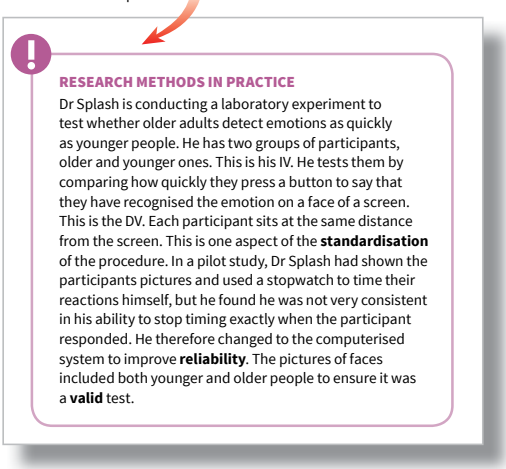
Key terms – Clear and straightforward explanations of the most important terms in each topic.



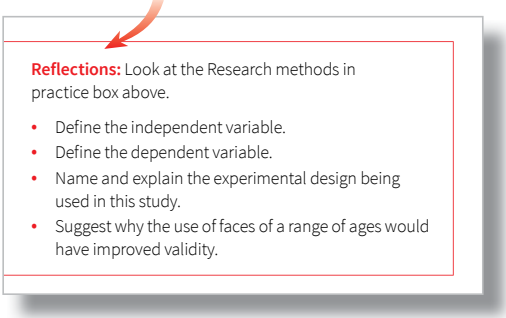
Core studies – Clear outlines of the studies mentioned in the syllabus discussing the aims, methodology, outcomes and evaluation.



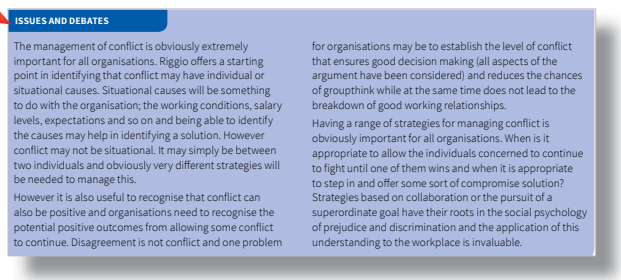
Research methods – Specific aspects of research methods that relate to key points in each chapter.



Reflections – Short prompts for students to reflect on their own experiences and to consider the psychological implications of those experiences.



Issues and debates – Areas of each topic that relate to current issues and debates in psychology are highlighted throughout each chapter, providing extra opportunities for discussion in class.



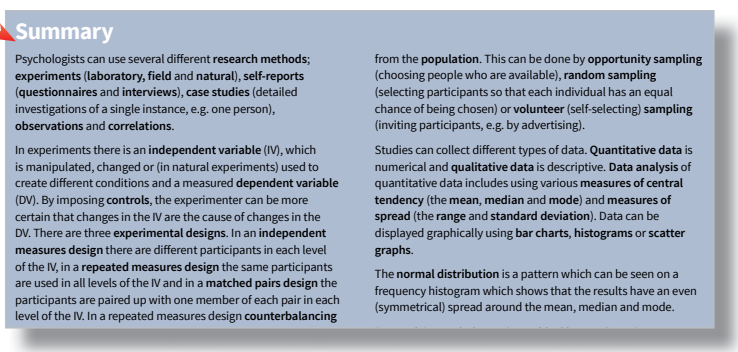
ISSUES AND DEBATES

The management of conflict is obviously extremely important for all organisations. Riggio offers a starting point in identifying that conflict may have individual or situational causes. Situational causes will be something to do with the organisation; the working conditions, salary levels, expectations and so on and being able to identify the causes may help in identifying a solution. However conflict may not be situational. It may simply be between two individuals and obviously very different strategies will be needed to manage this.

However it is also useful to recognise that conflict can also be positive and organisations need to recognise the potential positive outcomes from allowing some conflict to continue. Disagreement is not conflict and one problem for organisations may be to establish the level of conflict that ensures good decision making (all aspects of the argument have been considered) and reduces the chances of groupthink while at the same time does not lead to the breakdown of good working relationships.

Having a range of strategies for managing conflict is obviously important for all organisations. When is it appropriate to allow the individuals concerned to continue to fight until one of them wins and when it is appropriate to step in and offer some sort of compromise solution? Strategies based on collaboration or the pursuit of a superordinate goal have their roots in the social psychology of prejudice and discrimination and the application of this understanding to the workplace is invaluable.

Summary – A brief summary is included at the end of each chapter, providing a clear reminder of the key themes discussed.



Summary

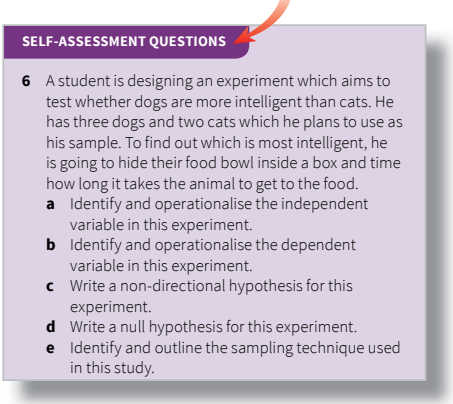
Psychologists can use several different **research methods**; **experiments** (**laboratory, field** and **natural**), **self-reports** (**questionnaires** and **interviews**), **case studies** (detailed investigations of a single instance, e.g. one person), **observations** and **correlations**.

In experiments there is an **independent variable** (IV), which is manipulated, changed or (in natural experiments) used to create different conditions and a measured **dependent variable** (DV). By imposing **controls**, the experimenter can be more certain that changes in the IV are the cause of changes in the DV. There are three **experimental designs**. In an **independent measures design** there are different participants in each level of the IV, in a **repeated measures design** the same participants are used in all levels of the IV and in a **matched pairs design** the participants are paired up with one member of each pair in each level of the IV. In a repeated measures design **counterbalancing** from the **population**. This can be done by **opportunity sampling** (choosing people who are available), **random sampling** (selecting participants so that each individual has an equal chance of being chosen) or **volunteer** (self-selecting) **sampling** (inviting participants, e.g. by advertising).

Studies can collect different types of data. **Quantitative data** is numerical and **qualitative data** is descriptive. **Data analysis** of quantitative data includes using various **measures of central tendency** (the **mean**, **median** and **mode**) and **measures of spread** (the **range** and **standard deviation**). Data can be displayed graphically using **bar charts**, **histograms** or **scatter graphs**.

The **normal distribution** is a pattern which can be seen on a frequency histogram which shows that the results have an even (symmetrical) spread around the mean, median and mode.

Self-assessment questions – Students can check their knowledge and track their progress by answering questions throughout each chapter.

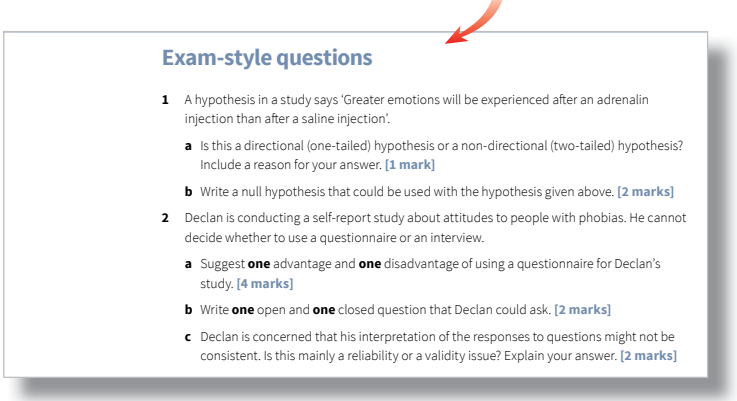


SELF-ASSESSMENT QUESTIONS

6 A student is designing an experiment which aims to test whether dogs are more intelligent than cats. He has three dogs and two cats which he plans to use as his sample. To find out which is most intelligent, he is going to hide their food bowl inside a box and time how long it takes the animal to get to the food.

- **a** Identify and operationalise the independent variable in this experiment.
- **b** Identify and operationalise the dependent variable in this experiment.
- **c** Write a non-directional hypothesis for this experiment.
- **d** Write a null hypothesis for this experiment.
- **e** Identify and outline the sampling technique used in this study.

Exam-style questions – Students can use the questions at the end of each chapter to check their knowledge and understanding of the whole topic and to practise answering questions similar to those they will encounter in their exams.



Exam-style questions

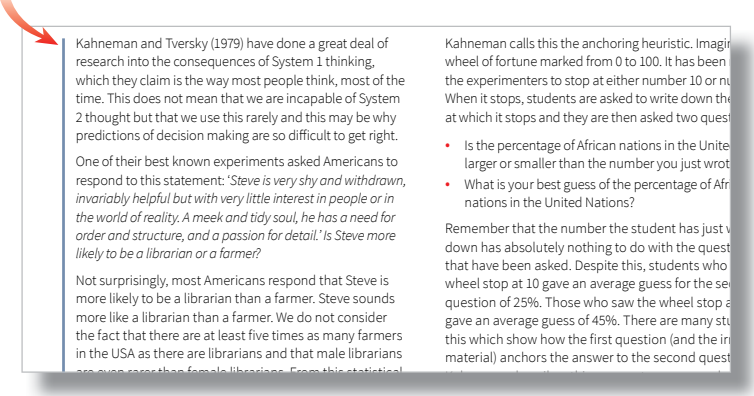
1 A hypothesis in a study says 'Greater emotions will be experienced after an adrenalin injection than after a saline injection'.

- **a** Is this a directional (one-tailed) hypothesis or a non-directional (two-tailed) hypothesis? Include a reason for your answer. **[1 mark]**
- **b** Write a null hypothesis that could be used with the hypothesis given above. **[2 marks]**

2 Declan is conducting a self-report study about attitudes to people with phobias. He cannot decide whether to use a questionnaire or an interview.

- **a** Suggest **one** advantage and **one** disadvantage of using a questionnaire for Declan's study. **[4 marks]**
- **b** Write **one** open and **one** closed question that Declan could ask. **[2 marks]**
- **c** Declan is concerned that his interpretation of the responses to questions might not be consistent. Is this mainly a reliability or a validity issue? Explain your answer. **[2 marks]**

Extension – Material that goes beyond the syllabus and encourages broader understanding of a topic, discussion and engagement.



Kahneman and Tversky (1979) have done a great deal of research into the consequences of System 1 thinking, which they claim is the way most people think, most of the time. This does not mean that we are incapable of System 2 thought but that we use this rarely and this may be why predictions of decision making are so difficult to get right.

One of their best known experiments asked Americans to respond to this statement: '*Steve is very shy and withdrawn, invariably helpful but with very little interest in people or in the world of reality. A meek and tidy soul, he has a need for order and structure, and a passion for detail.' Is Steve more likely to be a librarian or a farmer?*

Not surprisingly, most Americans respond that Steve is more likely to be a librarian than a farmer. Steve sounds more like a librarian than a farmer. We do not consider the fact that there are at least five times as many farmers in the USA as there are librarians and that male librarians

Kahneman calls this the anchoring heuristic. Imagi wheel of fortune marked from 0 to 100. It has been the experimenters to stop at either number 10 or nu When it stops, students are asked to write down th at which it stops and they are then asked two quest

- Is the percentage of African nations in the Unite larger or smaller than the number you just wrot
- What is your best guess of the percentage of Afr nations in the United Nations?

Remember that the number the student has just v down has absolutely nothing to do with the quest that have been asked. Despite this, students who wheel stop at 10 gave an average guess for the se question of 25%. Those who saw the wheel stop a gave an average guess of 45%. There are many stu this which show how the first question (and the iri material) anchors the answer to the second quest

Issues and debates at AS Level

Psychology can be defined as 'the science of mind and behaviour'. The topics explored in psychology include ways to understand, explain and predict the behaviour, thinking and emotions of humans and animals. Two of the key concepts on the syllabus describe the breadth of psychology as a subject. Most topics in psychology can be explored from a number of different approaches (e.g. biological, cognitive, learning and social). This means that explanations or theories used to understand a topic could be based on one of several different perspectives. The range of core studies illustrates a variety of approaches, and each approach has strengths and weaknesses. There are therefore debates both within and between approaches. However, the different approaches should not necessarily be seen as being in competition, but as alternative ways of thinking about and explaining topics, ideas or observations. These topics are the content of psychology and include ways to understand the behaviour, thinking and emotions of humans and animals.

In addition to debates based on the approaches, psychologists have a range of research methods they can use to test their explanations or theories and these also have strengths and weaknesses. The alternative methods can therefore be considered in terms of their relative usefulness and limitations. In particular, the role of ethics and the use of children and animals are issues that should be considered in the discussion of methods. Another difference between methods relates to the type of data they collect and whether it is numerical (quantitative) or descriptive (qualitative). For all psychological investigations, both those you learn about and those you design yourself, it is important to consider how well the research could be or has been done. In addition to ethics, two other key ideas here are validity (whether the research is really testing what it claims to) and reliability (the consistency of the measures used).

Psychological research and explanations aim to improve our understanding. Research which helps us to understand psychological phenomena may or may not have practical applications to everyday life. The extent to which the findings of research, or psychological theories, can be effectively applied to day-to-day problems is another important debate.

Finally, there are two specific debates you need to understand at AS Level. One is the nature versus nurture argument. This is about whether behaviour, feelings or thinking processes could result from nature (innate, genetic factors) or from nurture (can be explained in terms of the environmental influences). Again, these two sides of the debate are not necessarily in opposition. Contemporary psychology considers the relative contributions of each influence. The second debate is about the relative importance of individual versus situational influences in explanations. This means the role played by factors such as the person's personality or physiology that are unique to them (individual) and by factors in the setting, such as the people or the place (situational). Again, such factors may be present simultaneously and may interact, rather than being the influences working in isolation in a way which would be 'one or the other'.

Chapter 1
Research methods

Introduction

Psychology is a science, so the way psychological phenomena are explored is a research process. The methods used to investigate questions in psychology are called 'research methods'. This chapter will help you to understand how those methods are used by psychologists to find out about human (and animal) cognition, emotions and behaviour.

The chapter is divided into several sections, covering the basic research methods that you need to understand: experiments, self-reports, case studies, observations and correlations.

In addition, you will learn about features of the research process (hypotheses, variables, designs and sampling) and data and data analysis. There are also two further topics, which you will also consider within issues and debates: ethical and methodological issues. Together, these will help you to understand and be able to evaluate all aspects of research methods and to be able to apply your knowledge of research methods to novel research situations.

Why do psychologists do research?

As students, you may be bombarded with 'facts' about how to improve your learning. Perhaps you have heard of different learning styles, or the benefits of repetition or mind maps to help you to revise. Each of these methods should have been tested to see if they actually work (although many haven't!). The process of research allows scientists such as psychologists to test ideas in order to discover whether there is evidence to support them. This is how we decide which drugs or therapies work best for mental illnesses, whether different displays or music help to sell products in shops, and how we should organise work schedules to help factory workers to be efficient and healthy.

To be trustworthy, research needs to be planned well and conducted effectively. Imagine an investigation into new classroom techniques. If the researcher didn't know how hard the children worked, and compared the new techniques on a lazy class and a highly motivated class, this would produce false results. Consider a study into consumer psychology that compared how many goods were sold with and without music playing in the store. The researcher only played music at the weekends and played no music on weekdays. Would you believe the findings of studies such as these?

1.1 Where do we focus when we concentrate on a problem?

Reflections: Next time you see someone thinking really hard, perhaps trying to remember a name or work out the answer to a question, watch their eyes. It has been suggested that in such situations our eyes tend to look upwards and to the left (Figure 1.1). Consider how you might test whether this is true. Would you wait for people to get confused and then look at what they do, or would you give them a puzzle to make them think? How would you decide where they are looking? What would you do to be sure that they aren't just looking around the room for clues? Being able to decide on the answers to questions such as these is the basis of designing experiments in psychology.

1.1 Experiments

An **experiment** is an investigation which is looking for a cause-and-effect relationship. The researcher investigates the way one variable, called the **independent variable**, is responsible for the effect in another, the **dependent variable**. To test this, the researcher manipulates the independent variable (IV) to produce two or more conditions, such as 'high' or 'low' light levels or 'early' and 'late' in the day. The effect of these conditions on the dependent variable (DV) is measured. For example, an IV of light level might affect attention, with people being better at paying attention when the light levels are high. How well people pay attention would be the DV. If there is a big difference in the DV between the conditions, the researcher would conclude that the IV has caused the difference in the DV, i.e. that light levels affect attention (Figure 1.2).

KEY TERMS

experiment: an investigation looking for a causal relationship in which an independent variable is manipulated and is expected to be responsible for changes in the dependent variable.

independent variable: the factor under investigation in an experiment which is manipulated to create two or more conditions (levels) and is expected to be responsible for changes in the dependent variable.

dependent variable: the factor in an experiment which is measured and is expected to change under the influence of the independent variable.

1.2 An experiment can investigate whether the light level affects how well we concentrate

In order to be more certain that the difference between the conditions is caused by the IV, the researcher needs to control any other variables that might affect the DV. For example, people might find it harder to be attentive if they have eaten, exercised or sat through a very dull class. Such **extraneous variables** should therefore be controlled, i.e. kept the same in each condition (or 'level of the IV').

The levels of the IV being compared may be two or more **experimental conditions** (such as bright and dull artificial lights) or there may be one or more experimental conditions which are compared to a **control condition** (for example, artificial light compared to daylight). The control condition is simply the absence of the experimental variable. For example, in a comparison of the effect of eating chocolate on paying attention, we might compare either the effect of eating one bar or two bars (two experimental conditions) or the effect of eating one bar to no chocolate at all (one experimental and one control condition).

KEY TERMS

extraneous variable: a variable which either acts randomly, affecting the DV in all levels of the IV or systematically, i.e. on one level of the IV (called a confounding variable) so can obscure the effect of the IV, making the results difficult to interpret.

experimental condition: one or more of the situations in an experiment which represent different levels of the IV and are compared (or compared to a control condition).

control condition: a level of the IV in an experiment from which the IV is absent. It is compared to one or more experimental conditions.

laboratory experiment: a research method in which there is an IV, a DV and strict controls. It looks for a causal relationship and is conducted in a setting that is not in the usual environment for the participants with regard to the behaviour they are performing.

RESEARCH METHODS IN PRACTICE

A researcher might conduct a **laboratory experiment** to test the effect of the **independent variable** of time of day on the **dependent variable** of happiness of students. They might choose to control **extraneous variables** such as which lessons the students were in and whether they had recently eaten since these might affect happiness too. This would be a comparison between two **experimental conditions**.

Reflections: Look at the Research methods in practice box. Can you suggest:

- two different times of day to use as the levels of the *independent variable*
- how the *dependent variable* might be measured
- one other *extraneous variable* that it would be important to control?

Experimental design

The way that participants are used in different levels of the IV is called the **experimental design**. They may be allocated to all, or only one, of the levels of the IV.

The three experimental designs are:

- independent measures design
- repeated measures design
- matched pairs design.

Independent measures design

In an **independent measures design**, a separate group of participants is used for each experimental condition or level of the IV. This means that the data for each level of the IV is 'independent' because it is not related to any other data – it has come from different people. Note that this is a different use of the word 'independent' from that in the 'independent variable'.

If we wanted to know whether seeing aggressive models on television had long-term effects, we could (rather unethically) expose a group of young people to aggressive television and then wait for them to grow older. However, it would much quicker to compare two groups of adults, one group who had been allowed to watch aggressive TV as children and one group who had not been allowed to. This second example would be an independent measures design.

This design is good because the participants only encounter the experimental setting once. They are therefore unlikely

KEY TERMS

experimental design: the way in which participants are allocated to levels of the IV.

independent measures design: an experimental design in which a different group of participants is used for each level of the IV (condition).

to notice or respond to clues that might tell them the aims of the experiment (**demand characteristics**). One problem is that there might be individual differences between participants that could influence the findings. For example, in a study on the effect of noise on dreams, all the people who normally remember their dreams well might end up in the 'no noise' group. If so, it might look as though noise prevented dream recall when in fact it had little effect. This risk can be reduced by the **random allocation** of participants to different conditions. This spreads possible differences between individuals across the levels of the IV. To randomly allocate participants, each person is given a number, and the numbers are then randomly divided into two groups. This can be done by telling each participant a number, putting numbers into a hat and drawing out two sets, or using a random number generator (e.g. on a computer) to do the same thing.

Repeated measures design

In a **repeated measures design** the same group of people participate in every level of the IV. To help you to remember, think of the participants 'repeating' their performance under different conditions. For example, in a study looking at the effects of doodling on learning, we could count the number of words recalled in the same group of people when they did doodle and when they did not.

The main advantage of a repeated measures design is that each person acts as their own baseline. Any differences between participants that could influence their performance and therefore the DV will affect both levels of the IV in the same way. Individual differences are therefore unlikely to bias the findings. Imagine that in our experiment on doodling, one person was generally very quick to learn and another quite slow. In an independent measures design this might cause a problem if they were in different groups, but using a repeated measures design makes the differences between them less important, as both could show an improvement with doodling. Individual differences between participants are called **participant variables**. These variables, such as age, gender, personality or intelligence, can affect scores on the DV. It is therefore important to make sure that these variables do not hide, or exaggerate, differences between levels of the IV.

As each individual participates in every level of the IV they will perform the same or similar tasks two or more times. This can lead to a problem called the **order effect**. Repeated performance could cause participants to improve because they have encountered the task before – a **practice effect**. This matters because participants who were tested on a condition second would perform better than those who did it first. Alternatively, repetition might make performance worse, perhaps if they were bored or tired – a **fatigue effect**. In addition, the participants see both levels of the IV and have more opportunity to work out what is being tested, so are more likely to respond to demand characteristics.

Order effects can be solved in two ways: by randomisation or counterbalancing. Imagine an experiment with two conditions: learning while listening to music (M) and learning with no music (N). In randomisation, participants are randomly allocated to do either condition M followed by N, or vice versa. As some will do each order, any advantage of doing one of the conditions first will probably be evened out in the results. To be more certain that possible effects are evened out, **counterbalancing** can be used. Here, the group of participants is divided into two and one half will

KEY TERMS

demand characteristics: features of the experimental situation which give away the aims. They can cause participants to try to change their behaviour, e.g. to match their beliefs about what is supposed to happen, which reduces the validity of the study.

random allocation: a way to reduce the effect of confounding variables such as individual differences. Participants are put in each level of the IV such that each person has an equal chance of being in any condition.

repeated measures design: an experimental design in which each participant performs in every level of the IV.

participant variables: individual differences between participants (such as age, personality and intelligence) that could affect their behaviour in a study. They could hide or exaggerate differences between levels of the IV.

order effects: practice and fatigue effects are the consequences of participating in a study more than once, e.g. in a repeated measures design. They cause changes in performance between conditions that are not due to the IV, so can obscure the effect on the DV.

practice effect: a situation where participants' performance improves because they experience the experimental task more than once, e.g. due to familiarity or learning the task.

fatigue effect: a situation where participants' performance declines because they have experienced an experimental task more than once, e.g. due to boredom or tiredness.

randomisation:

counterbalancing: counterbalancing is used to overcome order effects in a repeated measures design. Each possible order of levels of the IV is performed by a different sub-group of participants. This can be described as an ABBA design, as half the participants do condition A then B, and half do B then A.

do M followed by N, the other half N followed by M. If on the second test there was a risk of participants accidentally including items learned in the first test, this would be a problem for exactly half the participants in the 'music' condition, and exactly half in the 'no music' condition. Alternatively, a different design could be used.

The problems associated with both independent measures and repeated measures designs are overcome in a **matched pairs design**. Participants are matched into pairs who are similar in ways that are important to the experiment, such as age, gender, intelligence or personality (Figure 1.3). This matching is done on variables relevant to the study, so in a study on the effects of playing a violent computer game, participants might be matched on their existing level of aggression. Identical twins make ideal matched pairs as they are both genetically the same and are likely to have had very similar experiences. Different groups of participants are then used for each level of the IV, with one participant from each pair being in each level of the IV. By using different participants in each group order effects are avoided and the matching of participants minimises the influence of individual differences.

KEY TERM

matched pairs design: an experimental design in which participants are arranged into pairs. Each pair is similar in ways that are important to the study and one member of each pair performs in a different level of the IV.

1.3 Identical twins are perfect participants for a matched pairs design

Experimental design			
	Independent measures	**Repeated measures**	**Matched pairs**
Strengths	Different participants are used in each level of the IV so there are no order effects Participants see only one level of the IV, reducing the effect of demand characteristics Random allocation to levels of the IV can reduce the effects of individual differences	Participant variables are unlikely to distort the effect of the IV, as each participant does all levels Counterbalancing reduces order effects Uses fewer participants than repeated measures so is good when participants are hard to find or if participants are at risk	Participants see only one level of the IV, reducing the effect of demand characteristics Participant variables are less likely to distort the effect of the IV than in an independent measures design as individual differences are matched No order effects
Weaknesses	Participant variables can distort results if there are important individual differences between participants in different levels of the IV More participants are needed than in a repeated measures design so the study may be less ethical if participants are harmed and less effective if there is a small sample because participants are hard to find	Order effect could distort the results As participants see the experimental task more than once, they have greater exposure to demand characteristics	The similarity between pairs is limited by the matching process, so the right matching criteria must be chosen in advance for this to be effective Availability of matching pairs may be limited, making the sample size small (although some studies conducted on twins use very large numbers of pairs)

Table 1.1 Strengths and weaknesses of experimental designs

RESEARCH METHODS IN PRACTICE

A child psychologist conducted an experiment to look at the effect of violent computer games (Figure 1.4). There were two experimental conditions (violent and non-violent). The **dependent variable** was the children's subsequent violent behaviour. The **experimental design** chosen was an **independent measures design**, with different children in each of the experimental conditions. If a **repeated measures design** had been used, in which the same children played each type of game, there could be **order effects**. For example, aggression caused by playing the violent game could still affect children in the non-violent game condition if they did this second. If this were the case, the problem could be reduced by using **counterbalancing**.

1.4 Are children more violent after they have played a violent computer game than before?

However, the use of an independent measures design risks **participant variables**, such as the original level of violence of each child, affecting the results. This could be reduced by either using **random allocation** of participants to each condition or by using a **matched pairs design**. In this case, children with similar aggression levels would be put in the different conditions. To avoid **demand characteristics**, the children would ideally be unaware that they are in an experiment, perhaps by telling them that they are in a computer games competition.

KEY TERMS

standardisation: keeping the procedure for each participant in an experiment (or interview) exactly the same to ensure that any differences between participants or conditions are due to the variables under investigation rather than differences in the way they were treated.

reliability: the extent to which a procedure, task or measure is consistent, for example that it would produce the same results with the same people on each occasion.

Reflections: Look at the Research methods in practice box. Think about the following:

- It would be a good idea to have another level of the IV that did not use a computer game but did use a computer, such as looking at non-violent pictures. Would this be a control condition or another experimental condition?
- One potential order effect that could arise if a repeated measures design was used for this experiment is that the children might get fed up with playing computer games by the second condition. Is this a practice effect or a fatigue effect?
- Suggest a *participant variable* other than initial level of violence that could affect the results of this study.

Types of experiments

Laboratory experiments

Many experiments in psychology are conducted in artificial surroundings, such as a laboratory. Experiments conducted in this way are called laboratory experiments; the participants are not in their usual environment for the behaviour they are performing, and there are strict controls over the situation. For example, a laboratory experiment on the attention of schoolchildren in high and low light levels could be conducted. It might be investigated by testing the children on a computerised attention task conducted in a psychology room in a university.

Evaluating laboratory experiments

Laboratory experiments use many controls. In addition, researchers in laboratory experiments can use **standardisation**, which means that the procedure for each participant can be kept exactly the same. Both controls and standardisation help to make the findings of the experiment **reliable**, that is the researchers would be more certain that the procedures and measures they are using are consistent. Controlling variables also improves **validity** – how certain the researcher can be that they are testing what they claim to be testing. By keeping the situation the same, the researcher can be more certain that any differences in the DV really are due to the differences between levels of the IV rather than due to any extraneous variables.

KEY TERM

validity: the extent to which the researcher is testing what they claim to be testing.

RESEARCH METHODS IN PRACTICE

Dr Splash is conducting a laboratory experiment to test whether older adults detect emotions as quickly as younger people. He has two groups of participants, older and younger ones. This is his IV. He tests them by comparing how quickly they press a button to say that they have recognised the emotion on a face of a screen. This is the DV. Each participant sits at the same distance from the screen. This is one aspect of the **standardisation** of the procedure. In a pilot study, Dr Splash had shown the participants pictures and used a stopwatch to time their reactions himself, but he found he was not very consistent in his ability to stop timing exactly when the participant responded. He therefore changed to the computerised system to improve **reliability**. The pictures of faces included both younger and older people to ensure it was a **valid** test.

Reflections: Look at the Research methods in practice box above.

- Define the independent variable.
- Define the dependent variable.
- Name and explain the experimental design being used in this study.
- Suggest why the use of faces of a range of ages would have improved validity.

Field experiments

Returning to the idea at the beginning of this section of the effect of light levels, the schoolchildren could be tested by altering the number of lights turned on in their normal classroom. Light level would still be the IV and the levels of the IV could be 'all the lights on' and 'half the lights on'. The DV of attention could then be measured by looking at their scores on a class test they were due to take that day. This is still an experiment because it has an IV and a DV (and there will still be some controls, such as the amount of time they spend studying for the test). However, it would be a **field experiment** because the children are being tested on a usual behaviour (the topic test) in their normal environment (the classroom).

Evaluating field experiments

It is a little harder to control variables and standardise procedures in a field experiment than a laboratory experiment. Reliability and validity may therefore be lower. However, validity might be improved because the participants are performing a task that seems normal in a familiar environment. School students taken into a university laboratory might concentrate really hard because they are nervous or interested, which might cover up any differences between the different light level conditions. This means the findings from the laboratory would not **generalise** to other settings as well as those from the classroom. This is a problem of **ecological validity**, and field experiments often have better ecological validity than laboratory experiments (but not always).

Another advantage, if the participants are unaware that they are in an experiment, is that there may be fewer demand characteristics than there would be in a laboratory experiment. These are any features of the experiment that give away the aims and cause participants' behaviour to change, for example to try to 'make the experiment work'.

Natural experiments

A third type of experiment is the **natural experiment**. This is not a true experiment because the researcher cannot manipulate the levels of the IV. The differences or changes in the IV exist, or would occur, even in the absence of the experiment. For example, children's attention could be measured on very dull and very bright days, when the amount of light in the classroom differed (even with the lights turned on). The DV could again be measured with a class test.

KEY TERMS

field experiment: an investigation looking for a causal relationship in which an independent variable is manipulated and is expected to be responsible for changes in the dependent variable. It is conducted in the normal environment for the participants for the behaviour being investigated.

generalise: apply the findings of a study more widely, e.g. to other settings and populations.

ecological validity: the extent to which the findings of research in one situation would generalise to other situations. This is influenced by whether the situation (e.g. a laboratory) represents the real world effectively and whether the task is relevant to real life (has **mundane realism**).

natural experiment: an investigation looking for a causal relationship in which the independent variable cannot be directly manipulated by the experimenter. Instead they study the effect of an existing difference or change. Since the researcher cannot manipulate the levels of the IV it is not a true experiment.

Evaluating natural experiments

Using this method there is less opportunity to control and standardise the situation. There may be **uncontrolled variables**, such as how warm the classroom is. It might be much warmer on sunny days for example. This could matter because the warmth might make the children sleepy and less able to concentrate. This would lower the validity of the findings, although this is countered by the familiarity of the task and setting, which would increase ecological validity.

KEY TERM

uncontrolled variable: a confounding variable that may not have been identified and eliminated in an experiment, which can confuse the results. It may be a feature of the participants or the situation.

Types of experiment			
	Laboratory experiment	**Field experiment**	**Natural experiment**
Strengths	Good control of extraneous variables, raising validity Causal relationships can be determined Standardised procedures raise reliability and allow replication	As participants are in their normal situation for the activity being studied they are likely to behave naturally, making the results representative If participants are unaware that they are in a study, the problem of demand characteristics is less than in laboratory experiments	They can be used to study real-world issues If participants are in their normal situation, their behaviour is likely to be representative If participants are unaware that they are in a study, demand characteristics will be less problematic They enable researchers to investigate variables that it would not be practical or ethical to manipulate
Weaknesses	The artificial situation could make participants' behaviour unrepresentative Participants could respond to demand characteristics and alter their behaviour	Control of extraneous variables is harder than in laboratory experiments, lowering reliability and making replication difficult The researcher will be less sure that changes in the DV have been caused by changes in the IV than in a laboratory experiment Participants may be unaware that they are in a study, raising ethical issues	They are possible only when differences arise naturally Control over extraneous variables is often very difficult As the researcher is not manipulating the IV, they will be less sure of the cause of changes in the DV, so a causal relationship cannot necessarily be established They are often hard to replicate, as controls and standardisation are hard to implement, so the reliability may be low

Table 1.2 Strengths and weaknesses of experimental methods

RESEARCH METHODS IN PRACTICE

A research team is deciding how to test the effect of watching television on children's pro-social behaviour, that is, how nice children are to each other. They will measure pro-social behaviour by observing how often the children hold hands. They are considering two methods. One is a **field experiment**, in which parents either do or do not allow their child to watch television. Alternatively, they could observe the children in a remote place that has no television and then observe them again after the area has begun to receive satellite transmissions. This would be a **natural experiment**. Both of these studies would have more **ecological validity** than a laboratory experiment in which children were shown additional television, because in a laboratory the children would in an unfamiliar environment so may not pay attention to the television if they were nervous or distracted. In both situations there may be **uncontrolled variables**, such as which exact programmes were watched, and for how long. These factors could affect later pro-social behaviour. If the children are aware that their television viewing is being manipulated (in the field experiment) or their pro-social behaviour is being observed (in either experiment) they may try to alter their behaviour to meet the research team's expectations, for example being extra nice to each other (or especially nasty!).

Reflections: Look at the Research methods in practice box above. Which of the following can you identify?

- Independent variable
- Dependent variable.

Is there a *control condition*?

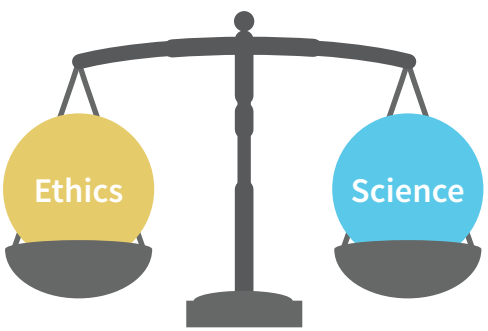
Can you suggest one *extraneous variable* that it would be important to control?

What effect might *demand characteristics* have in this study?

Suggest **one** strength and **one** weakness of conducting the study as a natural experiment in terms of *generalisability*.

Ethics in experiments

The role of ethics in psychology is discussed in detail in Section 1.10. Here we will briefly consider ethics in experiments (Figure 1.5). A participant in a laboratory experiment is likely to know that they are participating in a study and can readily be asked for their **informed consent**. However, it may be necessary to deceive them in order to avoid them working out the aim of the study and altering their behaviour, i.e. to reduce demand characteristics. There is therefore a balance between good ethics and good science. In field and natural experiments, in contrast, it may not be possible to gain consent as the participants may be unaware that they are even in a study. This is an ethical problem because participants should have the right to know what they are entering into and to agree to participate or not. They should also have the **right to withdraw**, which they cannot do if they do not even know that they are in a study, and they should be protected from possible harm.



1.5 Researchers must achieve a balance between good ethics and good science

In all experiments, privacy and confidentiality are important. **Privacy** can be respected in laboratory experiments because the tests or questions used are pre-planned. In the natural settings of field and natural experiments, however, there is a risk of invading privacy so researchers must be more careful of this. **Confidentiality** can be respected in all experiments by keeping the participants' data secure and anonymous, although if the participants are unaware that data has been collected, as in a field experiment, it is important to ensure that they cannot be individually identified, for example by their place of work.

KEY TERMS

informed consent: knowing enough about a study to decide whether you want to agree to participate.

right to withdraw: a participant should know that they can remove themselves, and their data, from the study at any time.

privacy: participants' emotions and physical space should not be invaded, for example they should not be observed in situations or places where they would not expect to be seen.

confidentiality: participants' results and personal information should be kept safely and not released to anyone outside the study.

RESEARCH METHODS IN PRACTICE

A psychology department ethical committee is looking at a research proposal for a study about the effect of cognitions on a therapy designed to help people to relax. The researchers only plan to ask for **consent** about the procedure they will use – listening to an imagery-based relaxation tape – and not their aim. They intend to deceive the participants about the independent variable, which will be either to tell them what will really happen – their pulse rate should fall – or to give them false information by telling them that some people see disturbing flashing lights. When the participants are given the limited information at the start of the study, they will also be told that they can leave at any time, giving them the **right to withdraw**. The instructions on the tape tell the participants to imagine relaxing, intimate thoughts. However, they will also be told that they will not be asked about these thoughts, which ensures their **privacy** is protected. When the participants join the study, each will be given a number, which will be used to identify their data so that their names do not have to be used, ensuring their **confidentiality**.

Reflections: Look at the Research methods in practice box above. Which of the following can you identify?

- The type of *experiment* being planned
- The independent variable
- The dependent variable
- The experimental design

Can you suggest one way in which possible harm to participants could arise as a result of this study?

Suggest why participants may want to withdraw from the study.

Why might it be necessary for the researchers to *deceive* the participants?

Applying your knowledge of experiments to novel research situations

You should be able to recognise experiments (including the IV and DV – and be able to operationalise them, i.e. define them in detail) to decide whether an experiment is a laboratory, field or natural experiment and to comment on controls, standardisation, ethics and reliability and validity. In addition, you should be able to plan an experiment, deciding on an IV and a DV, the type of experiment and how to implement suitable controls and to avoid ethical issues.

SELF-ASSESSMENT QUESTIONS

1 Barry and Anouk are deciding how to test whether gender affects artistic ability. Barry suggests doing a study in the psychology department where they ask students to come in for a study about memory in which they must redraw a complicated image. Barry and Anouk can then see how well they do it. Anouk thinks it would be better to persuade the art teacher to use an art class and set a lesson where students have to copy the same complicated image.

a Explain the type of experiment that is being suggested:

i by Barry

ii by Anouk.

b The independent variable is the same in Barry and Anouk's studies, as is the dependent variable.

i Describe the independent variable (IV).

ii Describe the dependent variable (DV).

c Explain **one** ethical issue that is clear from the procedure they have suggested.

d Suggest **one other** ethical issue and how they could avoid problems with this issue.

1.2 Self-reports

In a **self-report**, the participant gives the researcher information about themselves directly. This is different from experimental tests or observations where the researcher finds the data out from the participant. There are two techniques, questionnaires and interviews, both of which ask the participant questions.

Questionnaires

In a **questionnaire**, the questions are presented to the participant in written form. This may be on paper or as an online survey. There are several different types of questions. The two most important are **closed questions**, which have

KEY TERMS

self-report: a research method, such as a questionnaire or interview, which obtains data by asking participants to provide information about themselves.

questionnaire: a research method that uses written questions.

closed questions: questionnaire, interview or test items that produce quantitative data. They have only a few, stated alternative responses and no opportunity to expand on answers.

a fixed set of possible responses, and **open questions**, which ask for descriptive answers in the participant's own words. Closed questions can take the form of simple choices, such as those asking for yes/no answers or items from a list. Other forms of closed questions include rating scales (where a number is chosen, e.g. between 0 and 5) and Likert scales, which ask the respondent to say how much they agree with a statement such as 'Obesity is not important' or 'Exercise is a necessity' using the choices 'strongly agree / agree / don't know / disagree / strongly disagree'. Some examples of closed questions are as follows:

- What is your gender: male or female?
- How do you travel to school? walk / bicycle / bus / train / car
- Indicate which animal(s) scare you: dog, spider, cat, rat, fish, rabbit, bird. [You may tick as many as you like]
- How much do you like psychology on a scale of 0–4? (0 = not at all, 4 = very much)

Open questions prompt the respondent to give detailed answers, which may be quite long. They contain more depth than the answers to closed questions and are more likely to be able to explore the reasons behind behaviours, emotions or reasoning. They typically ask 'Why…' or simply 'Describe…'. Some examples of open questions are as follows:

- What do you think about children having access to the internet?
- Why do you believe it is important to help people who suffer from phobias?
- How would you suggest parents should discipline their children?
- When do you feel it is important to allow young people the freedom to control their own TV viewing?
- Describe your views on the use of social media sites with regard to encouraging helping behaviour.
- Explain how you would respond if you were told to hurt another person.

KEY TERMS

open questions: questionnaire, interview or test items that produce qualitative data. Participants give full and detailed answers in their own words, i.e. no categories or choices are given.

inter-rater reliability: the extent to which two researchers interpreting qualitative responses in a questionnaire (or interview) will produce the same records from the same raw data.

social desirability bias: trying to present oneself in the best light by determining what a test is asking.

filler questions: items put into a questionnaire, interview or test to disguise the aim of the study by hiding the important questions among irrelevant ones so that participants are less likely to alter their behaviour by working out the aims.

Evaluating questionnaires

Questionnaires using mainly closed questions are easier to analyse than interviews (using more open questions) as they can be used to produce totals of each category of answers so making it simple to summarise the findings. It is also possible to work out averages, which can help to describe the patterns in the results. Where qualitative data is gathered from questionnaires, it produces more detailed, in-depth information. This is an advantage, although it also leads to a problem. Answers to open questions have to be interpreted, and this can lead to a lack of reliability as the researcher may not be consistent in their interpretation. If more than one researcher is involved, there may also be differences between them. This would be a lack of **inter-rater reliability**.

One problem with questionnaires is that it is easy for participants to ignore them, which means the return rate may be very low. Importantly, the people who do reply to a questionnaire may all be quite similar, for example have time to spend because they are unemployed or retired. This would mean all the people who filled out the questionnaire would be quite similar.

1.6 People may lie in questionnaires, lowering validity, for example giving socially desirable responses to questionnaires about eating habits

Another problem with questionnaires is that participants may lie. They may do this because they want to look more acceptable; this is called a **social desirability bias** (Figure 1.6). Participants may also lie if they believe they have worked out the aim of the study. To avoid this, researchers sometimes include **filler questions** among the real questions. The answers to filler questions are not analysed in the research since they serve only to hide the real purpose of the study.

RESEARCH METHODS IN PRACTICE

Dr Blot is a psychology teacher. She wanted to know how her students were progressing on the course. She decided to use the **self-report** method and used an online **questionnaire** that the students did in their free time to collect data. This included several **closed questions** (1–4), which collected quantitative data, and some **open questions** (5 and 6) which collected qualitative data. She asked her colleague to help her to interpret the responses to the open questions and to help to ensure that they had good **inter-rater reliability**, she devised a list to help them to interpret questions 5 and 6. For question 5 it included looking for comments about:

reading up notes
copying up notes
reading the textbook
looking things up online
asking friends
checking with the teacher

For question 6 it included looking for comments about:

copying out notes
making summary notes
making mind maps
using past paper questions
making test cards

Some of the questions on the questionnaire were:

1 How often do you do the homework set?

always | *sometimes* | *never*

2 Have you written yourself a research methods glossary?

yes | *no*

3 'Psychology is a difficult subject'. Do you:

strongly agree | *agree* | *don't know* | *disagree* | *strongly disagree*

4 Rate from 0 to 6 how well you understand the topic we have just completed:

0 = don't understand at all

6 = completely understand

5 Explain what you do after each lesson to help you to remember what you have learned.

6 Describe how you will plan your revision for the next test.

Reflections: Look at the Research methods in practice box.

- Explain the difference between the *open* and *closed questions.*
- Suggest one more open question.
- Suggest one more closed question.
- Suggest why Dr Blot may have chosen to use an online questionnaire rather than one the students did on paper in the classroom.
- Explain why it was important that Dr Blot took steps to raise *inter-rater reliability*.

Interviews

In an **interview**, the researcher is typically face-to-face with the participant. Interviews can, however, be conducted through any medium that allows real-time interaction, such as by telephone or through a chat facility. The same kinds of questions can be asked in interviews as in questionnaires, although more open questions may be used.

The schedule of questions, that is the range of questions that are asked and the order of them, differs between different types of interviews. In a **structured interview**, the questions asked are the same for every participant and the order is fixed. There may even be instructions for the interviewer about how to sit or dress in order that the procedure is standardised each time data is collected. In an **unstructured interview**, in contrast, the questions asked depend on what the participant says, so the questions may be different for each participant. This is a very flexible technique but it may be hard to compare data collected from different participants or by different researchers. A compromise is a **semi-structured interview**. Here, there

KEY TERMS

interview: a research method using verbal questions asked directly, e.g. face-to-face or on the telephone.

structured interview: an interview with questions in a fixed order which may be scripted. Consistency might also be required for the interviewer's posture, voice, etc. so they are standardised.

unstructured interview: an interview in which most questions (after the first one) depend on the respondent's answers. A list of topics may be given to the interviewer.

semi-structured interview: an interview with a fixed list of open and closed questions. The interviewer can add more questions if necessary.

are some fixed questions, which make sure that there is some similar information from every participant. This means that comparisons can be made between them, and averages can be calculated if this is appropriate. In addition, it is possible to ask some questions that are specific to individual participants. This allows the researcher to develop ideas and explore issues that are particular to that person.

Evaluating interviews

As with questionnaires, interviewees may lie either because they want to seem more acceptable (a social desirability bias) or because they think they know the aim of the study, and are either trying to help the researcher by giving the answers they need, or to disrupt the research by doing the opposite. Interviewing is often time consuming and this can be a problem if it restricts the types of participants who volunteer for the research because it would give a narrow representation of feelings, beliefs or experiences.

When interpreting participants' responses to questions in an interview, researchers must be careful not to be **subjective**, that is, to produce findings which are based on a personal perspective. Instead, they should aim for **objectivity**, i.e. taking a view that is not led by one's own feelings or beliefs. To achieve this, the interviewer may ask other researchers, who are experienced but unaware of the aims of their research, to interpret the findings.

KEY TERMS

subjectivity: a personal viewpoint, which may be biased by one's feelings, beliefs or experiences, so may differ between individual researchers. It is not independent of the situation.

objectivity: an unbiased external viewpoint that is not affected by an individual's feelings, beliefs or experiences, so should be consistent between different researchers.

Applying your knowledge of self-reports to novel research situations

You should be able to recognise self-report studies, and decide whether they are questionnaires or interviews. You should also be able to choose which of these to use in a new situation. In addition, you should be able to recognise and write different types of questions (open and closed) and to identify and design different interview schedules (structured, semi-structured and unstructured). When doing this, it is important to consider how the method used affects the availability of different types of participants and their honesty, as this affects the validity of the findings.

You should also think about the kinds of data that are produced, and the way it will be used. Although numerical data from closed questions can be analysed mathematically, data from open questions provides more in-depth information which may be more valid. For example, a closed question might not have a response close to a person's view, so an open question would allow that person to express views that they could not do in the choices available in the closed question.

Finally, the reliability of self-report data is important. Questionnaires and structured interviews may be higher in reliability because they are likely to be administered in a consistent way and because they generate numerical results which do not need interpretation. Responses to open questions, in contrast, have to be interpreted by the researcher and since they may differ in their opinions there is the possibility that they will be subjective.

RESEARCH METHODS IN PRACTICE

Dr Splash is planning an **interview**-based study because he wants to confirm that a new shopping centre is making people more helpful to each other. He wants to collect objective data about the number of times people are altruistic so has devised a **structured interview** with a list of specific questions such as 'How many times has someone held a door open for you?', 'Have you helped anyone carry their shopping?' and 'Have you seen anyone assisting a parent with a buggy?'. However, he is worried that this may produce very limited data so has an alternative plan to use an **unstructured interview**. This would begin with the question 'Please can you describe how friendly or helpful you have found people to be at the new shopping centre', after which he would base his questions on what they said. A colleague suggests that both methods have limitations. Interpreting the responses to the unstructured interview might lead to very **subjective** data, especially as Dr Splash already believes that the participants will be finding the shopping centre encourages helpfulness. Although the data from the closed questions in the structured interview might produce more objective measures, this would limit opportunities for asking participants to expand on their answers. The colleague suggests that a **semi-structured interview** might be better.

Reflections: Look at the previous Research methods in practice box.

- Why is the first of Dr Splash's suggestions a structured interview?
- Why would the data from these questions be more objective?
- Why is the second plan an unstructured interview?
- What is the problem with subjective interpretations of the participants' responses in the unstructured interview?
- Suggest why a semi-structured interview would be better in this case.

SELF-ASSESSMENT QUESTIONS

2 Shareen and Judith are investigating people's phobias. They have decided to use self-reports. Shareen is suggesting using a questionnaire and Judith wants to interview people instead.

a Suggest **one** closed question and **one** open question that Shareen could use.

b Suggest **one** reason why Judith might want to conduct an unstructured interview.

c Describe **one** ethical problem that might arise in **either** Shareen's **or** Judith's version of the study.

1.3 Case studies

A case study is a detailed investigation of a single instance, usually just one person, although it could, for example, be a single family or institution. The data collected is detailed and in-depth and may be obtained using a variety of different techniques. For example, the participant may be interviewed, observed, given tests or asked to fill in questionnaires. Case studies are particularly useful for looking at rare cases where a detailed description is useful, and for following developmental changes, where the progress of a child, or a person with a disorder can be tracked through their improvement or decline. Case studies are therefore sometimes linked to therapy but it is important to remember that when the case study as a research method is being discussed, the therapeutic purpose is not the main aim.

Evaluating case studies

In some ways, the findings from case studies are highly valid, as the individual is explored in great depth and within a genuine context such as their work or family. Validity may be improved further using triangulation, where the use of different techniques should produce similar findings, for example observations and interviews with the participant and questionnaires for their family should all lead to similar conclusions. The research includes details such as their past as well as their present situation, their social interactions, their thinking and their emotions as well as their behaviours. Such detail, however, carries risks. One potential problem is the development of a close relationship with the researcher. This may make the researcher subjective in their outlook, which would reduce the validity of the study. The level of detail can also be an ethical threat, as the questions asked may intrude into the participant's private life and they may feel unable to refuse to answer them. The detail about the individual may make it hard to disguise their identity, even if they are not referred to by name, which would risk breaking the guideline of confidentiality.

Reliability is also an issue, as there is a single participant and perhaps one or only a few researchers. This, and their involvement with the case, means that they may find it hard to be objective, that is to take an external, unbiased view of the findings, for example when they interpret what the participant has said. This means that the findings may be limited to only this case, or to very few others.

Applying your knowledge of case studies to novel research situations

You should be able to recognise case studies, and when it is appropriate to use one. You should also be able to suggest possible techniques that could be used in a case study. When making these decisions, it is important to consider the validity and reliability of the findings. One way that the validity can be improved is though triangulation, where different methods are used within the case study to obtain the same information: for example, finding out about the participant's behaviour by observing them, interviewing them and asking their relatives to fill out a questionnaire. If the same results are obtained by all the methods, this suggests that the results are valid. Another consideration in planning case studies is an ethical one. Participants should be aware of their commitment, so that they can give their informed consent, and particular attention should be paid to ensuring their privacy is not invaded and that confidentiality is maintained.

RESEARCH METHODS IN PRACTICE

A psychologist in a sleep clinic has been conducting a **case study** on a patient, SL, who has had very bad dreams for several years. The psychologist uses an EEG to follow SL's sleep cycles and to detect when the patient is dreaming. The patient is then woken up and asked what the dream is about. SL has also been asked to keep a dream diary to record when the bad dreams occur. Members of SL's family have been interviewed to find out when the problems with nightmares started and how often they occur.

Reflections: Look at the Research methods in practice box above.

- How many different methods can you identify?
- Give two reasons why this is a case study.
- The psychologist is concerned that if the patient SL wanted to *withdraw* from the study, this might be quite difficult. Explain why this might be so.
- Explain the *ethical* reason for the researcher referring to the patient as SL.
- Suggest one **other** ethical issue that might be a problem in this study.
- Suggest **one** practical issue that might be a problem in this study.

SELF-ASSESSMENT QUESTIONS

3 Damon and Inka are planning a case study to investigate responses to emotional situations.

a Suggest **three** techniques that Damon and Inka might use in their case study.

b i Describe **two** ethical problems that might arise in the study that Damon and Inka are planning.

ii For **one** of these problems, suggest a possible solution.

c Explain whether the results from Damon and Inka's study would be typical of the way everyone would respond to emotional situations.

1.4 Observations

Observations involve watching human or animal participants. This can be done in two overall ways. A **naturalistic observation** is conducted in the participants' normal environment, without interference from the researchers in either the social or physical environment. A **controlled observation** is conducted in a situation which has been manipulated by the researchers. This may be in terms of the social or physical environment. Controlled observations can be done in either the participants' normal environment or in an artificial situation such as a laboratory.

At the beginning of a study, observations may be non-focused, that is, the whole range of possible behaviours are considered. If this continues throughout the study, it is called an **unstructured observation**. Usually, however, the range of behaviours studied is narrowed to a set of behaviours, and this technique is called a **structured observation**. The specific activities to be recorded are clearly defined in **behavioural categories**. This helps the observers to be consistent, i.e. it improves **inter-observer reliability**.

Another decision to be made is the role of the observer in the social setting. This may be participant or non-participant. A **participant observer** is part of the social setting, whereas a **non-participant observer** does not become involved in the situation being studied. This can be

KEY TERMS

naturalistic observation: a study conducted by watching the participants' behaviour in their normal environment without interference from the researchers in either the social or physical environment.

controlled observation: a study conducted by watching the participants' behaviour in a situation in which the social or physical environment has been manipulated by the researchers. It can be conducted in either the participants' normal environment or in an artificial situation.

unstructured observation: a study in which the observer records the whole range of possible behaviours, which is usually confined to a pilot stage at the beginning of a study to refine the behavioural categories to be observed.

structured observation: a study in which the observer records only a limited range of behaviours.

behavioural categories: the activities recorded in an observation. They should be operationalised (clearly defined) and should break a continuous stream of activity into discrete recordable events. They must be observable actions rather than inferred states.

inter-observer reliability: the consistency between two researchers watching the same event, i.e. whether they will produce the same records.

participant observer: a researcher who watches from the perspective of being part of the social setting.

non-participant observer: a researcher who does not become involved in the situation being studied, e.g. by watching through one-way glass or by keeping apart from the social group of the participants.

KEY TERMS

overt observer: the role of the observer is obvious to the participants.

covert observer: the role of the observer is not obvious, e.g. because they are hidden or disguised.

achieved by watching through one-way glass or by keeping apart from the social group of the participants.

The role played by the observer may be either **overt** (it is obvious that they are an observer) or **covert** (they are hidden or disguised so the participants do not know the individual is an observer). Participant observers are overt, for example, if the researcher is holding a clipboard. When a participant observer is disguised as a member of the social group (Figure 1.7), or when a non-participant observer is physically hidden (e.g. by using CCTV), they are covert. Participants cannot be aware that they are being watched if the observer is covert. This increases validity as it is unlikely that participants would be affected by being observed, so demand characteristics and the effects of social desirability are reduced. However, covert observations raise practical issues, as the observer must be either hidden, far away or disguised in their role. This may make data collection more difficult, potentially reducing validity and reliability. Furthermore, covert participant observation raises ethical issues as the participants cannot give informed consent, and if they work out the observer's role this can cause distress.

1.7 A covert participant observer is disguised by being part of the social group: which one is the observer?

Evaluating observations

Naturalistic observations have the advantage that the behaviours seen are true to life. They are more likely to reflect the way the individuals really behave than if there is interference in the situation from researchers, as is the case in controlled observations. However, there is no guarantee that the behaviours being studied will actually occur in a naturalistic situation, so it may be necessary to use a controlled observation.

Using an unstructured observation ensures that any important behaviours are recognised, but it may be very difficult to record all the activities accurately and many may be irrelevant. It is therefore likely, especially when only specific activities are of interest, that a structured observation will produce more reliable data.

The role played by the observer, and the participants' awareness of this, affect validity. If participants are unaware of the observer, or can ignore them, their activities are more likely to reflect their normal behaviour. This means that covert observers would produce more valid results than overt ones. However, in the case of covert participant observers there is an ethical issue of deception. The participants may interact with the observer in ways that they might have chosen not to if they had been aware that the individual was a researcher. This could invade their privacy and cause distress. However, an overt observer is likely to alter the behaviour of the participants as they are aware that they are being watched. This would reduce the validity of the findings as the activities being recorded are less likely to reflect real-world behaviour.

Applying your knowledge of observations to novel research situations

Observations can be used either as a research method or as a means to collect data in other research methods such as case studies, experiments or correlations. You should be able to distinguish between these two situations. Observation is being used as a research method in itself when the study consists solely of a means to collect data by watching participants and recording their behaviour directly to provide data. Observations are used as a technique to collect data about variables in other research methods when they are used to measure the dependent variable in an experiment or one or both variables in a correlation. In a case study, observations can be used alongside other techniques to explore a single instance in detail.

You will need to be able to decide when it is appropriate to use observations as a method, or as a technique within other methods. You should be able to recognise and justify choices about naturalistic versus controlled, structured versus unstructured, participant versus non-participant and covert versus overt observations. You will also need to be able to suggest ways of achieving these, such as how to make an observer participant or covert.

RESEARCH METHODS IN PRACTICE

Dr Blot is interested in whether her students detect each other's emotions and plans a **controlled observation**. She asks three students to act as confederates. They are told to take it in turns to appear quite sad in the common room at lunchtime. Dr Blot is on lunch duty with a colleague so they can act as **non-participant**, **overt** observers as they walk through the common room. The students will take no notice of them as they are used to them being there. Dr Blot suggests that she and her colleague use a list of specific behaviours to record, so they are doing a **structured observation**. This will also help to raise **inter-observer reliability** as they will be working from the same definitions, such as recording 'shows concern without action' if people look at the confederate without moving towards them, 'verbalises concern' if someone goes up to the confederate and asks them if they are OK and 'takes action' if they engage in a behaviour such as putting their arm round the confederate or buying them a drink.

Reflections: Look at the Research methods in practice box above.

- Suggest **one** other *behavioural category* that might have been included in the structured observation and define it.
- If Dr Blot had conducted an *unstructured observation*, how would the method have differed?
- An alternative plan would have been to have conducted a *naturalistic observation* and watched to see if any students appeared to be sad and how others responded. Outline **one** way it would have been ethically more acceptable and **one** way in which it would have been ethically less acceptable.
- Suggest how Dr Blot could have used a *participant, covert observer* rather than being an overt observer.

SELF-ASSESSMENT QUESTIONS

4 Debra and Jin want to use observations to find out about the behaviour of animals. Debra wants to go to the park and hide in a tree to observe the animals that live there. Jin thinks it would be better to set up an artificial situation and watch laboratory rats interacting with objects they would put in a special box.

a Who is suggesting a naturalistic observation and who is suggesting a controlled observation?

b Explain whether the observers in Debra's study would be overt or covert.

c For either Debra's or Jin's suggestion, decide whether it should be conducted as an unstructured or a structured observation and justify your choice.

1.5 Correlations

A correlational analysis is a technique used to investigate a link between two measured variables. **Correlations** are useful when it is possible only to measure variables, rather than manipulate them, i.e. when an experiment cannot be conducted. This may be because changing the variables would not be practical or would be unethical. For example, it would not be practical to conduct an experiment which controlled children's long-term exposure to television and it would not be ethical to increase real-life exposure to violent television programmes. Both of these could, however, be investigated using correlations. It is important to recognise that any link found between two variables in a correlation cannot be assumed to be a **causal relationship**, that is, we cannot know whether the change in one variable is *responsible* for the change in the other variable (Figure 1.8).

1.8 A bizarre positive correlation has been reported between ice cream consumption and murder rates. This relationship is a correlation, however, so we cannot conclude that eating ice cream causes people to commit murder

To look for a correlation between two variables, each variable must exist over a range and it must be possible to measure them numerically. Several techniques can be used to collect data for correlations, such as self-reports, observations and different kinds of tests.

We cannot say from one correlation that an increase in one variable has caused an increase (or decrease) in the other, because it is possible that the changes in both variables could be the result of another factor. Imagine that two variables are being measured: attention in class and score

KEY TERM

correlation: a research method which looks for a causal relationship between two measured variables. A change in one variable is related to a change in the other (although these changes cannot be assumed to be causal).

on a test. If these two correlate it would be tempting to say that paying attention in class is responsible for good test results but we cannot be sure of this. It is possible that both of these factors depend on another variable, such as the dedication of the individual student. The sort of student who pays more attention in class might also study much harder for the test. All we can conclude is that the two factors we have measured vary together, not that there is a cause-and-effect or causal relationship between them. As a consequence, it is important that you refer to 'measured variables' or 'co-variables' in a correlation and not independent and dependent variables. To make judgements about causality, an experiment must be used, so that we can be more certain that it is the manipulation of one variable that is responsible for the change in the other. If, on the other hand, we conduct a correlational study and find that there is *no* link between two variables, then we can conclude that there is no causal relationship.

The nature of the relationship between the two variables in a correlation can be described in terms of its *direction*. In a **positive correlation**, the two variables increase together. The change is in the same direction, so higher scores on one variable correspond with higher scores on the other. For example, in a positive correlation between exposure to aggressive models and violent behaviour, greater exposure to models would be linked to higher levels of violence. When two variables are **negatively correlated**, higher scores on one variable correspond with low scores on the other. For example, a negative correlation might exist between number of years in education and level of obedience: people with fewer years of education are more obedient (see also Section 1.9 on how to draw a scatter graph and a discussion of the *strength* of a correlation).

Evaluating correlations

A correlational study can only be valid if the measures of both variables test real phenomena in effective ways. To achieve this, the variables must be clearly defined and relate directly to the relationship being investigated. The reliability of a correlation depends on the measures of both variables being consistent. So, for some correlations, such as those using scientific scales (such as volume in cm^3 or time in seconds), the measures will be highly reliable. In other cases, such as studies correlating variables measured using self-reports or observations, there is a risk that reliability will be lower. This is because results from these measures may be less objective than from scientific measurements.

The main issue with correlations, however, is to remember that the conclusions do *not* necessarily reflect a causal relationship.

Applying your knowledge of correlations to novel research situations

Correlations provide a good starting point for research. They can indicate whether a relationship exists that might be worth pursuing with other research methods, such as experiments. Correlations are also useful because they enable researchers to explore problems when it is not practically or ethically possible to conduct experiments. You should be able to distinguish between correlations (with two measured variables) and experiments (where there is one variable – the IV – that is manipulated by the researcher and only one that is measured – the DV). You should also be able to recognise the difference between positive and negative correlations.

You will need to be able to decide when it is appropriate to use a correlation rather than any other method, for example when it is impossible to manipulate variables for practical or ethical reasons. You should also be able to justify choices about ways to measure the variables in a correlation and to suggest whether you would expect a positive or a negative correlation in a study. Finally, you will need to understand how to display the results of a correlational study on a scatter graph. This is discussed in Section 1.9.

KEY TERMS

positive correlation: a relationship between two variables in which an increase in one accompanies an increase in the other, i.e. the two variables increase together.

negative correlation: a relationship between two variables in which an increase in one accompanies a decrease in the other, i.e. higher scores on one variable correspond with lower scores on the other.

RESEARCH METHODS IN PRACTICE

Professor Smudge is studying phobias. She thinks that there may be a **correlation** between how long a phobia has lasted and how severe it is. She is asking her sample of participants with phobias to record how many years they have suffered with their fear and rate how much the phobia interferes with their life on a scale of 1 (hardly at all) to 10 (almost constantly and prevents me from functioning normally). If there is a link between the two measured variables, there are two possible outcomes. There may be a **positive correlation** – phobias that have lasted longer may be more severe. There may, however, be no relationship between the two variables. If so, when she plotted the results on a **scatter graph**, the points would appear randomly placed, rather than lying on a line.

Reflections: Look at the Research methods in practice box above.

- An alternative outcome might have been that phobias that have lasted longer are less severe. Explain why this is a negative correlation.
- If Professor Smudge found a positive correlation, it would be tempting, but incorrect, to say that the passage of time makes phobias worse. Why would this conclusion be incorrect?

SELF-ASSESSMENT QUESTIONS

5 Ekua and Takis are going to find out if there is a correlation between the amount of coffee people drink and the number of dreams they recall.

a Explain why this is a correlational study and not an experiment.

b Suggest whether the results will show a positive correlation or a negative correlation.

c **i** Suggest **one** way to measure the amount of coffee that people drink.

ii Explain either **one** advantage or **one** disadvantage of the way you have suggested measuring this variable.

1.6 Research processes

We began this chapter with a discussion about the need for research to test different ways to help students to learn or different therapies to help people who are mentally ill. These are examples of real-world problems that psychologists try to solve through their research. In this section we will consider the steps a psychologist might take in developing research to investigate a question or problem. This research process can be thought of as having several steps, the:

- development of an aim and **hypothesis**
- selection of a research method and, in an experiment, the experimental design
- definition, manipulation, measurement and control of variables
- ethical considerations
- selection of participants
- analysis of data, including the drawing of conclusions
- evaluation of research.

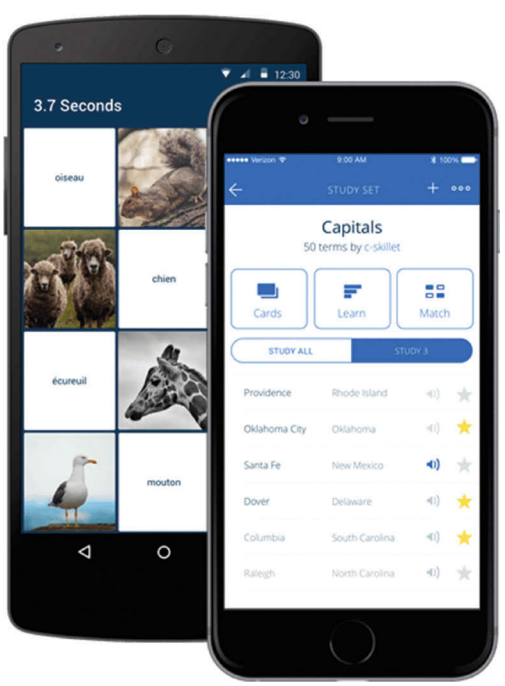
We will consider each of these steps in turn, evaluating the alternatives where appropriate and illustrating how the ideas can be applied to novel research situations.

Aims and hypotheses

Aims

Consider the idea of different ways to help students to study, perhaps using mind maps or revision apps (see Figure 1.9). Imagine that a psychologist, Dr Blot, asks a few of her psychology students which method they prefer, and finds that both are quite popular. Dr Blot wants to know which is most effective. This is Dr Blot's aim – *to investigate whether mind maps or revision apps are more effective at helping students to learn*. So, the *aim* tells you the purpose of the investigation. It is generally expressed in terms of what the study intends to show.

In a correlation, the aim is to investigate a link or relationship between two measured variables, such as between the number of computer games a student plays and their final A Level grade.



1.9 Revision apps such as Quizlet and Gojimo may – or may not – help students to learn

Hypotheses

To make her research more exact, Dr Blot needs to present this aim as a hypothesis, that is, as a testable statement. A hypothesis should provide a little more detail about the

KEY TERM

hypothesis (plural hypotheses): a testable statement predicting a difference between levels of the independent variable (in an experiment) or a relationship between variables (in a correlation).

variables being investigated than the aim. Importantly, a hypothesis should also be *falsifiable*, that is it should be possible for it to be shown to be wrong. The main hypothesis in a study (sometimes called the **alternative hypothesis**) can be written in several different ways. They differ in terms of the nature of the prediction they make about the results of an investigation.

Non-directional hypotheses

A **non-directional (two-tailed) hypothesis** predicts that there will be an effect, but not the direction of that effect (Figure 1.10). In an experiment, this means that the hypothesis will suggests that the IV will change the DV but not whether the effect will be an increase or a decrease. This type of hypothesis is chosen if the effect of the variable is being tested for the first time, so there are no previous results to suggest what the results might be. For example, Dr Blot's hypothesis could be: *There is a difference between the effectiveness of mind maps and revision apps in helping students to learn.* Note that it is predicting a difference, but not which condition will be better at helping with learning.

A non-directional hypothesis in a correlational study predicts that there will be a relationship between the two measured variables. For example, a directional hypothesis might be: *There will be a correlation between the number of computer games a student plays and their final A Level grade*.

Directional hypotheses

When most previous research or other evidence suggests the nature or 'direction' of an effect we can use a **directional (one-tailed) hypothesis**. In an experiment this means saying which condition will be 'best' (i.e. produce the 'highest' scores) and in a correlational study, whether there will be a positive or negative correlation.

1.10 Unlike with a one-tailed hypothofish, you can't see which way a two-tailed hypothofish will swim

Returning to Dr Blot's study, there might be evidence that revision apps are better than mind maps, perhaps because they are more 'active' and being actively engaged helps memory. This is a directional prediction so the hypothesis might be: *Students using revision apps will learn better than students using mind maps.* Note that the opposite prediction could also be expressed as a directional hypothesis. This would be: *Students using mind maps will learn better than students using revision apps.* We might make this prediction if we believed that writing a mind map yourself was more effective than just reusing ready-made materials on revision apps.

A directional hypothesis for the correlational study about computer games and grades could say: *There will be a negative correlation between the number of computer games a student plays and their final A Level grade*. We might make this prediction if we believed that the time spent playing games might stop students working. However, a different directional hypothesis could be: *As the number of computer games a student has increases, their A Level grade increases.* We might make this prediction if we believed that students who engaged more with technology, even through games, were also more likely to benefit from technology-based learning aids. Remember that your hypothesis should not say that one factor *causes* the change in the other.

Null hypotheses

The alternative hypothesis is an alternative to the **null hypothesis**. In an experiment, the null hypothesis states that any difference in the DV between levels of the IV is so small that it is likely to have arisen by chance. For Dr Blot's study, the null hypothesis could be written either as: *There will be no difference between the effectiveness of mind maps and revision apps in helping students to learn* or *Any difference in effectiveness of mind maps and revision apps in helping students to learn is due to chance.*

KEY TERMS

alternative hypothesis: the testable statement which predicts a difference or relationship between variables in a particular investigation.

non-directional (two-tailed) hypothesis: a statement predicting only that one variable will be related to another, e.g. that there will be a difference in the DV between levels of the IV in an experiment or that there will be a relationship between the measured variables in a correlation.

directional (one-tailed) hypothesis: a statement predicting the direction of a relationship between variables, e.g. in an experiment whether the levels of the IV will produce an increase or a decrease in the DV or in a correlation whether an increase in one variable will be linked to an increase or a decrease in another variable.

null hypothesis: a testable statement saying that any difference or correlation in the results is due to chance, i.e. that no pattern in the results has arisen because of the variables being studied.

To help you to write null hypotheses for experiments, remember that they should say 'There will be no difference in the DV between *condition X* and *condition Y*' or that 'Any difference in the DV between *condition X* and *condition Y* is due to chance'. Make sure that you *always* state both of the levels of the IV and the DV otherwise your null hypothesis will not make sense. For example, the null hypothesis 'There is no difference between mind maps and revision apps' is meaningless.

Correlational studies also need a null hypothesis. These predict either no link or that any relationship could have occurred by chance. A general null hypothesis for a correlational study reads: *There will be no relationship between variable X and variable Y* (or *Any relationship between variable X and variable Y is due to chance*). For example: *There will be no relationship between the number of computer games a student has and their A Level grade* (or *Any relationship between the number of computer games a student has and their A Level grade is due to chance).*

Reflections: Look at the Research methods in practice box.

- Which study is an experiment and which is a correlation?
- Can you suggest a different directional hypothesis for the correlation, one that proposes a negative correlation?
- What is wrong with the alternative hypothesis '*Soft chairs will be better than hard chairs*'?

1.7 The definition, manipulation, measurement and control of variables

Variables are factors that change or can be changed. In experiments these are the independent and dependent variables as well as any extraneous factors that are or are not controlled. In correlations there are two measured variables (see Section 1.5).

Experiments look for changes or differences in the dependent variable (DV) between two or more levels of the independent variable (IV), which are set up by the experimenter. It is important that the IV is clearly defined, or **operationalised**, so that the manipulation of the conditions represents the intended differences. Consider

KEY TERM

operationalisation: the definition of variables so that they can be accurately manipulated, measured or quantified and replicated. This includes the IV and DV in experiments and the two measured variables in correlations.

RESEARCH METHODS IN PRACTICE

Dr Blot is thinking about buying new chairs for her classroom. Her **aim** is to explore whether hard or soft chairs help her students to work better (Figure 1.11). She wonders whether to predict a **non-directional (two-tailed) hypothesis**: *There is a difference in work rate of students sitting on comfortable and uncomfortable chairs.* Another psychology teacher says that students respond well to other comforts like access to a drinks machine or snack bar, and the soft chairs might make them happier, so they work harder. Dr Blot rewrites her prediction as a **directional (one-tailed) hypothesis**, saying: *Students on comfortable chairs will have a higher work rate than ones sitting on uncomfortable chairs.* A third teacher is not convinced and suggests that if the students are too comfortable they will become sleepy and lazy, so work less. The hypothesis would then be: *Students on comfortable chairs will have a lower work rate than ones sitting on uncomfortable chairs.* Her **null hypothesis** would be: *Any difference in work rate of students sitting on comfortable and uncomfortable chairs is due to chance.*

Now imagine a study which aims to look for a link between sleep and emotions. A non-directional hypothesis might be: *There will be a correlation between amount of sleep and emotional reactivity.* The possible directional hypothesis could say: *There will be a positive correlation between amount of sleep and how emotional someone is*. Remember *not* to say that one factor causes the other to change. The null hypothesis here would be: *Any relationship between amount of sleep and emotional reactivity is due to chance.*

1.11 Would you work harder in lessons if you had more comfortable classroom chairs?

a study testing the effect of age on susceptibility to false memories. The IV would be age, with, for example, 'young', 'middle-aged' and 'old' groups. It is important to know *how* old the people in the groups are; this is operationalisation. You might operationalise 'young' as under 20 years old, 'middle aged' as 40–50 years old and 'old' as over 70. The DV must also be operationalised, so it can be measured effectively. We could operationalise the DV by counting the number of details 'remembered' about the false memory or how convinced the participants were that it was true.

Controlling variables and standardising procedures

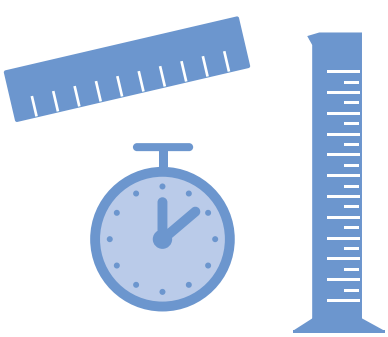
Controlling of variables

Psychologists need to control variables in their studies in order to be more certain about their findings. In particular, in experiments, it is important to control any **extraneous variables** that might have a consistent effect. These are called **confounding variables** as they confound, i.e. confuse, the results. Confounding variables can either work against the effect of the IV or increase the apparent effect of the IV because they act on the DV selectively in one level of the IV. These variables are the most important to control. Other extraneous variables, which have a random effect on the DV across all levels of the IV, are not so problematic. The difficulty is to identify which variables it will be important to control before the experiment starts. This is one function of a **pilot study**, a preliminary test of the procedures of a study. However, if important extraneous variables are not identified in advance, they will become uncontrolled variables, which will affect the results, making them difficult to interpret because it will be hard to separate the effects of the IV from those of the other factors that may have influenced the DV systematically.

Consider Dr Blot's study of students and chairs (Section 1.6). Perhaps Dr Blot compares one class in a room with the new (soft) chairs and another class in a different room with the old (hard) chairs. If the room containing the new chairs happens to have better lighting, Dr Blot may find that the students in the 'soft chairs' condition perform better. However, this may be due to the confounding variable of brighter lighting rather than the comfort level of the chairs. This is an example of a **situational variable**, because lighting is an aspect of the environment. Another possible extraneous variable is how hard working the individual students are. We might expect normally hard-working students to be randomly distributed among the different classes, in which case this variable is not a problem. However, suppose that all the students in the 'soft chairs' class do arts and humanities subjects and all the students in the 'hard chairs' class do maths and sciences. If Dr Blot happens to use a test of data analysis as her measure of the DV, she might find that the students in the 'hard chairs' level of the IV perform better. This would suggest that the soft chairs make students perform worse but could in fact be due to the extraneous variable of subject groups. This is an example of a participant variable, because the difference has been caused by a feature of the individuals, i.e. their ability in maths.

Standardisation

Controls make sure that the levels of the IV represent what they are supposed to, i.e. that the differences between them are going to create the intended situations to test the hypothesis. This helps to ensure validity (see Section 1.11). It is also important that every participant is treated in the same way. This is the process of standardisation. One way that this is achieved is by having standardised instructions, that give the same advice to every person in the study. Imagine a questionnaire testing attitudes to helping behaviour. All participants would need to have the same advice about how to fill it in, so that any effects of social desirability – the influence of needing to give answers that were acceptable to society – were equally likely.



1.12 Scientific instruments are likely to produce objective, reliable data

The procedure itself also needs to be standardised. This involves having equipment or tests that are consistent, i.e. that measure the same variable every time and always do so in the same way. Consider the questionnaire about attitudes to helping again. All the questions should focus on the same aspect of behaviour, i.e. helping, rather than some looking at a different but possibly

KEY TERM

situational variable: a confounding variable caused by an aspect of the environment, e.g. the amount of light or noise.

control: a way to keep a potential extraneous variable constant, e.g. between levels of the IV, to ensure measured differences in the DV are likely to be due to the IV, raising validity.

related factor, such as being friendly or happy. In laboratory experiments, standardisation is easier than in other studies, as equipment is likely to be consistent, for example stopwatches or brain scans. However, some of these measures, such as brain scans, may need to be interpreted and this must also be done in a standardised way (Figure 1.12).

Applying your knowledge of variables and controls to novel research situations

In experiments it is important to be able to decide how to operationalise the IV to produce the different conditions (to achieve validity) and to measure the DV in a consistent (reliable) way and to be able to justify these choices. You will also need to be able to decide what controls it is appropriate to use and to suggest how these can be implemented.

When writing hypotheses, you should ideally operationalise the variables you are referring to. For example, in the hypothesis 'Students using revision apps will learn better than students using mind maps', we do not know how 'better learning' will be measured, or which apps are being used because the variables are not operationalised. To be complete, the hypothesis needs more detail, such as 'Students using the Gojimo revision app will gain better test marks than students using mind maps'. Similarly, the hypothesis 'There will be a correlation between amount of sleep and emotional reactivity' does not operationalise either variable. This could be improved by saying 'There will be a correlation between the number of hours a person sleeps for and their emotional reactivity indicated by how loudly they cry during a sad film'.

RESEARCH METHODS IN PRACTICE

In Dr Blot's experiment about classroom chairs (see Section 1.6), the IV of hard and soft chairs must be operationalised. The text also referred to them as 'comfortable' and 'uncomfortable' chairs, but this still does not make clear what is meant by 'hard' and 'soft'. This could be done by saying *'chairs with wooden/plastic seats'* and *'chairs with padded seats'*. **Operationalisation** of the DV is also needed. The text referred to working 'better' and 'harder' but this is also incomplete. We need to expand on the idea of *work rate,* which was also used. This might be measured by counting the number of pieces of homework handed in late, or the time spent doing extra work. Either of these would indicate the amount of work being done. There are many **extraneous variables** that could be important in this study, for example, some of the students might work harder anyway or the rate of work might vary with the weather. If students worked harder on sunny days, this would be a **situational variable**. The important variables to control are those that could confound the results. For example, if there was a choice of chairs, the students who chose to sit on comfy ones might be the laziest. If left as an **uncontrolled variable**, this could alter the results by making it look as if soft chairs made students work less.

In the description of the correlation on sleep and emotions (Section 1.6), the two measured variables were the *'amount of sleep'* and *'how emotional someone is'* or their *'emotional reactivity'*. It is important to operationalise variables in correlations too. To operationalise these variables we could measure *the amount of time* spent sleeping and ask the participant to fill in a questionnaire about their feelings to measure their emotions.

Reflections: Look at the Research methods in practice box.

For the experiment:

- Suggest **one other** way the IV could be operationalised.
- Suggest **one other** way the DV could be operationalised.
- Would a possible difference between how lazy students were be a *situational variable* or a *participant variable*?
- Suggest **one other** possible *extraneous variable*.

For the correlation:

- Suggest **one other** way the variable of 'emotions' could be operationalised.

1.8 Sampling of participants

A **population** is a group of people (or animals) with one or more characteristics in common. For example, the population of a country is all the people who live there, the population of internet users is everyone who can access the internet. A population could also be people who share a particular interest, such as 'all football supporters' or who have a particular feature, for example 'all left-handed people'. The **sample** is the group of people who participate in a study. They are taken from a population and should ideally be representative of that group so that the findings will be representative. Details about the sample, such as age, ethnicity and gender, are important in most investigations because these features affect many psychological differences.

Other characteristics of the sample, such as socio-economic status, education, employment, geographical location or occupation, may also be relevant. The size of the sample also matters. Small samples are less reliable and are likely to be less representative. The different **sampling techniques** described below produce samples which differ in terms of how well they represent the population. The extent to which they are representative of the population determines how effectively generalisations can be made.

Opportunity sampling

Studies are often conducted with the people who are around at the time. Selecting participants in this way is called **opportunity sampling**. An opportunity sample is unlikely to represent the population fairly because readily available people will tend to be alike so they are unlikely to include the variety that exists. For example, many studies are conducted using university students as they are convenient for the researchers. However, this means that the sample will be predominantly young, with a better than average education. This means that the results may not reflect the scores that people of different ages or educational opportunities might produce. Despite this potential problem, opportunity sampling is the most common method, even for professional psychologists, as for many investigations the results are unlikely to be affected by age or education.

Volunteer (self-selected) sampling

Rather than the researcher choosing individuals to ask, they may invite people to volunteer to take part in their study. They might put up an advertisement, make an announcement or post a request on the internet. In this way, the people who respond and become participants choose to do so, i.e. are volunteers, so are described as a **volunteer sample** (Figure 1.13). As the individuals are self-selected, that is they choose whether to join in, this sampling technique is unlikely to be representative of the population. Volunteers may have more free time than average and, apart from being willing, often have other characteristics in common, such as being better educated. Nevertheless, it is a useful technique when looking for participants who are unusual in some way, for example in Baron-Cohen et al.'s study, where people on the autistic spectrum were needed.

KEY TERMS

population: the group, sharing one or more characteristics, from which a sample is drawn.

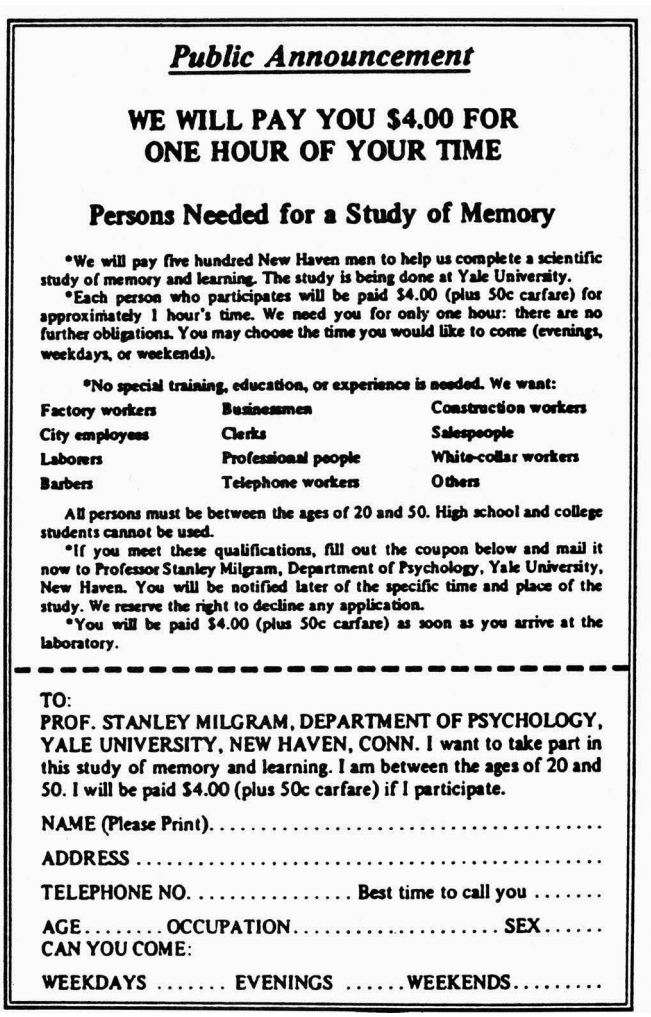
sample: the group of people selected to represent the population in a study.

sampling technique: the method used to obtain the participants for a study from the population.

opportunity sample: participants are chosen because they are available, e.g. university students are selected because they are present at the university where the research is taking place.

volunteer (self-selected) sample: participants are invited to participate, e.g. through advertisements via email or notices. Those who reply become the sample.

random sample: all members of the population (i.e. possible participants) are allocated numbers and a fixed amount of these are selected in a unbiased way, e.g. by taking numbers from a hat.



Public Announcement

WE WILL PAY YOU $4.00 FOR ONE HOUR OF YOUR TIME

Persons Needed for a Study of Memory

*We will pay five hundred New Haven men to help us complete a scientific study of memory and learning. The study is being done at Yale University.

*Each person who participates will be paid $4.00 (plus 50c carfare) for approximately 1 hour's time. We need you for only one hour: there are no further obligations. You may choose the time you would like to come (evenings, weekdays, or weekends).

*No special training, education, or experience is needed. We want:

Factory workers	Businessmen	Construction workers
City employees	Clerks	Salespeople
Laborers	Professional people	White-collar workers
Barbers	Telephone workers	Others

All persons must be between the ages of 20 and 50. High school and college students cannot be used.

*If you meet these qualifications, fill out the coupon below and mail it now to Professor Stanley Milgram, Department of Psychology, Yale University, New Haven. You will be notified later of the specific time and place of the study. We reserve the right to decline any application.

*You will be paid $4.00 (plus 50c carfare) as soon as you arrive at the laboratory.

TO:
PROF. STANLEY MILGRAM, DEPARTMENT OF PSYCHOLOGY, YALE UNIVERSITY, NEW HAVEN, CONN. I want to take part in this study of memory and learning. I am between the ages of 20 and 50. I will be paid $4.00 (plus 50c carfare) if I participate.

NAME (Please Print).....

ADDRESS .....

TELEPHONE NO. ..... Best time to call you .....

AGE ..... OCCUPATION ..... SEX .....

CAN YOU COME:

WEEKDAYS ..... EVENINGS ..... WEEKENDS .....

1.13 Would you respond to this advert?

Random sampling

Opportunity and volunteer samples may be biased – they will probably contain very similar people so are unlikely to include the spread of characteristics in the population. In **random sampling** each person in the population has an equal chance of being chosen so the sample is much

more likely to be representative. Imagine you are looking for a sample of students at your school and you put an advert for volunteers on the library notice board. Students who never go to the library cannot be included so your sample might be biased towards those who work the hardest. Similarly, if you took an opportunity sample from the common room, it would only include students who are relaxing. Now your sample might be biased towards the *least* hard working. To obtain a representative sample you could instead use a numbered list of all students and use a random number generator to choose the participants. This would be a random sample as any individual is equally likely to be chosen. If the population is small, such as all the members of your class, you can simply give each person a number, put pieces of paper with each number on in a hat, and draw out numbers until there are enough for the sample.

Applying your knowledge of sampling techniques to novel research situations

An early step in any research is to obtain an appropriate sample. The extent to which generalisations can be made from research depends in part on how representative the sample is. It is therefore important to get the best possible sample. However, practical constraints prevent researchers from using random samples most of the time and, for many psychological phenomena, it is reasonable to believe that processes happen in a fairly universal way so some sample bias is unproblematic. However, to assume there are no differences in emotional responses, cognitive processing or behaviour between populations would be misleading. Indeed, the psychology of individual differences, of developmental psychology and cross-cultural research are three areas specifically devoted to the study of such differences. It is therefore important that you can recognise limitations in the sampling technique used. This means that you should be able to identify possible differences between individuals or groups that might matter for the particular phenomena being explored in a study. Imagine two researchers at different universities are both studying obedience and both want samples from people nearby but not students. One university is near a police college and the other is next to a hospital and the researchers both obtain opportunity samples with the same age and gender spreads from these workplaces. Even though the samples are similar in age and gender, the difference in occupations may mean that the results of their studies will be different – because police officers tend to be more obedient than nurses.

You will need to be able to explain how you would use each sampling technique and to explain reasons for choosing each technique. For example, why it might be difficult to use a technique in practice or why generalisations could or could not be made from the sample obtained.

Sampling technique			
	Opportunity sampling	**Volunteer (self-selected) sampling**	**Random sampling**
Strengths	Quicker and easier than other methods as the participants are readily available	Relatively easy because the participants come to the researcher. They are also likely to be committed, e.g. willing to return for repeat testing	Likely to be representative as all types of people in the population are equally likely to be chosen
Weaknesses	Likely to be non-representative as the variety of people available is likely to be limited, so they will tend to be similar and the sample could therefore be biased	Likely to be non-representative as people who respond to requests may be similar, e.g. all have free time	In reality everyone may not be equally likely to be chosen, e.g. if they cannot be accessed (if the original list is incomplete) or if mainly one type of participant, e.g. girls, happen to be selected. This is particularly important if the sample is small

Table 1.3 Strengths and weaknesses of sampling techniques

RESEARCH METHODS IN PRACTICE

Your teacher has asked you to do a cognitive psychology investigation. You want it to work well so you want a **sample** of 30 people from which you can generalise. You think it would be easiest to take an **opportunity sample** from your classes at the college but you realise this might produce a biased sample as all your subjects are sciences. This might matter as the investigation is about using logic to solve problems and you think that science students might be especially good at the task. If so, their results might not be representative of the college **population** as a whole. A friend suggests making an announcement in the canteen asking for students studying all different subjects. This **volunteer sampling** technique might be better but there would be no guarantee of getting a range of people. You decide that the best sampling technique would be to choose individuals at random from a list of all the students in the college. You hope that this would mean you would be equally likely to get students taking each subject. You decide to use this **random sampling** technique based on the students' examination candidate numbers. You enter the candidate numbers into a random number generator and use the first 30 numbers that are generated.

Reflections: Look at the Research methods in practice box above. What problems would the following situations lead to?

- You revert to your idea of an *opportunity sample* but use your neighbours, who are mainly retired people.
- You followed your friend's advice about *volunteer sampling* but lots of the younger students were in detention at lunchtime that day.

Read the examples below. Which *sampling technique* is being used in each situation?

- Professor Smudge is doing some internet research and is recruiting participants by posting on Facebook asking for people to help with her study.
- Dr Splash is investigating the effects of ageing and is asking all the residents at two local care homes for their help.
- Dr Blot pulls student numbers on the college register from a hat to select a sample for a new study on homework and part time jobs.

1.9 Data and data analysis

Psychologists, like all scientists, often produce numerical results from their investigations. These results are called the 'raw data'. As it is difficult to interpret large amounts of figures, the results are often simplified mathematically and represented visually on graphs. We will discuss a range of methods in this section. Note that you are not required to perform calculations in examinations but you could be asked to count up scores, find the mode, median and range of a data set, make simple comparisons and interpret data from tables or graphs.

Types of data

As you may know from the core studies or from earlier parts of this chapter, psychologists use a variety of different research methods. These methods can produce a range of different types of data. The main types are discussed below.

Quantitative and qualitative data

When psychologists collect data they can collect either numerical results, called **quantitative data**, or **qualitative data**, which is detailed and descriptive. Quantitative data indicates the *quantity* of a psychological measure, such as the amount or strength of a response and tends to be measured on scales, such as time, or as numerical scores on tests such as IQ or personality. Quantitative data is associated with experiments and correlations which use numerical scales but it is also possible to obtain quantitative

KEY TERMS

quantitative data: numerical results about the *quantity* of a psychological measure such as pulse rate or a score on an intelligence test.

qualitative data: descriptive, in-depth results indicating the *quality* of a psychological characteristic, such as responses to open questions in self-reports or case studies and detailed observations.

	Data type	
	Quantitative	**Qualitative**
Strengths	Typically uses objective measures Scales or questions often very reliable Data can be analysed using measures of central tendency and spread making it easy to compare	Data is often valid as participants can express themselves exactly rather than being limited by fixed choices Important but unusual responses are less likely to be ignored because of averaging
Weaknesses	Data collection method often limits responses so the data are less valid, e.g. if the participant wants to give a response that is not available	Data collection is often relatively subjective so findings may be invalid as data recording or interpretation may be biased by the researcher's opinions or feelings Detailed data from one or a few individuals may not generalise to the majority

Table 1.4 Quantitative versus qualitative data

data from observations, questionnaires or interviews. For example, a record of the number of times a behaviour is seen or the total of responses to a closed question in an interview would be quantitative data. The sources of quantitative data are typically highly objective, as the scales or questions used need little if any interpretation, making them high in validity. In addition, the measures used are generally highly reliable, as the measures are fixed quantities.

Qualitative data indicates the *quality* of a psychological characteristic. Such data is more in-depth than quantitative data and includes detailed observer accounts and responses to open questions in questionnaires, interviews or case studies. Although there is a risk of subjectivity in the interpretation of such data by the researcher, qualitative data may be more representative as the participant can express themselves fully, so in some senses qualitative data can also be valid.

RESEARCH METHODS IN PRACTICE

Dr Splash and Professor Smudge disagree over the best way to collect data about people's emotions when they are put in stressful situations. Dr Splash wants to collect **quantitative data** by measuring their pulse rate and give them scales of very / quite / not at all to rate how stressed they feel. Professor Smudge thinks it would be better to collect **qualitative data** by interviewing each participant and getting them to describe their feelings. She plans to ask questions such as *'How do you feel when you meet an important person for the first time?'* and *'Describe how you felt the last time you were late'.*

Reflections: Look at the Research methods in practice box above. What are the advantages and disadvantages of each suggested data collection method?

Are the questions suggested by Professor Smudge open or closed questions?

Using ethical ideas only, suggest two more questions that could be used in the *interview*, **one** *open question* and **one** *closed question*. State which type of question would collect *qualitative data* and which would collect *quantitative data*.

Data analysis

This section explores different ways that mathematics can be used to simplify and understand the data produced by studies in psychology.

Measures of central tendency

A set of quantitative results can be summarised to one number that represents the 'middle' or typical score, called a **measure of central tendency** or 'average'. There are three different measures of central tendency: the **mode**, **median** and **mean**.

KEY TERMS

measure of central tendency: a mathematical way to find the typical or average score from a data set, using the mode, median or mean.

mode: the measure of central tendency that identifies the most frequent score(s) in a data set.

median: the measure of central tendency that identifies the middle score of a data set which is in rank order (smallest to largest). If there are two numbers in the middle they are added together and divided by two.

mean: the measure of central tendency calculated by adding up all the scores and dividing by the number of scores in the data set.

The mode

The mode is the most frequent score in a data set. It can be used with numerical data (such as scores on a test) and also with data sets that are choices that can be counted (such as written responses to the question 'What is your favourite subject: maths, English or psychology?'). If two (or more) values are equally common there will be two (or more) modes. For example, the faces in Figure 1.14 could be used in a test to compare people on the autistic spectrum with a control group. The participants could be asked 'Which face looks the happiest?' The face which was chosen as the happiest by each group would be the mode for that group.

1.14 A facial expression test

A self-report in a school produced the data set in Table 1.5. The mode for subject choice is 'Psychology', because more people said this subject was their favourite – ten compared to four and six for the other subjects.

	Subject		
	Maths	**English**	**Psychology**
Number of people	4	6	10

Table 1.5 Number of people choosing each subject as their favourite

Another question asked 'On which day of the week do you do most homework?' (see Table 1.6). The responses from girls and boys were compared.

In Table 1.6 more boys have 'Sunday' as their main homework night, so this is the mode for boys. Girls have said that 'Friday' and 'Sunday' are their main homework nights, but these two categories are the same, so there are two modes, each containing six girls. We could also combine the totals to work out an overall mode. Adding together the totals for each day shows that for all students, Sunday is the most popular homework night, with 17 students in total.

The median

Unlike the mode, the median cannot be used with data in discrete (separate) categories, it is only used with numerical data on a linear scale (i.e. points in a sequence). To find the median, all the scores in the data set are put in a list from smallest to largest (ranked). The middle one in the list is the median. If there are an even number of participants, so there are two numbers in the middle, these are added together and divided by 2 to find the median.

Another question in the school survey asked participants to rate how hard they thought they worked, from 1 to 10. Students in their AS and A Level years were asked.

AS student data:

8, 6, 9, 1, 5, 6, 2, 7, 3, 6, 9, 8, 5, 6, 3, 8, 5, 10, 2, 3

A Level student data:

7, 9, 6, 7, 9, 7, 10, 10, 7, 10, 9, 4, 9, 6, 10, 10, 7, 9, 7, 7

Putting these data into order for the two groups separately:

AS students:

1, 2, 2, 3, 3, 3, 5, 5, 5, 6, 6, 6, 6, 7, 8, 8, 8, 9, 9, 10

6 + 6 = 12, 12/2 = 6 so the median = 6

A Level students:

4, 6, 6, 7, 7, 7, 7, 7, 7, 7, 9, 9, 9, 9, 9, 10, 10, 10, 10, 10

7 + 9 = 16, 16/2 = 8 so the median = 8

	Night of the week						
	Monday	**Tuesday**	**Wednesday**	**Thursday**	**Friday**	**Saturday**	**Sunday**
Number of boys	0	1	2	3	3	0	11
Number of girls	1	1	2	4	6	0	6

Table 1.6 Main homework night

The median for the A Level group, of 8, is higher than the median for AS students, which is 6. This suggests that A Level students believe they are working harder than AS students do.

The mean

The mean is the measure of central tendency that we usually call the 'average'. It can only be used with numerical data from linear scales. The mean is worked out by adding up all the scores in the data set and dividing by the total number of scores (including any that were zeros). It is the most informative measure of central tendency because it takes every score into account.

Looking back at the data used in the section on the median, mean could be calculated instead. There were 20 students in each group. For the AS students, the calculation is therefore all the scores added together, then divided by 20, i.e. 112/20 = 5.6, so the mean is 5.6. For the A Level students, the calculation is again all the scores added together, and divided by 20, i.e. 160/20 = 8, so the mean is 8. Like the median, this too shows that the A Level students believe they are working harder than the AS students do.

Measures of spread

A **measure of spread** is an indicator of how varied the results are within a data set: are they clustered together or widely dispersed? If two data sets are the same size, with the same average, they could still vary in terms of how close the majority of data points were to that average. Differences such as this are described by measures of spread: the **range** and the **standard deviation**.

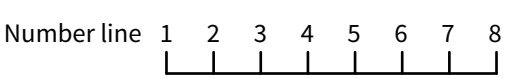
The range

The range is the simplest measure of spread and is calculated in the following way:

1 Find the largest and smallest value in the data set.

2 Subtract the smallest value from the largest value, then add 1.

You may have learned to calculate the range without adding 1. In psychology we do this because the scales we use measure the gaps between points, not the points themselves. Consider a scale of student happiness from 1 (sad) to 8 (very happy). This can be represented on a line:



If we say someone's happiness is at level of 3, they could be anywhere between 2.5 and 3.5, and someone scoring 6 has a happiness level somewhere between 5.5 and 6.5. So, if 3 and 6 were the lowest and highest scores, the real spread extends to those limits, i.e. from 2.5 to 6.5, so this spread works out as 6.5 – 2.5 = 4. This figure is one bigger than the largest score (6) minus the smallest score (3) = 3.

The range for the two sets of data given in the section on the median would be calculated in the following way:

AS students:

1, 2, 2, 3, 3, 3, 5, 5, 5, 6, 6, 6, 6, 7, 8, 8, 8, 9, 9, 10

10 – 1 = 9, 9 + 1 = 10 so the range = 10

A Level students:

4, 6, 6, 7, 7, 7, 7, 7, 7, 7, 9, 9, 9, 9, 9, 10, 10, 10,10, 10

10 – 4 = 6, 6 + 1 = 7 so the range = 7

So, not only are the medians and means for these two data sets slightly different, the ranges are different too. This tells us that the diversity of opinion about how hard they are working is greater for AS students than A Level students. We could also say that although most A Level students think they are working very hard, AS student opinion varies from 'not working hard' to 'working very hard'.

One problem with the range is that it does not accurately reflect outliers. That is, it would not be clear from the range whether the most extreme scores, e.g. very large scores, were single odd scores or typical of the data set. Imagine that the least hard-working student in the A Level set had rated themselves as working at level 1 rather than 4. This would make very little difference to the mean (it would be 7.85 instead of 8), but would change the range from 7 to 10 (the same as the range for the AS group).

The standard deviation

In the same way that the mean can tell us more than the mode, a measure of spread called the standard deviation can tell us more than the range. Rather than looking only at the extremes of the data set, the standard deviation (given

KEY TERMS

measure of spread: a mathematical way to describe the variation or dispersion within a data set.

range: the difference between the biggest and smallest values in the data set plus one (a measure of spread).

standard deviation: a calculation of the average difference between each score in the data set and the mean. Bigger values indicate greater variation (a measure of spread).

the name *s*, SD or σ) considers the difference between each data point and the mean. This is called the *deviation*. These deviations are then squared, added together and the total is divided by the number of scores in the data set, minus 1. The final step is to find the square root. The standard deviation is represented by the formula:

$$s = \sqrt{\frac{\Sigma (x-\bar{x})^2}{n-1}}$$

The following symbols are used:

s = standard deviation

x = each score in the data set, i.e. a figure for the variable being measured

$\bar{x}$ = the mean of the data set (called the 'sample mean')

Σ = the Greek letter sigma means 'the sum of', i.e. 'add them all up'

n = the number of scores in the data set

$\sqrt{}$ = the square root.

The deviation, *d*, is sometimes used in place of the difference between each score in the data set and the mean $(x - \bar{x})$ in the formula above.

As the standard deviation tells us the spread of a group, groups with scores that are more spread out have larger standard deviations, groups with closely clustered scores have smaller standard deviations. When the standard deviations of two groups are similar, this means that they have a similar variation around the mean.

Returning to the data about how hard students believe they are working (from the section on the median) the standard deviations for the two sets of data would be:

AS students: SD = 2.62
A Level students: SD = 1.72

These figures show, as the range did, that there is greater variation in the opinions of the AS students (as the figure of 2.62 for the standard deviation for this group is larger than 1.72, the figure for the A Level group). Note that if the standard deviation is calculated for the A Level group with the opinion score of 4 for one student being replaced with a 1, the standard deviation increases, as this makes the group more varied. However, it still does not become as large as the figure for the AS group. This is different from the effect of the change in this participant's score on the range. The range of the two year groups become the same (they would both be 10), whereas in fact *within* the groups, the AS students are more varied. This is reflected in the standard deviation however, which changes from 1.72 when the student has a score of 4 to 2.16 if they have a score of 1. So, the main advantage of the standard deviation over the range is that it takes every score into account and therefore provides a representation of variation *within* the data set. As it is not just considering the extremes is not distorted by outliers like the range would be.

RESEARCH METHODS IN PRACTICE

A new psychology teacher has tested a group of ten of his students on their recall of the aims, methods, results and conclusions of one of the core studies. The test was marked out of 15. Two students scored 0, and one student scored each of the marks 3–10. The teacher works out the **mode** and is horrified to find that the modal score is zero! A colleague recommends he works out the **median** instead, so he finds the two middle scores in the group (5 and 6), adds them together and divides by 2. This is 5.5, so he feels much better. He wonders if calculating the **mean** will make him feel better still, but it doesn't. When he adds up all the scores and divides by 10 (because he had 10 students), the mean is only 5.2. This is because the median does not consider the value of two zero scores, whereas the mean does. These three figures are different **measures** of **central tendency**. He wants to compare this group to his colleague's students, who scored 0, 1, 1, 2, 2, 2, 3, 4, 4, 5. He calculates two different **measures of spread**. The biggest and smallest values in her set are 0 and 5, so he subtracts 0 from 5 and adds 1, giving a **range** of 6. The **standard deviation** for her group is 1.58.

Reflections:

1 Look back at Figure 1.14. For the data set in the table below, which is the modal response?

	Face A	Face B	Face C	Face D
Number of participants selecting each face as the happiest	0	3	7	1

2 Look back at the data for AS and A Level students in the section on the median. What is the mode for each group?

3 Using the information about the teacher in the Research methods in practice box above answer the following questions:

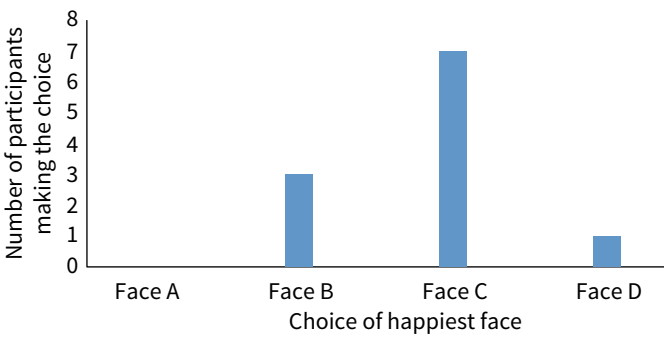
- What is the mode for the colleague's group?
- Which group does this suggest performed better on the test?
- What is the median for his colleague's group?
- Which group does this suggest performed better on the test?
- The mean for his colleague's group was 2.4. Which group does this suggest performed better on the test?
- What is the range for the teacher's own group?
- When compared to the range for his colleague's group, what does this tell you?
- The standard deviation for his own group was 3.49. Does this tell you that his group was more varied or less varied than hers?

Graphs

A graph is a visual illustration of data. There are many different types of graph and in this section we will consider only bar charts, histograms and scatter graphs, each of which you should be able to name, recognise, draw and use to interpret data. In addition, you will need to be able to recognise, interpret and understand a normal distribution curve.

Bar charts

A **bar chart** is used when the data are in separate categories rather than on a continuous scale. Bar charts are therefore used for the totals of data collected in named categories and for all measures of central tendency (modes, medians or means). The bars on a bar chart must be separate. This is because the *x*-axis represents the distinct groups and not a linear scale. For a bar chart of the results of an experiment, the levels of the IV go along the bottom (on the *x*-axis) and the DV goes on the *y*-axis. To help you to remember which is the *x*-axis and which is the *y*-axis, think 'X is a-*cross*' (Figure 1.15).



1.15 A bar chart showing the number of participants selecting each face as the happiest

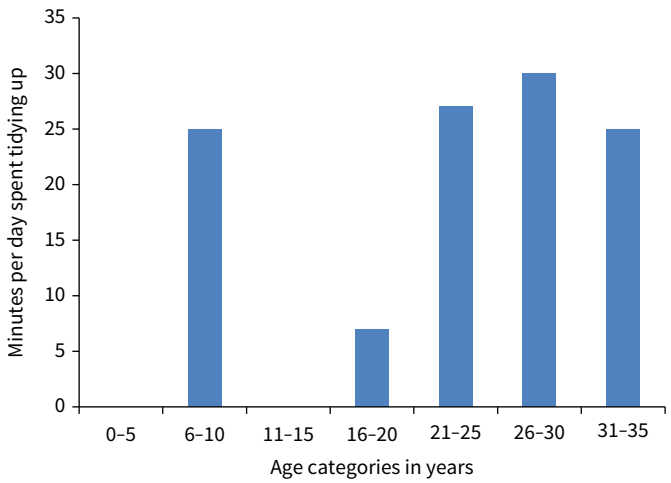
Histograms

Histograms can be used to show the pattern in a whole data set, where this is continuous data, i.e. data measured on a scale rather than in separate categories. A histogram may be used to illustrate the distribution of a set of scores. In this case, the DV is plotted on the *x*-axis (across) and the frequency of each score plotted on the *y*-axis (up the side). The scores along the *x*-axis may be grouped into categories (e.g. if the DV is age, the data may be grouped into 0–5 years, 6–10 years, 11–15 years, etc.). As the scale represented on the *x*-axis is continuous the bars are drawn next to each other, unlike in a bar chart. This means that if there are no scores in a category, a gap must be left to show that the category is empty (see Figure 1.19, which shows 'empty' categories on the *x*-axis).

KEY TERMS

bar chart: a graph used for data in discrete categories and total or average scores. There are gaps between each bar that is plotted on the graph because the columns are not related in a linear way.

histogram: a graph used to illustrate continuous data, e.g. to show the distribution of a set of scores. It has a bar for each score value, or group of scores, along the *x*-axis. The *y*-axis has frequency of each category.



1.16 A histogram of the time spent tidying by people of different ages

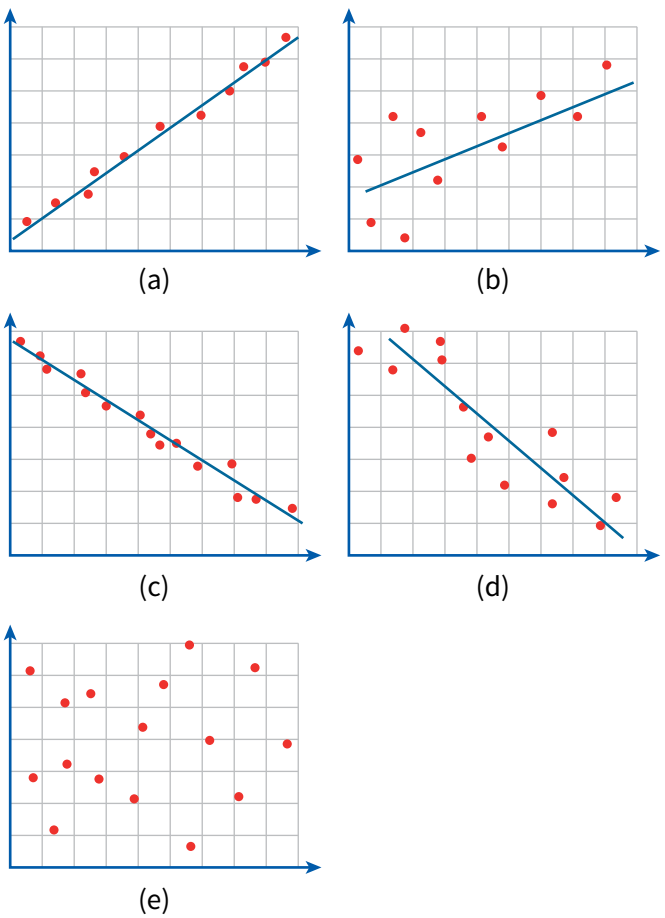
Scatter graphs

Correlations were discussed in Section 1.5. The results from a correlational study are displayed on a scatter graph. To construct a **scatter graph**, a dot is marked at the point where an individual's scores on each variable cross. Sometimes you will see a 'line of best fit' drawn on a scatter graph. The position of this line is calculated and its line is drawn so that it comes close to as many points as possible (see Figure 1.17a-d). In a strong correlation all the data points lie close to the line, but in a weak correlation they are more spread out. Note that you will often see the strength of a correlation described as a number from +1 to –1. Values close to +1 are strong positive correlations and values close to –1 are strong negative correlations. Lower or 'smaller' values (closer to 0) are weaker correlations. Where there is no correlation, the points do not form a clear line (and this has a '*r*' value of 0).

KEY TERMS

scatter graph: a way to display data from a correlational study. Each point on the graph represents the point where one participant's score on each scale for the two measured variables cross.

It is important to remember that you *cannot* draw a causal conclusion from a correlational study. Therefore, scatter graphs such as the ones in Figure 1.17 only tell you that there is a relationship between the variables but not which (if either) of them, is the cause of this link. An experiment could help to find this out.



1.17 Scatter graphs showing (a) strong positive correlation, (b) weak positive correlation, (c) strong negative correlation, (d) weak negative correlation and (e) no correlation

The normal distribution curve

The graph in Figure 1.18 forms a 'bell-shape', which is typical of a **normal distribution**. This is a frequency distribution that:

- has the mode, median and mean together in the centre
- has 50% of the scores to the left and 50% to the right of the mean
- is symmetrical.