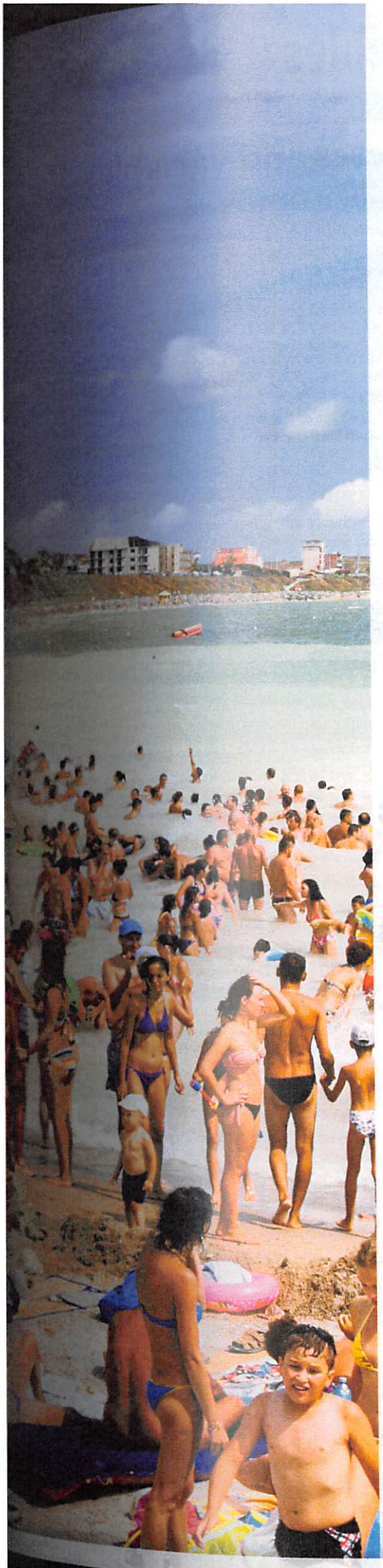
Research methods

People eh? Fascinating creatures aren't they?

We can't study them all – about seven and a half billion worldwide at the last count – but we would like to study some of them.

Say, for example, we wanted to understand why people love beaches. How could we find out?

What research methods could we use?



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The specification says...

Formulation of testable hypotheses: Null hypothesis and alternative hypothesis.

Types of variable: Independent variable and dependent variable.

People are obsessed with predicting the future aren't they? Whether it's economists trying to predict the state of the country's finances, weather forecasters telling us how much rain we will have next week, or bookmakers trying to work out the 'odds' of some event taking place.

Predicting the future is what keeps fortune-tellers in work. People are desperate to know whether they can look forward to a happy and successful future. The fortune-teller will gaze into a crystal ball, read tarot cards or even interpret the pattern of tea leaves as a way of predicting the future. Whilst many people swear by these methods, others question whether fortune-telling has any basis in fact and is anything more than *'just a bit of a fun'*.

Having said that, scientists in psychology try and predict the future too – though they use *hypotheses* rather than crystal balls, and would call it *research* rather than fortune-telling.

What is meant by ...

Alternative hypothesis states a relationship (correlation or difference) between variables. It is called 'alternative' as in alternative to the null hypothesis.

Dependent variable (DV) The thing that the researcher measures in an investigation. Any changes in the DV should depend on the IV, and the IV alone.

Hypothesis A clear, precise, testable statement that is written at the beginning of an investigation. It states the relationship between the variables being investigated.

Independent variable (IV) The thing that is varied in an experiment – either deliberately changed by the experimenter or varies naturally. There are different levels of the IV – which are called *conditions* of the experiment.

Null hypothesis A statement of no relationship (correlation or difference) between variables.

Variable Any 'thing' that can vary or change within an investigation.

Hypotheses and variables

We have a theory...

We don't know for certain, it's just a thought – but we reckon being in front of an audience might affect how well someone can perform a task. Even though we've been teaching for many years, we still get nervous when we have to stand up in front of a new group of people and we know it affects our concentration. So, we think being in front of an audience may have some effect on performance.

At this stage, our thought is just a *theory* – a suggested explanation for behaviour. Psychologists come up with theories too – you've read about a number of these already in this book. Psychologists *test* their theories by doing *research*. This chapter is about all the different ways in which psychologists can do research, and all the different techniques they use to make their research objective and unbiased.

Formulating an aim

If we're going to put our theory to the test, we need to make it clear what we are testing. We could give people a simple task to do – let's say, throwing some balls into a bucket – to see how well they get on when other people are watching.

All psychological investigations start with an *aim* which is a general statement that explains the purpose of the study; so here's ours:

> *To investigate whether performance on a task (throwing balls into a bucket) is affected by an audience being present or not.*

The next step is to turn the aim into a **hypothesis** that can be tested. A hypothesis states the relationship between the *variables* being investigated.

So, before we get on to the hypothesis, we need to look at variables.

Variables

A **variable** is any 'thing' that can vary or change within an investigation. In an experiment, there are two key types of variable: the **independent variable (IV)** and **dependent variable (DV).**

Independent variable The IV is the thing that the experimenter deliberately changes. In our investigation, the thing that will change is whether participants are performing in front of an audience or alone. That is what is manipulated (changed) by the researcher.

There are actually two levels of the IV here: some participants perform in front of an audience whereas others perform alone. If we had decided to have just one level (performing in front of the audience) then we have nothing to compare that performance with. How would we know whether it was better or worse? So we have a second level of the IV. Each level of the IV is called a *condition*.

Dependent variable The DV is the variable that is measured by the researcher. In a properly run experiment, the *only* thing that should affect the DV is the change in the IV – the change in the DV *depends* upon the change in the IV. Anything else that might potentially affect the DV should be kept constant and controlled (more on that later in this chapter).

In our investigation, the DV is the number of balls (out of 20) the participant manages to throw into the bucket. This is what we will measure.

Operationalisation of variables

It's really important that variables in an experiment – or any other investigation – are as clearly defined as possible. For example, when we say we want to assess the effect of an audience on performance we need to decide what 'performance' is going to mean.

In our study, we decided to measure performance as the number of balls (out of 20) the participant manages to throw into the bucket. This is clear and precise. We could have decided to have the participants do something else, for example sing a song or recite a poem from memory.

Making the variable clear and precise is called *operationalisation* – identifying some clear operational instructions. We can also do this with the IV and specify the exact size of the audience.

Formulating a testable hypothesis

Now we are ready for that hypothesis ...

As we have already said, a hypothesis states the relationship between the variables being investigated.

And as we have also said, the hypothesis should be *clear* and *precise* (operationalised). So we need to be as clear and precise as we can about the variables we are testing and the relationship between them:

- The *variables* are: the IV (two levels) and the DV.
- The *relationship* is: there should be a difference between the two levels of the IV.

So the hypothesis could be:

> *There is a difference in the number of balls thrown into a bucket (out of 20) by participants performing with an audience of 30 people or performing the task alone.*
>
> *[relationship + DV + two levels of the IV]*

That looks pretty precise. Notice how when people take part in psychology studies, they are no longer people – they are now *participants* (well OK, they're still technically people but you get what we mean...).

Alternative hypothesis The hypothesis we have written above is called an **alternative hypothesis** – as in, alternative to the **null hypothesis**, coming next. It is a statement of the relationship between the variables.

Null hypothesis The null hypothesis is a statement that there is no relationship between the variables being tested. For example, it might be that having an audience present during the task makes no difference – or very little difference – to the number of balls participants manage to get into the bucket. Participants might perform just as well, or just as badly, regardless of whether there is an audience watching or not. For this reason, as researchers (*which we've now decided we are!*) we need to write another hypothesis which allows for the possibility that this might happen.

> *There is no difference in the number of balls thrown into a bucket (out of 20) by participants performing with an audience of 30 people or performing the task alone.*

Job done. Now we have our two hypotheses (alternative and null), we can get on with the business of finding out which one of them is true.

Trying to get all your balls in the bucket – but would you be better or worse in front of an audience?

Stretch and challenge

Can you see how our alternative hypothesis does not say which *direction* the results will go in – that is, it doesn't say whether participants will perform better or worse in front of an audience?

Sometimes it makes better sense to give the direction. For example we might say:

> *Participants performing with an audience throw more balls into a bucket than those performing the task alone.*
>
> *Participants performing with an audience throw fewer balls into a bucket than those performing the task alone.*
>
> *The number of balls thrown into a bucket is greater if participants are performing with an audience than if participants are performing alone.*

There are lots of different ways to write a hypothesis but they all follow the same basic rule of relationship + DV + two levels of the IV.

Study tip

Don't get mixed up

It is easy to get the IV and DV mixed up so use a simple mnemonic to help you remember the difference between them:
Ice **C**reams **D**o **M**elt

IV **C**onditions – **D**V **M**easure. The IV relates to the conditions of your study whilst the DV is the thing that you measure in both conditions.

Apply it – research

Light touch

A researcher uses a confederate* to serve students in a college canteen. When she gives change, for half of the students she lightly touches their hand; for the other half she does not. The researcher then asks each student to rate the likeability of the confederate on a scale from 1 (extremely dislikes) to 7 (extremely likes).

*confederate - an individual in an experiment who is not a real participant and has been instructed how to behave by the researcher.

Questions

1. Write an aim for this study. *[2 marks]*
2. Identify the independent and dependent variables. Write your answers as operationalised variables. *[2 marks + 2 marks]*
3. Write suitable null and alternative hypotheses. *[2 marks + 2 marks]*

Check it

1. Distinguish between a null and alternative hypothesis. *[3 marks]*
2. What is a 'dependent variable'? *[1 mark]*
3. What is an 'independent variable'? *[1 mark]*

Extraneous variables

The specification says...

Types of variable: Extraneous variable.

Research procedures: The use of standardised procedures, instructions to participants, randomisation and extraneous variables (including explaining the effect of extraneous variables and how to control for them).

Throughout history, many scientific discoveries have happened by accident. Alexander Fleming left a pile of dirty dishes in his lab, went on holiday and returned to find a strange fungus that had killed off all the surrounding bacteria. This led to the discovery of penicillin.

Percy Spencer walked in front of a magnetron machine in his engineering lab and found that the chocolate bar he was carrying in his pocket had melted. As a result, he went on to invent the microwave oven.

John Pemberton was trying to cure headaches using a combination of coca leaves and cola nuts. When his lab assistant accidentally mixed the two substances with fizzy water, Coca Cola was born.

'Lucky mistakes' like these are very rare. When conducting scientific research, researchers have developed systematic procedures to test their hypotheses – including procedures that ensure that unexpected or unwanted variables do not affect their research.

What is meant by ...

Extraneous variable (EV) Any variable, apart from the independent variable (IV) that could have an effect on the dependent variable (DV). If extraneous variables are not controlled this means that the researcher cannot know what truly caused the change in the DV.

Randomisation Using chance – such as tossing a coin or picking names from a hat – to control for the effects of bias when designing a research study.

Standardised procedures Using exactly the same methods and instructions for all participants in a research study.

Extraneous variables

Cause and effect

In a properly run experiment, the only thing that should cause a change in the *dependent variable* (DV) is the *independent variable* (IV). Any other things that may affect the DV should be controlled or removed altogether.

If the only thing that has affected the IV is the DV, then the experimenter has demonstrated *cause and effect* – that any change in the DV is due to the IV.

Extraneous variables

Determining cause and effect is threatened by **extraneous variables** (**EVs**). These are any unwanted 'extra' variables that may interfere with the relationship between the IV and the DV.

The experimenter identifies these when designing the experiment, and tries to control them. For instance, consider a study to investigate whether participants work better if they have had a drink of coffee.

In this study the IV is whether participants have a drink of coffee or not. The DV is 'working better' which we can test by giving participants a quiz. We want to know if the coffee *causes* participants to do better on the quiz, i.e. whether the IV changes the DV.

It is possible that any noise or other distractions might also affect quiz performance so these need to be controlled. Also, the temperature and lighting in the room where the experiment takes place should stay constant.

This is why researchers prefer to do experiments in a *laboratory* because things like noise and lighting are much easier to control. However, other EVs, such as the mood and motivation of the participants, may be much more difficult to control even in a laboratory.

Balls in the bucket experiment

There are lots of potential EVs in the balls in a bucket experiment, and these are things we would need to try and control. The only thing that should change between the two levels of the experiment is the IV – whether an audience is present or not. Everything else should be kept as constant as possible.

This would include the room where the throwing task takes place, the size and type of balls thrown, the type of bucket, etc. All these things should be the same for each participant in the investigation.

We might also want to keep certain things about the participants themselves constant. Perhaps they should all be of a similar age, similar height, have similar eyesight, etc. Hmm...this might be more difficult than we thought!

Stretch and challenge

There are lots of different types of extraneous variable in any experiment.

Aspects of the environment that may affect the performance of participants, such as noise and lighting, are called *situational variables*.

There might also be things about the participants themselves that influence their performance, such as their mood, concentration or skill level. These individual differences (differences between people) are called *participant variables*.

Finally, there may be things the experimenter does that affect the IV, such as giving more information to some participants than others, or being nicer to some participants than others. These are called *experimenter* or *investigator effects*.

THINK LINK

There are examples of randomisation in Chapter 1 on Memory. Studies of LTM and STM involving lists of words – such as the study of coding by Baddeley (page 14) and the primacy-recency effect by Murdock (page 20) – would have used a random method to determine the order of the words.

Research procedures

Over the years, *scientists* have learned that it is very important to design their studies in a systematic way in order to control possible extraneous variables (EVs).

Instructions to participants

All participants should receive exactly the same information throughout an investigation. These are called *standardised instructions*.

Before a study is conducted a researcher will write down exactly what should be said to each participant, word-for-word. This might include:

- Some information about the task that is involved.
- How participants should record their answers.
- What a participant should do if they wish to quit the study (they should be told they can leave at any time).

These standardised instructions ensure that what is said to participants does not act as an EV. For example, a researcher might tell one participant to do their best but not say that to another participant and this could affect their performance.

Standardised procedures

The standardised instructions are part of the wider **standardised procedures**. All participants should be given the same information at the start of the study, identical instructions throughout the study and be tested in the same environments. The only thing that should vary is the IV.

This is easier to achieve in a laboratory setting than, for example, assessing the effects of coffee by going up to people in coffee shops and giving them a memory test. In a laboratory, it is easier to make sure everything is the same for each participant. Any differences would act as EVs.

Randomisation

Randomisation is using *chance* during the design of the investigation. This means that key aspects of the procedure are not decided by the researcher, but are decided randomly. This reduces *bias* – a leaning in one direction rather than another.

For instance, when testing the primacy-recency effect on recall of words (page 20), the order of the words on the list should be decided randomly. This ensures that a researcher does not accidently put all the easy words at the start of the list which might mean that participants remember more of these words. The word order might act as an EV.

People often don't quite get what 'random' means – for example they think that it would be very unlikely that the lottery balls might be 1, 2, 3, 4, 5, 6, but that is as likely as any other six numbers if each ball has an equal chance of being selected.

Apply it – research

AM or PM?

A researcher wanted to find out if performance on a memory task was better in the morning or afternoon. He selected two groups of participants. One group was tested in the morning and the other group was tested in the afternoon.

Questions

1. Write **one** standardised instruction the researcher could have read to the participants. *[2 marks]*
2. Apart from instructions, identify **one** extraneous variable that could have been a problem in this study. *[2 marks]*
3. Explain how the extraneous variable you identified in question 2 could have affected the outcome of the study. *[1 mark]*
4. Explain **one** way in which the researcher could have used randomisation in this study. *[2 marks]*

If a researcher was testing *primacy-recency effects* when recalling a word list, the order of the words should be decided randomly and not by the researcher.

Not a problem. But where are this researcher's clothes and face? Now that is random.

Study tip

Operationalise!

Don't forget to operationalise the variables when writing your hypothesis – clearly stating how each variable will be measured is really important.

Check it

1. Explain how a researcher could use randomisation to decide the order to use when testing participants. *[3 marks]*
2. Explain why it is important to use standardised procedures with participants in research. *[2 marks]*
3. Using an example, explain what is meant by an 'extraneous variable'. *[3 marks]*

Types of experiment

The specification says...

Designing research: Quantitative and qualitative methods.

Laboratory experiments, field and natural experiments.

Strengths and weaknesses of each research method and types of research for which they are suitable.

Obedience

Sometimes people obey a request and sometimes they don't. What makes the difference?

One study by Leonard Bickman in 1974 showed that a uniform did make a difference. Bickman used three male actors (confederates) dressed either in normal clothes or as a milkman or as a security guard.

The actors made requests to people passing by such as 'Pick up this bag for me', or 'This fellow is over-parked at the meter but doesn't have any change. Give him a dime', or 'Don't you know you have to stand on the other side of the pole?'

The results were clear. Many more people obeyed the orders from the actor dressed as a guard than the other two.

So if you want people to do as you tell them – get a uniform (but make sure it's the right kind).

(Obedience is a topic you will study in Chapter 5.)

What is meant by ...

Field experiment An experiment that takes place in a natural setting. The researcher deliberately changes the independent variable (IV), and measures the effect of the IV on the dependent variable (DV). It is more difficult to control extraneous variables (EVs) in a field experiment than in a laboratory experiment.

Laboratory experiment An experiment that take place in a controlled environment. The researcher deliberately changes the IV, and measures the effect of the IV on the DV. It is easier to keep control of EVs in a laboratory experiment than in a field experiment.

Natural experiment An experiment where the IV is not manipulated by the experimenter but would have changed whether the experimenter was interested or not. The experimenter records the effect of the change on the DV. Natural experiments can take place in real-life settings (in the 'field') or in a laboratory.

Qualitative method Using data that is expressed in words and is non-numerical (although qualitative data may be converted to numbers for the purpose of analysis).

Quantitative method Using data that can be counted, usually given as numbers.

Quantitative and qualitative methods

Psychologists have two ways of collecting data about people. One approach is to collect numbers – to find out how many balls a participant can get in a bucket, or how many answers a person can get right, or to see how tall different people are and so on. Such research is **quantitative** because it deals in quantities (numbers).

The alternative is to collect descriptions, for example to ask people to describe how good their memory is or look at the different ways that men and women present themselves on TV. This is a **qualitative** approach.

Experiments

Experiments are a quantitative approach. All experiments involve an *independent variable* (IV) and a *dependent variable* (DV). The experimenter looks for a measurable change in the DV which has been caused by changes in the IV. However, *how* the IV changes, and in what *situations*, depends on the type of experiment.

Laboratory experiments

A *laboratory* is a controlled environment. The experimenter has a high degree of control of everything that happens in that space – for example what participants hear and what they see. A **laboratory experiment** is an experiment that takes place in a laboratory.

Strengths

One strength of a laboratory experiment is that *extraneous variables* (EVs) can be controlled. This means the researcher can be more certain that any changes in the DV are due to the IV and not some other variable. This means that we can be more confident about cause and effect conclusions.

Another strength is that laboratory experiments can use *standardised procedures* because of the control that is possible. This controls EVs but also means the experiment can be repeated (*replicated*) by another researcher to see if the results are the same. If they are, this confirms the **validity** of the findings.

Weaknesses

One weakness is that laboratory experiments may not be like everyday life. When throwing a ball in a bucket in a highly controlled setting, participants may not feel the same as they do when, say, doing a talk in front of a 'real' audience or playing sport in front of a 'real' crowd. This means that the behaviour produced in a laboratory may not generalise that well to the wider world. Laboratory experiments may have low validity.

Another weakness is that in a laboratory experiment participants know they are being tested. This may cause them to change their behaviour to try to help the experimenter get the results they want. This means that participants' behaviour is not like it would be in everyday life and the data collected will lack validity.

Validity

A number of the strengths and weaknesses on this spread refer to increased or decreased validity – in fact we have also been using the concept of validity throughout this book when evaluating research.

What is it? Put simply it refers to whether a result is 'true'. It does not mean that the researcher got the 'right' answer – it means that the researcher got a realistic answer..

Valid research represents something that is real. When a researcher conducts a study, they want their results to relate to everyday life.

Validity is probably THE MOST IMPORTANT CONCEPT in research methods. It concerns the question of whether any observed effect is a genuine one and tells us something about real people in everyday life – not just about participants in a research study.

Field experiments

Field experiments take place 'in the field' – not an actual field but just a natural setting such as a gym, a café or a New York street (see the study in the introduction on the facing page). However, as in a laboratory experiment, the researcher still changes the IV to see what effect this has on the DV.

Strengths

One strength of field experiments is that they are often more realistic than laboratory experiments because they are conducted in a natural environment. Participants often don't realise they are being studied in a field experiment so their behaviour may be more natural too. This means field experiments usually have good validity.

Another strength of field experiments is that, like laboratory experiments, they follow standardised procedures. This helps to control some extraneous variables.

Weaknesses

One weakness with field experiments is the researcher may lose control of extraneous variables in the real-life setting. This means it is much more difficult to show cause and effect in field experiments. For example, in the Bickman study (facing page), it might happen that there was increased traffic during the milkman *condition* which distracted participants and made them less obedient.

Another weakness is that there may be special *ethical issues* in field experiments. One ethical issue is whether people know they are involved in an experiment, and whether they have given their permission to be involved in all aspects of it. The people who were given instructions in the Bickman study became participants in a field experiment without their knowledge or *informed consent*. It could be argued that this was unethical.

Natural experiments

A **natural experiment** is when the change in the IV is not brought about by the experimenter. A change in the IV is happening anyway – whether the experimenter is interested or not – he or she just records the effect on the DV.

For example, a researcher might want to know if girls or boys are happier. Gender is the IV but this would not be changed by the experimenter!

Here's another example. Let's say, as part of their PE lessons, some of our ball throwing participants had extra training on how to throw a ball. We might be interested to see if students who had extra training were less affected by the presence of an audience. Now the IV would be extra training or no extra training, and the DV would be performance on the task in front of an audience. However, in this case, the IV is not controlled by the experimenter – the experimenter is making use of something that varies anyway. Therefore this is a natural experiment.

Strengths

One strength is that natural experiments usually have high validity because, for example, they involve real-life changes and these normally occur in a natural setting. In such a study, we would still eventually test the ball throwing abilities of our participants in a laboratory-like environment.

Another strength of natural experiments is that when the DV is measured in a laboratory there can be a high level of control over EVs.

Weaknesses

One weakness is that the natural event that the psychologist is interested in studying may only happen very rarely, such as the effect of a hurricane on stress levels. This means there may be fewer opportunities for this kind of research.

Another weakness is that there may be unique characteristics of the participants. In the example above, those students who took part in extra PE lessons may have been chosen because they were better (or worse) at throwing a ball anyway. The researcher can't *randomly allocate* participants to the conditions of the IV. This may act as an EV and affect the results of the investigation.

Does sunny weather put people in a better mood than cloudy weather? Now that sounds like a cue for a natural experiment. Weather is the IV.

Apply it – research

Decisions

Researchers wanted to investigate whether…

- Being deprived of sleep for 48 hours has a negative effect on memory test performance compared to sleeping 'normally'.
- People who have been the victims of a serious crime are more likely to suffer stress-related illnesses than people who have not been victims.

Questions

Which of the above aims would lead to:

1. A natural experiment? Explain your answer. *[2 marks]*
2. A laboratory experiment? Explain your answer. *[2 marks]*
3. A field experiment? Explain your answer. *[2 marks]*

Stretch and challenge

Not all laboratory studies are laboratory *experiments*. A researcher may set up a controlled environment in which to view behaviour. However, there may be no manipulation of an IV – there may be no IV at all. The researcher will just observe behaviour as it happens, and record what they see.

For instance, a researcher may observe interactions between a parent and child through a one-way mirror and record different categories of behaviour. This would be a *controlled observation* rather than a laboratory experiment.

THINK LINK

Many of the experiments in the Memory and Perception chapters are carried out in the laboratory – for instance, those that investigate the effect of factors on perceptual set in Chapter 2 (pages 52–57).

There are examples of field experiments, such as Godden and Baddeley in Chapter 1 (page 28) and of natural experiments, such as Bennett in Chapter 3 (page 77) or Kaij's twin study in Chapter 8 (page 220).

Check it

1. Distinguish between quantitative and qualitative methods. *[3 marks]*
2. Natural experiments are said to have more validity than laboratory experiments. Explain why this might be so. *[3 marks]*
3. Explain **one** strength and **one** weakness of conducting a field experiment. *[4 marks]*

Experimental designs

The specification says...

Designing research: The experimental method.

Experimental designs: Independent groups, repeated measures, matched pairs, including strengths and weaknesses of each experimental design.

Allocation to conditions, counterbalancing.

One of the first reported attempts to design experiments was by Robert Fisher in 1935. In his book called (would you believe) *The Design of Experiments* he described the *lady tasting tea* experiment.

The experiment had a very small sample. It involved one lady who claimed she could tell whether the tea or the milk had been added to the cup first. Fisher set up eight trials, four where tea had been added first, and four where it was milk first. The cups were presented to the lady in a random order.

In the language of modern psychology, this is a *repeated measures design*. It was also one of the first reported experiments to make use of a *null hypothesis*. For the record, the lady got all eight cups correct.

Experimental designs

One aspect of the design of experiments is the type of experiment used by a researcher – *laboratory*, *field* or *natural*.

There is another aspect of the design of experiments, which is called (*yes, you've guessed it*) **experimental design**. This is a little confusing because you might think that all aspects of the design of experiments would be called 'experimental design' but, no, this refers specifically to which *conditions* of the experiment participants will take part in (i.e. which level of the IV a participant is given). There are three options described below.

Independent groups

The clue's in the name! An **independent groups** design is when there are separate groups of people for each level of the independent variable (IV) in the experiment (i.e. each *condition* of the experiment). Often there are just two levels of the IV, one of which acts as a control or baseline for making comparisons. So one group is called the **control group** and the other is the experimental group.

In the balls in the bucket experiment, one group of participants would throw balls with an audience (*experimental group/condition*), and another group would throw balls without an audience (*control group/condition*). The performance of the two groups is then compared.

Strength

One strength of this design is that **order effects** are not a problem – these are described on the facing page. Each participant only does the task once and therefore, for example, there is no *practice effect*. Order acts as an *extraneous variable* (EV) which is good to avoid.

Weakness

One weakness of this design is that the participants in each group may differ. What if all the really good ball throwers are in one group? Or all the confident people? These are called *participant variables*. The difference in performance may be more to do with participant variables than the change in the IV. This acts as an EV and reduces the *validity* of the results.

Dealing with participant variables: Allocation to conditions

The participant differences described above can be dealt with using an unbiased method of **allocation to conditions**.

This can be done in a variety of ways. For example, the first person to arrive to the experiment can be placed in one group, the next in another group, and so on. This is a systematic method.

Or a random method can be used such as flipping a coin – participants who get heads go in the experimental group and those who get tails go in the control group (this is another form of *randomisation* – see page 97). You may end up with more participants in one group but that is not a problem.

This procedure is done so the researcher does not influence who goes in which group. It also means that, chances are, participant variables will be evened out between groups/conditions.

What is meant by ...

Allocation to conditions In an independent groups design, each group receives one level of the IV (one condition of the experiment). Random allocation is an unbiased unbiased method used to control for participant variables. If random methods are used this ensures that each participant has the same chance of being in one group as any other.

Control group A group of participants who receive no 'treatment'. Their behaviour acts as a baseline against which the effect of the independent variable may be measured.

Control condition The condition in a repeated measures design that provides a baseline measure of behaviour without the experimental treatment (IV).

Counterbalancing Used in repeated measures designs to control for order effects. Half the participants complete the conditions in one order, and the other half in the opposite order.

Experimental design The different ways in which participants can be organised in relation to the conditions in an experiment.

Independent groups Participants are allocated to different groups where each group represents one experimental condition (level of the independent variable), e.g. condition A and condition B.

Matched pairs Pairs of participants are matched in terms of variables relevant to the study, such as age or IQ. One member of each pair takes part in condition A of the experiment and the other takes part in condition B.

Order effects In a repeated measures design, an extraneous variable arising from the order in which conditions are presented.

Repeated measures When all participants take part in all the conditions of the experiment.

Apply it – research

Designing

A team of researchers conducted two studies and discovered that…

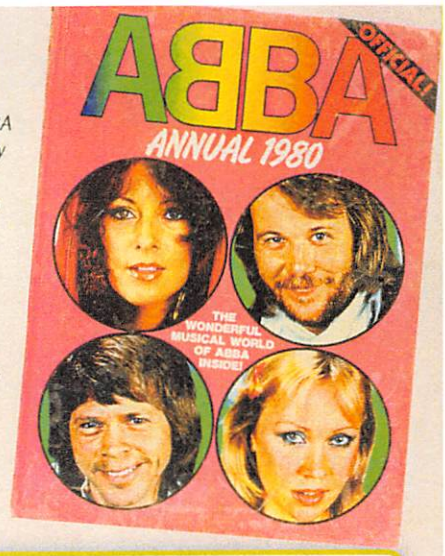
- People who had high stress levels were more likely to develop colds than people with low stress levels.
- People performed better on memory tasks after they took a caffeine tablet than they did before they took it.

Questions

For each of these studies:

1. Identify the experimental design. *[1 marks]*
2. Explain **one** strength of the design. *[2 marks]*
3. Explain **one** weakness of the design. *[2 marks]*
4. Explain how this weakness could be dealt with. *[2 marks]*

It's a little known fact that the Swedish pop group ABBA took their name from a way of reducing order effects in a repeated measures design experiment. The ABBA design is a sophisticated form of counterbalancing – the two conditions are called A and B. Each participant does four trials, A, B, B then A.



Repeated measures

Perhaps it might be better to compare *like with like*. In a **repeated measures** design, all the participants receive all levels of the IV (i.e. they are involved in all conditions of the experiment). So, participants would throw balls in the bucket with an audience present, and also throw balls in the bucket without an audience present. The two sets of results (data) for each participant would then be compared.

Strengths

One strength of repeated measures is that the problem of participant variables is removed. Each participant is compared against themselves rather than other people. This means that the participant variables are controlled.

Another strength is that fewer participants are needed in this design than in an independent groups design. If you have 20 participants this produces 20 sets of comparisons whereas in an independent groups design you need 40 participants to get 20 sets of comparisons. This means the study may be more expensive because more participants are needed.

Weakness

One weakness is order effects. When participants are tested twice the order in which they do the tasks may make a difference. In the balls in the bucket study, participants do the task twice – they throw the balls in front of an audience and then do the same thing with no audience. The second time their performance may be better because of practice rather than because of having no audience. This is called (again no surprise) a *practice effect* which acts as an EV. This is likely to reduce the validity of the results.

Dealing with order effects: Counterbalancing

Counterbalancing tries to control order effects in repeated measures designs. Because all participants will eventually take part in both conditions – half the participants should complete the conditions in one order, and the other half should complete the conditions in the opposite order.

So, the first participant takes part in the **control condition** (A) and then the experimental condition (B), the second participant takes part in the experimental condition (B) and then the control condition (A), and so on. If there is an issue with participants completing the conditions in a particular order, this will be evened out across the whole investigation.

Matched pairs

A **matched pairs** design is a kind of 'halfway house' between the other two designs. In a matched pairs design, participants only take part in one condition of the experiment – as in an independent groups design. The participants are in two separate groups; however, these groups are not made up of completely different people. The participants are tested on key participant variables (such as ability to throw a ball or self-confidence). Then, they are put into pairs by matching the person with the best ball throwing ability with the person with the second best and so on. One of each pair is allocated to a different group of the experiment.

Strengths

Matched pairs is a 'happy medium' between the other two designs and so deals with some of the problems of both. Because the participants are only tested once, this means there are no order effects as there are in repeated measures designs.

As well as this, participants are matched on a variable that is important for the experiment. This partly solves the problem of participant variables which are a feature of an independent groups design.

Weakness

One weakness is that matching participants takes time and is never exact. It takes time to get the data to do the matching. Plus, it is also likely that only one or two key variables will be matched so some participant variables remain. This means the method sometimes involves quite a lot of effort for little gain.

Stretch and challenge

We discussed extraneous variables on page 96. One important type of extraneous variable is *demand characteristics*. These are features of the experimental situation that may give away the aim of the investigation and 'demand' a particular response from participants. Demand characteristics can affect the validity of the results because participants are unlikely to act naturally if they work out the aim of the study.

The more aspects of the investigation the participants see, the more likely they are to work out the aim. This means that demand characteristics tend to be a bigger problem in repeated measures designs as participants are involved in all conditions of the experiment.

Check it

1. Explain how counterbalancing is used with a repeated measures design. *[3 marks]*
2. Describe and evaluate the matched pairs design. *[6 marks]*
3. Explain **one** strength of using an independent groups design. *[3 marks]*