RESEARCH METHODS

YES, YOU NEED TO LEARN IT

This can occur on any paper and in its own section.

CONTENRS:

FORMULATION OF TESTABLE HYPOTHESES

WHAT IS A HYPOTHESIS?

A hypothesis is simply a formal and testable statement of the relationship between two variables that is to be tested through experimentation. In psychology, as well as other sciences, we use them as part of the scientific method. The hypothesis is not strictly speaking a prediction and should not be used in the future tense i.e. "this will happen". It is only at the end of the study that the researcher decides whether the research evidence supports the hypothesis or not.

There are different types of hypotheses used in psychology, however, the main ones that crop up frequently are:

- Directional hypotheses
- Non-directional hypotheses
- Null hypotheses
- Alternative hypotheses

For GCSE Psychology and the AQA specification, we need to know about null hypotheses and alternative hypotheses.

NULL HYPOTHESIS

A null hypothesis is a general statement that the observed variables will have **no impact** as there is no relationship between them. This hypothesis assumes that any difference observed is due to sampling or experimentation errors.

An example of a null hypothesis for a hypothetical scenario is "watching television before bed has no impact on how well you sleep".

ALTERNATIVE HYPOTHESES

The alternative hypothesis would be a prediction that one variable **will affect the other**. An example would be that "watching scary movies before bed affects how fast you fall asleep". The alternative hypothesis does not specify the direction of the outcome, merely that there will be an effect.

FORMULATING HYPOTHESES

So we now know enough about hypotheses that we need to consider how we can apply them. When conducting research, most of the time the experiment comes from a simple or vague idea we wish to test. Here's an example; ***Does music affect people's ability to learn?***

This is rather a vague question and to turn it into a testable experiment, we need to be able to operationalise the two key variables; music and learning. These two variables are then known as the independent variable and dependent variable – often referred to as the IV and DV for short. More information is given on them below.

Hypotheses are then easier to form, a suitable one for this experiment would be an **alternative hypothesis** such as:

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

A null hypothesis for this example would simply be:

"The presence of music has no effect on the score in a learning test"

TYPES OF VARIABLES

There are 3 different types of variables we need to know about for research methods; **The independent variable (IV)**, **The dependent variable (DV)** and **Extraneous variables.**

INDEPENDENT VARIABLE

An experiment will look to measure the effect of one variable on another. These two variables have special names, which are the independent variable and dependent variable. **The independent variable** is what researchers manipulate in order to test its effect on the dependent variable (the outcome). Let's use the example mentioned earlier about music and learning to illustrate this:

We are conducting an experiment to see if music affects the ability for students to learn. In this case, the independent variable (IV) we will be manipulating is music. Within the context of an experiment, we may simply have two conditions where one group is exposed to music while another group is not. We would then compare the findings to assess the results.

DEPENDENT VARIABLE

The dependent variable (DV) is the outcome or effect we are measuring within the study. So using the example above, the dependent variable would be how well the students are able to learn with or without music. This may be measured in a number of ways (taking a memory test for example or quiz).

So to clarify – the independent variable is what we change and the dependent variable is the outcome we then measure. A good way to remember the difference is to think of it like this:

The dependent variable "depends" on whats being changed (the independent variable).

Another way would be to remember that **"WE MEASURE THE EFFECT OF THE IV ON THE DV".**

If you remember that the independent variable (IV) always comes first, you should be able to recall that the dependent variable (DV) is then the outcome.

These are just two simple ways of remembering the difference between the IV and DV but feel free to use what works for you.

EXTRANEOUS VARIABLES

The extraneous variable is a third variable that may unknowingly be affecting the outcome of the study (the DV). We conduct experiments to measure the effect of the IV on the DV but sometimes extraneous variables are actually the cause of the changes. They can be seen as "nuisance variables" that affect the study and make it difficult to know whether it is the IV which affects the DV.

Let's use that example mentioned earlier about how music may affect a students ability to learn. We may conduct this experiment and find that music improves learning as the students who listened to the music performed better. We may, therefore, conclude music improves students ability to learn, however, what if it was actually a third variable affecting the results which is unaccounted for? (an extraneous variable). Perhaps we find that the students who performed the best were those with prior knowledge of the questions in the test?. The extraneous variable could then be argued to be prior knowledge participants had that we have not accounted for or could control.

Looking into the study we could argue perhaps the extraneous variable may be the intelligence of participants from one group to another that is affecting the outcome. It may be that some participants in one group were more educated and therefore better problem solvers, and this is an extraneous variable that is affecting the dependent variable (outcome).

With research studies you will be presented, you can almost always find arguments to highlight extraneous variables in some form. It is handy to get into the habit of recognising these different forms as they prove useful in critically analysing studies and topping up your points with further evaluation marks, especially at A level (should you continue your studies there).

SAMPLING METHODS

This section of AQA GCSE psychology requires you to know about 4 different sampling methods and their strengths and weaknesses. Sampling methods are merely the different strategies researchers use to get participants for their studies.

In any psychological research study, there is usually a target population, which is the group of individuals the researcher is interested in. The aim of the researcher is to try and take a representative sample from this target population using a sampling method. The goal is to gain a representative sample that then allows the researcher to make generalisations across the whole population, based on this samples findings.

The four sampling methods you are required to know about are:

- Random sampling
- Opportunity sampling
- Systematic sampling
- Stratified sampling

RANDOM SAMPLING

Random sampling involves the researcher identifying members of the target population, number them and then attempt to draw out the required number of people for their study. The selection of participants can be done in a randomised way such as drawing out numbers from a hat if the sample size is small or having a computer randomly select the participants if the sample size is large.

STRENGTHS AND WEAKNESSES OF RANDOM SAMPLING

- Random sampling has the benefit of being more unbiased as all members of the target population have an equal chance of being selected for the study. This would mean that the sample is likely to be more representative of the target population making more valid generalisations possible from the research findings.
- Random sampling also means there is less chance that researcher can influence the results as they have no say as to who is picked. This reduces the impact of investigator effects which means the findings may have more validity.
- However even despite this, it is still possible for the researcher to end up with an unbalanced and biased sample by chance, particularly if the sample size is too small.
- Gathering randomised samples can also be time-consuming, as attempting to gather enough willing participants from the target population takes a considerable amount of time and effort.

OPPORTUNITY SAMPLING

Opportunity sampling is a form of sampling method that means you ask those who are around you and most easily available, that represent the target population, to participate in the study. This may involve asking those around you in your class, school or people walking in the street for their involvement.

STRENGTHS AND WEAKNESSES OF OPPORTUNITY SAMPLING

- The main benefit of opportunity sampling is it is one of the fastest and easiest ways to gather participants for a study when compared to other sampling methods.
- Opportunity samples have a greater chance of being biased because the sample is drawn from a very narrow part of the target population. For example, if you selected participants at school, your sample is likely to consist of mostly students and the behaviours they display in the study may not generalise to adults. Participants may also try to "help" the researcher in a way that would support the hypothesis so the results may be unreliable and invalid.
- With opportunity sampling methods, it is possible the researcher can influence those selected as the process is not randomised. The researcher may select the people they think will support their hypothesis, so investigator effects is a potential hindrance.

SYSTEMATIC SAMPLING

Systematic sampling involves selecting every "nth" member of the target population. An example of this would be if the researcher decided that "n" will be "5", every 5th person in the target population is selected as a participant. This is still unbiased as the researcher has no influence as to who is picked and it is technically not a "random sample" either as not everyone gets an equal opportunity to be selected (it is only the person 5 positions away). Be sure not to confuse this with the random sampling method due to this slight difference; just remember that there is a fixed systematic way for selection that determines this to be a systematic sample.

STRENGTHS AND WEAKNESSES OF SYSTEMATIC SAMPLING

- A strength of the systematic sampling method is that it is a simple way for researchers to gather participants and there is little risk of research bias influencing this. Therefore the participants gathered should, in theory, be representative and unbiased which should lead to more reliable results.
- A weakness, however, is participants gathered could still be unrepresentative and biased due to chance selection. This would make the results unreliable when re-tested.
- Another weakness of systematic sampling is you need a bigger sample size to be able to filter out participants based on the "nth" selection. If you require 100 participants for a study and picked them based on every 10 participants, you would need 1000 participants to filter through. Therefore gathering participants for a study based on systematic sampling methods can be very time-consuming.

STRATIFIED SAMPLING

Stratified sampling is the most complex of the sampling methods and it is most often used in questionnaires. Sub-groups (or strata) within the population are identified (e.g. boys and girls or age groups: 10-12 years, 13-15 years etc) and then participants are gathered from each strata in proportion to their occurrence in the population. Selection of participants is generally done using a random technique.

For example, in a school, there are several subgroups such as teachers, support staff, students and other staff. If the teachers made up 10% of the whole school's population, then 10% of the sample must be teachers. This is then repeated for each sub-group.

STRENGTHS AND WEAKNESSES OF STRATIFIED SAMPLING

- A major strength of using stratified sampling techniques is that they are very representative of the target population. This means the findings should have high reliability and validity to make generalisations to the target population.
- A major weakness of using stratified sampling is that it is very time-consuming to identify the subgroups, select necessary participants and attempt to get a proportionate sample involved in the study. Therefore, this form of sampling method is extremely difficult to execute and can be impractical.

VOLUNTEER SAMPLE

A volunteer sample consists of people that have volunteered to take part in the study. Volunteers can be gathered in a number of ways such as putting an advert out on the newspaper, internet or some media outlet to try and gather people to take part. Volunteers may put themselves forward to be part of the study but they may not necessarily be told the aim of the study or what they are really being tested in. For example, Milgram's shock study gathered volunteers who agreed to take part but did not necessarily know what they were being tested on (obedience).

STRENGTHS AND WEAKNESSES OF VOLUNTEER SAMPLING

- A strength of using volunteer sampling is the people should be willing to give their informed consent to be a part of the study. The people that tend to volunteer tend to be those motivated to take part in the study.
- Volunteer sampling can also be a fast and efficient way of gathering research participants. Instead of having to search for volunteers, an advert could be placed to gather participants based on the traits/characteristics the researcher requires.
- A weakness of using volunteer sampling is the people that tend to volunteer may be a biased sample that are not representative of the target population. For example, volunteers are already motivated to engage in the research (volunteer bias) and more motivated than those that do not and this can influence the outcome of the study in some way.

DESIGNING RESEARCH

This section on designing research for GCSE psychology and research methods is quite extensive and requires you to know about a quite a few different aspects of designing psychological research studies. The topics you need to know for research methods include:

- The experimental method including:
  - Independent group design
  - Repeated measures design
  - Matched pairs design
  - Strengths and weaknesses of each design
- Laboratory experiments
- Field and natural experiments
- Interviews
- Questionnaires
- Case studies
- Observation studies
- Strengths and weaknesses of each research method and types of behaviour for which they are suitable.

INDEPENDENT GROUP DESIGN

An independent group design is the simplest to understand and conduct with participants involved in the study usually divided into two subgroups. One group will take part with the experimental condition (with the independent variable introduced), while the other group would not be exposed to this and form the control group for comparison.

Let's use the example we mentioned earlier with a study that measures the effects of music on learning. In an independent group design, one group of participants would be measured on their ability to learn with music being played while the other group would be tested on their learning ability without music.

The results (dependent variable) are then compared between the two groups to measure the effects. If the results are significantly different then researchers may conclude that this is because of the independent variable, which in our case would be music affecting learning ability.

PICTURE/VIDEO OF INDEPENDENT GROUP DESIGN***

STRENGTHS AND WEAKNESSES OF INDEPENDENT GROUP DESIGNS

- A strength of using independent group designs is there are no order effects which can invalidate the results, as participants only take part in one of the conditions. Order effects are apparent in experiments where repeated measure designs are used and this involves participants learning or improving from their experience of having to do the experiment more than once. This does not happen in independent group designs which can give more valid results.
- Independent group designs are beneficial as the materials or apparatus can usually be used across both the experimental condition and the control group (minus the independent variable being manipulated or introduced as required). This makes setting up independent group designs far easier than other experimental conditions due to saving time.
- Another strength of independent group designs is that participants are less likely to display demand characteristics. Demand characteristics are when participants change their own behaviour as they figure out (or think they do) the purpose of the study. The participants may then display behaviour which is different in response which can invalidate findings. Demand characteristics are less likely in independent group designs as participants are only exposed to one condition and they don't have the opportunity to learn or adjust their behaviour in another condition (as they cannot compare).
- A weakness of independent group designs is that differences between the experimental condition and control group may be due to participant variables, such as individual differences between the two groups, rather than the independent variable. Just by probability or chance, one group may be smarter than another or have individual characteristics that make them more able (or less able) for the condition they are exposed. This would then be a confounding variable that affects the results. Using the music example mentioned previously, the group that performs best (whether its the group exposed to music or not) may do so simply because they have more educated or intelligent people than the other condition.
- Another criticism of using independent group designs in experiments is that you need to gather more participants. For example, you need a large enough sample to be exposed to the experimental condition to make generalisations but you then need to gather this number again for the control group condition. Using our example earlier, if we wanted to test how music affects people's ability to learn and we gather 50 people, we need another 50 people for the control condition that is exposed to no music.

- Gathering too few participants increases the risks of individual differences being the difference in results while gathering a large number requires more time, effort and resources.

REPEATED MEASURES DESIGN

A repeated measures design sees all the gathered participants of the study being exposed to both conditions of the experiment. Referring to our music and learning scenario (once again!), we would have a group of 50 participants that would first be exposed to the experimental condition whereby they attempt to learn with music present and then they would attempt to learn without music. The results would then be compared between the conditions to assess what impact the IV had on the DV. In experiments where there were numerous different conditions, the same participants would be used across them while exposed to different independent variables.

STRENGTHS AND WEAKNESSES OF REPEATED MEASURES DESIGNS

- A major strength of repeated measure designs is that they require less effort to gather participants as they use the same people across the different experimental conditions. Therefore setting up the experiment tends to be faster compared to group designs such as independent measures where you would require double the amount of participants to cross compare against.
- Another strength of using repeated measure designs is participant variables are eliminated. This is because the same people are used across the different conditions and they are comparing against themselves directly. This means there is less chance of individual differences influencing the results.
- A weakness of using repeated measure designs is that there is the high risk of order effects affecting the validity of findings. As participants are required to do multiple tasks across different conditions, there is the risk that participants may improve as they repeat the experiments. For example, if they were tested on their learning ability while music was played in one condition, when they are tested without music, the experience and practice gained from the first condition may see them improve. Researchers may then incorrectly view this improvement as due to the independent variable (IV) rather than order effects.
- Another criticism of using repeated measures is you need to create multiple different tasks or materials between the conditions. For example, you could not use the same content for participants to memorise from one condition to another in a memory test experiment. You would need to create content that was judged to be similar in difficulty which in itself would be a subjective measure. For example, having participants memorise 20 “easy” words with similar syllables in one condition, would require a researcher to spend a significant time and effort in creating another set of similar words for another condition.
- There is a higher risk of demand characteristics when using repeated measure designs. This is because participants may be able to guess the purpose of the study (if it is intentionally obscured to improve the validity of findings) and then adjust their behaviour accordingly. This is more likely to happen as the same participants are used across the different conditions and they may notice the different setups and the purpose of the study. This may lead to invalid findings from the behaviour that is observed.

MATCHED PAIRS DESIGN

A matched pairs design involves gathering participants and testing them prior to them taking part in the study on certain characteristics. The tests allow them to be matched in pairs with someone who is deemed to have similar qualities as to them which may be relevant to the study. The pairs may be identified as Pair Aa or Pair Bb etc.

In conducting a matched pairs design research study, one pair will take part in one experimental condition while their matched partner/pair is exposed to another experimental condition. The results are then compared by the researcher between the conditions and treated as if they were gathered from one individual despite coming from two individuals.

Within psychological research, the most ideal matched pairs participants tend to be identical twins as they account have identical biology (as they are similar) and potentially very similar personality factors too.

STRENGTHS AND WEAKNESSES OF MATCHED PAIRS DESIGN

- One strength of using matched pairs designs in research is they reduce participant variables which can affect the results. This is because the people are paired up together based on similar traits that are relevant to the study.
- Another strength of using matched pairs is that there are no order effects, unlike repeated measure design studies. This is because everyone does the experiment once and have no opportunity to learn from their previous attempts.
- Matched pairs designs can re-use the same materials/apparatus across the pairs as everyone will only be exposed to them once. This makes the setup of the experiment easier as researchers do not have to create unique set-ups across the two groups which can be time-consuming.
- A weakness of using matched pairs design is matching people on key variables is time-consuming and not always successful. Attempting to find people who can be matched requires an initial large sample to filter through and this can take a very long time to do.
- It is difficult to match people based on personality variables or filter out individual differences for certain. You can generally only match people based on fixed traits such as gender (sex), age, height etc, however, personality factors may be what determine differences in the experiments. Therefore matched pair designs can produce invalid results that are not the result of the independent variable.

LABORATORY EXPERIMENTS

Laboratory experiments are experiments that are conducted in a controlled setting, usually a research laboratory where participants are aware of being observed and part of a study. Laboratory experiments tend to have high internal validity because researchers can control all the variables so the main differences between the experimental condition and control group are only the independent variable whose effect is being monitored. This allows researchers to more confidently assume that any differences between the conditions is due to the independent variable.

STRENGTHS AND WEAKNESSES OF LABORATORY EXPERIMENTS

- A major strength of laboratory experiments is they have high validity. This means that researchers can be confident to a higher degree that what they are measuring is in fact due to the independent variables effect because this is the only differences between the experimental condition and control group.
- Another strength of using a laboratory setup is this limits the role of extraneous variables from influencing the results as researchers have complete control of the environment. This means unaccounted for outside influences are limited and makes drawing cause and effect between the IV and DV more reliable.
- Laboratory experiments can be checked for reliability as they are easier to replicate. Due to the artificial setup of the experiments (being in a laboratory setting), other researchers can recreate the experiment exactly to check the results for reliability. This can be harder to do with other setups.
- A weakness of using laboratory experiments is they lack ecological validity. This is because the setup of the experiment is artificial and in a completely controlled environment and the results gathered in the lab, may not generalise to real-world situations due to their contrived setup. Therefore laboratory experiments tend to lack ecological validity as the setup involved to test behaviour may not occur similarly in real life e.g. testing memory ability and learning in a lab setup is unlikely to be how people learn with or without music being present – or using a film clip to test eyewitness testimony is not realistic.
- Participants in laboratory setups may display demand characteristics and adjust their behaviour due to the contrived setup and being aware that they are being observed. Therefore the behaviour observed may lack validity as it may not be indicative of how people are likely to behave in the real world if they think they are not being observed or under supervision. Participants may, therefore, behave how they think researchers want them or what would be deemed normal with others watching, not necessarily what they would actually do.

FIELD AND NATURAL EXPERIMENTS

A field experiment, also known as a natural experiment, is conducted in a more natural or everyday environment, unlike the laboratory experiment where the behaviour being measured is more likely to occur. The field experiment can be conducted anywhere in real-world settings with researchers manipulating an independent variable to measure its impact on the dependent variable. A field or natural experiment can include confederates that participants are unaware of also being involved to test their response in the field setting.

One key difference between a field experiment (or natural experiment) compared to a laboratory experiment, are participants may not be aware of being observed or studied. This is in an attempt to generate more realistic behaviour or responses from them that can generalise to real-world settings.

STRENGTHS AND WEAKNESSES OF FIELD AND NATURAL EXPERIMENTS

- A strength of using field experiments is they are high in ecological validity as the setup and environments are more realistic. This is thought to increase more realistic responses if participants in a natural experiment are not aware of being observed (unlike lab settings). The argument here is natural experiments then have higher internal validity and the behaviours from participants that can then be generalised to the wider population.
- A weakness of using field experiments is they are at higher risk of extraneous variables influencing the behaviour of participants. Researchers, therefore, have less control and cannot say with as much certainty that the behaviour they observed was in fact due to the independent variable or not.
- Another criticism of natural experiments is they are difficult to replicate. Participants may be members of the public with personality factors that influence the results which are unaccounted for and the environment itself may be difficult to recreate in order to test the study for reliability in its findings. Therefore replication and reliability become an issue for field experiments.
- Another weakness of using field experiments is they raise ethical issues in regards to informed consent. This is because participants may be unaware of being observed or part of a study and this raises ethical concerns. On the other hand, this may also provide us with more realistic and valid results without demand characteristics being a potential confounding variable.

INTERVIEWS

One way psychologists find out about peoples behaviour is to quite simply ask them through the form of interviews. Interviews involve a researcher in direct contact with the participant and this could either be face to face or via phone/video call. The vast majority of interviews involve a questionnaire that the researcher records the responses on at the time of the interview.

There are different forms of interviews used which vary in structure and we will look at specifically structured and unstructured interviews for GCSE psychology.

STRUCTURED INTERVIEWS

Structured interviews involve all participants being asked the same pre-set questions in the same order. The researcher is unable to ask additional questions outside of this. The questions are often closed questions which require a yes or no response, or they can be open questions which simply requires the researcher to record the participant's response. Open questions can be questions that begin with who, what, where, when, why and how. These force a participant to explain their answers beyond simply saying yes or no.

STRENGTHS AND WEAKNESSES OF STRUCTURED INTERVIEWS

- Structured interviews can be replicated far more easily than unstructured interviews as the questions are all pre-set. This helps in testing the reliability of research findings to check for consistency and validity in the conclusions drawn.
- A criticism/weakness of using structured interviews is they can be incredibly time consuming and require skilled researchers. People's responses can also be affected by social desirability bias.
- Structured interviews gather quantitive data but lack qualitative data. When participants can only answer yes or no, this does not tell us why they think or respond this way which may be more important to understand behaviour.

UNSTRUCTURED INTERVIEWS

In unstructured interviews, participants are free to discuss anything freely. The interviewer may devise new questions as the interview progresses or on the previous answers given, to explore further. With unstructured interviews, each participant is likely to be asked different sets of questions within the interview. The questions asked in unstructured interviews may be a mix of open and closed questions.

STRENGTHS AND WEAKNESSES OF UNSTRUCTURED INTERVIEWS

- Unstructured interviews provide rich and detailed information however they cannot be replicable and people's responses cannot be easily compared.
- Unstructured interviews have the benefit of allowing participants to explain their responses which can help us understand why they think or behave in particular ways which may be more valuable than structured interviews telling us merely how they would behave.
- Unstructured interviews can be more time-consuming as there is no structure or guideline to follow in regards to how many questions are being asked. They also require more trained interviewers who are able to articulate themselves and the questions they wish to ask, unlike structured interviews which can merely be read from a list and explained more easily.

QUESTIONNAIRES

Questionnaires are an example of a survey method that are used to collect large amounts of information from a target group that may be spread out across the country. The researcher must design a set of questions for participants to answer; people taking part in a survey are referred to as "respondents" because their answers or behaviours are in response to the questions presented. Questionnaires can be conducted face to face, via phone or video call too. Questionnaires are similar to structured interviews as respondents all answer the same questions, in the same order and they often narrow the possible responses to closed questions (yes or no answers).

STRENGTHS AND WEAKNESSES OF USING QUESTIONNAIRES FOR RESEARCH

- Questionnaires are practical ways for researchers to gather large amounts of information very quickly on topics where the responses are best suited for yes or no responses.
- Another strength of using questionnaires is that they can be replicated very easily as all the questions are pre-set. Responses can be gathered again to check for reliability and validity this way far more easily.
- Problems arise in the use of questionnaires when the questions are unclear or if they suggest or lead respondents into a desirable response. Responses can be affected by social desirability bias so participants may not necessarily answer truthfully which can invalidate findings.
- Another criticism of using questionnaires in research is respondents can only answer yes or no. This limits the amount of information that can be gathered but also participants may not be able to answer in certain terms yes to every presented scenario (or no). It may be that their responses only represent given situations but can be different in other situations.
- Respondents may misunderstand the meaning of questions and therefore answer incorrectly. Unlike structured interviews that allow participants to ask questions to clarify their understanding, respondents may misread or misunderstand questions and answer in a way that is not truly representative of their views.

- The researcher needs to make sure that in writing the questions, they are clear and unambiguous. This can be a difficult task to achieve and requires a great deal of time to construct questions that do not bias or lead the respondents into responses.

CASE STUDIES

A case study is a very detailed study into the life and background of either one person, a small group of people or institution or event. Case studies use information from a range of sources, such as the person concerned, related family members or even friends. Various techniques may be used such as interviewing people or observing people as they engaged in daily life. Psychologists may also use various tests such as IQ tests, personality tests or some questionnaire to produce psychological data about the target in question. Researchers may also refer to school or work records for an individual or carry out observations of the individual or groups in question. The case study is then written up as a description of the target individual or group and interpret the information based on psychological theories. Case studies tend to be longitudinal and follow the target over a long period of time (often many years).

STRENGTHS AND WEAKNESSES OF USING CASE STUDIES

- A strength of using case studies is they provide detailed information about individuals (or target group/institution) rather than collecting a score on a metric test from a person.
- Another benefit is case studies collect information over a long period of time so changes in behaviour can be observed and comparisons are drawn over this period to understand the changes.
- A weakness of using case studies is they target a single individual and this makes it difficult to generalise the findings to others. The situation or factors that influence this individual's outcomes may not necessarily do the same for others due to individual differences. The data collected is also very subjective as it relies on usually people's perceptions of things and their memories may not be so reliable over such a long period of time. There is also the risk that the researcher themselves projects their own biases onto the findings and makes their own interpretations of the content making the case study unreliable.
- There can be ethical concerns with using case studies as the people or group being followed are usually of interest because of some psychological problem. This could make them vulnerable and raise ethical concerns about whether they can give informed consent.

OBSERVATION STUDIES AND THE OBSERVATIONAL METHOD

In an observational study, the researcher watches or listens to the participants engaging in whatever behaviour is being studied and records their behaviour. In most natural observations, people are observed in their normal environments without interference from the researcher. In some studies, a researcher may cause something to happen to gauge the responses of people and record these. Here's an example:

A NURSE IS CALLED BY A "DOCTOR" VIA TELEPHONE AND INSTRUCTED TO GIVE MEDICINE TO A PATIENT WHICH IS AGAINST THE RULES.

The study was conducted in the nurses natural setting of the hospital and researchers then observe whether the nurse follows this instruction or not.

In some studies, the data may also be collected in a "laboratory setting" although this may necessarily be a laboratory. This may be a natural setting that has been organised by the researcher to make it easier to observe the targets.

CATEGORIES OF BEHAVIOUR

In order to make sure that accurate records of behaviour are made, researchers use **categories of behaviour system**. If researchers wanted to observe "playground behaviour", researchers would not necessarily know what they were looking for in this definition or what may be classified as "playground behaviour". The observers would need to know what they are looking for to make accurate recordings and therefore behavioural categories are created to make it clear what behaviours are to be recorded.

categories of behaviour table example***

STRENGTHS AND WEAKNESSES OF OBSERVATIONAL STUDIES AND THE OBSERVATIONAL METHOD

- What people say is often very different from what they may do in a given situation. The observational method is high in ecological validity and its use is very suitable for social behaviours as it allows researchers to gauge peoples true responses. If participants were asked about their behaviour prior, they may give socially desirable responses which may not be what they would really do and observational studies allow us to see true behaviour without this bias.
- The behaviours observed in observational studies have higher external validity as they can be more easily generalised. Unlike laboratory studies that test participants under contrived circumstances (e.g. memorising lists of words to test memory), observational studies and their setup are more natural providing more ecologically valid results.
- A weakness, however, is although researchers see and record behaviour in an observational study, they do not know why the behaviour happened. This then requires the researcher to make a judgement on its cause which may be riddled with bias or may simply be incorrect.
- Participants or subjects may become aware of being observed and thus change their behaviour leading to researchers recording incorrect responses. Also, the researcher themselves may make a mistake recording the behaviour which can invalidate findings.
- Observational studies also raise ethical issues particularly around informed consent as participants are usually not aware of being observed or part of a study. Informing them prior may lead to their behaviour altering when they are aware of being observed however not informing them raises ethical issues of privacy and lack of consent.

INTER-OBSERVER RELIABILITY

When an observation study is conducted, observers record the amount of times certain behaviours occur (usually in the form of a tally chart). This record of the number of incidents for the different behaviours needs to be accurate and that the observer is recording the correct behaviour within the correct categories. In observation studies, observers may miss the behaviour and so accuracy of recording the behaviour becomes an issue as it cannot be seen again in live environments. A solution to this problem is to design a record sheet with the pre-defined suitable behavioural; categories and then have two observers independently observe the targets at the same time and location. Each would then record what they see in their own individual sheets independently from the other. At the end of the study, the observers may compare their record sheets to check for consistency.

If the sheets have been recorded correctly, they should have matching or very similar recordings of their observations. If this occurs, they have established inter-observer reliability. If the record sheets are considered vastly different, this would mean the studies lacks inter-observer reliability and the results lack validity as they are not measuring what they are supposed to measure accurately.

WHAT IS A CORRELATION?

A correlation is quite simply a relationship between two variables. There can be a **positive correlation, a negative correlation and zero correlation.** With positive and negative correlations, the relationship is seen as a "cause and effect" relationship whereby one variable has a direct impact on the other. Correlations form part of a statistical technique to analyse and display the possible relationship between the two variables.

Let's work through a few subjective examples for each:

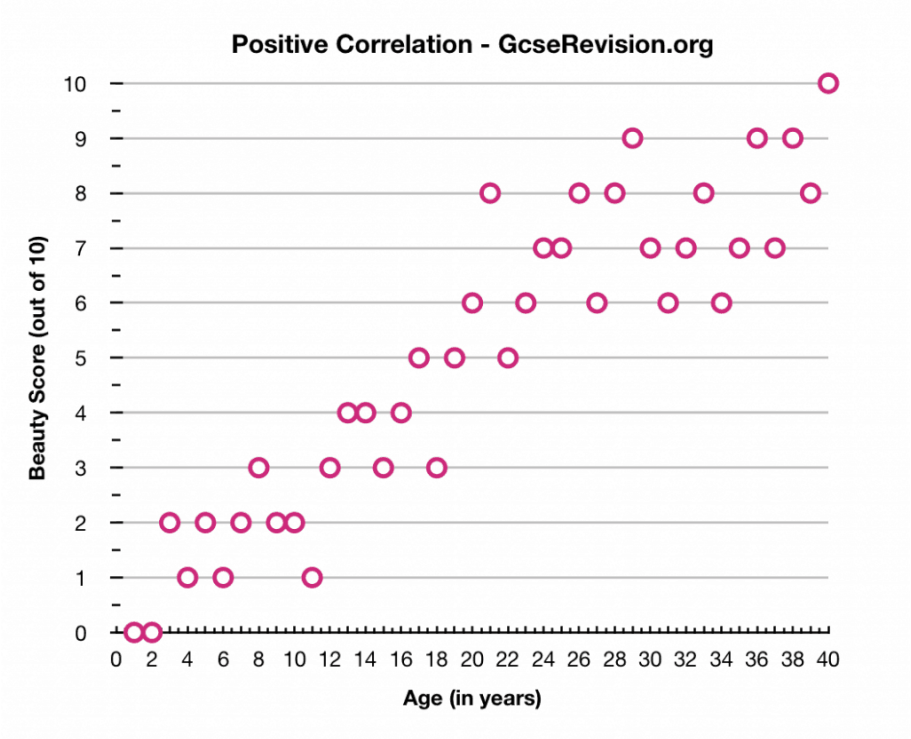
Let's assume there is a correlation (relationship) between the two variables **age** and **beauty.** As people get older they may be seen to be more beautiful. This would be considered a **positive correlation** because both the variables **increase together.**

If, however people disagreed and thought that as people age and get older, they are less beautiful, this would be a **negative correlation.** This is because as one variable increases, the other one decreases which in our case would be age increasing while beauty **decreases.**

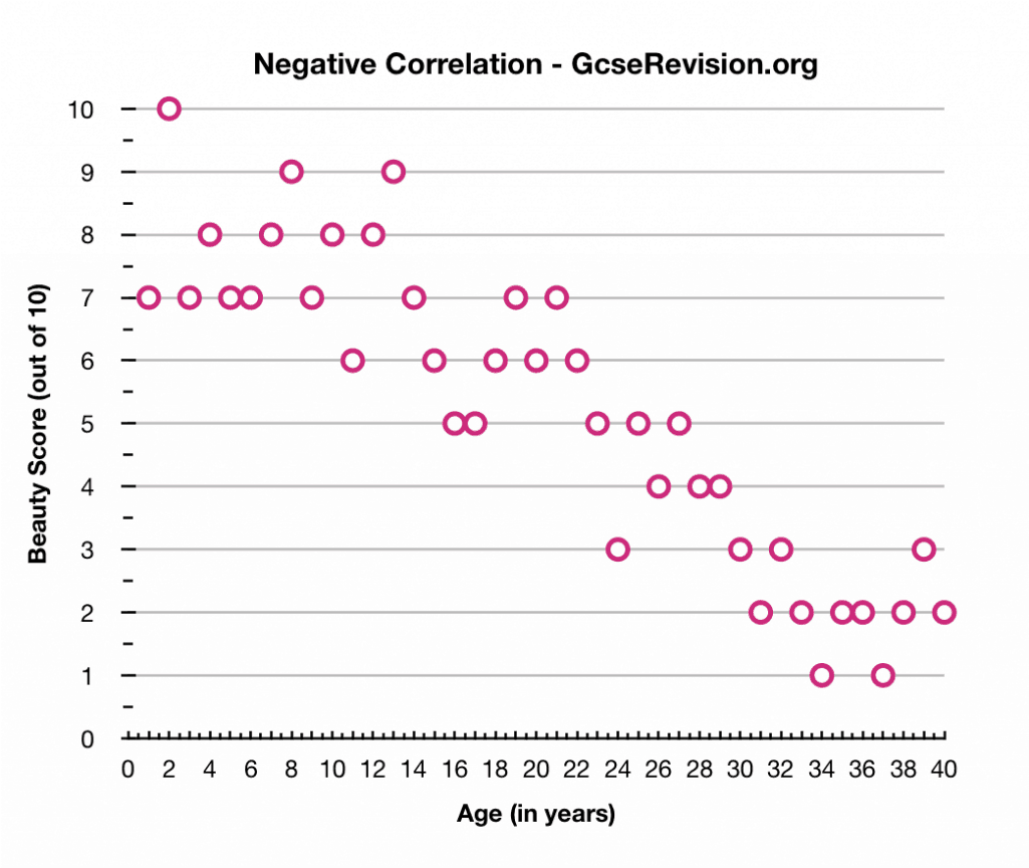
The third way of looking at this is thinking the age has no effect on perceived beauty. As people get older you may think this has no bearing on a person's beauty so the two variables would be seen as having **zero correlation.**

Below we have some examples of scattergrams that give you an idea of how each correlation would look if presented to you. You may sometimes be asked to draw a line of central tendency too within a correlation; all this means is you draw a line down the middle of all the correlations with equal amounts on either side of it.

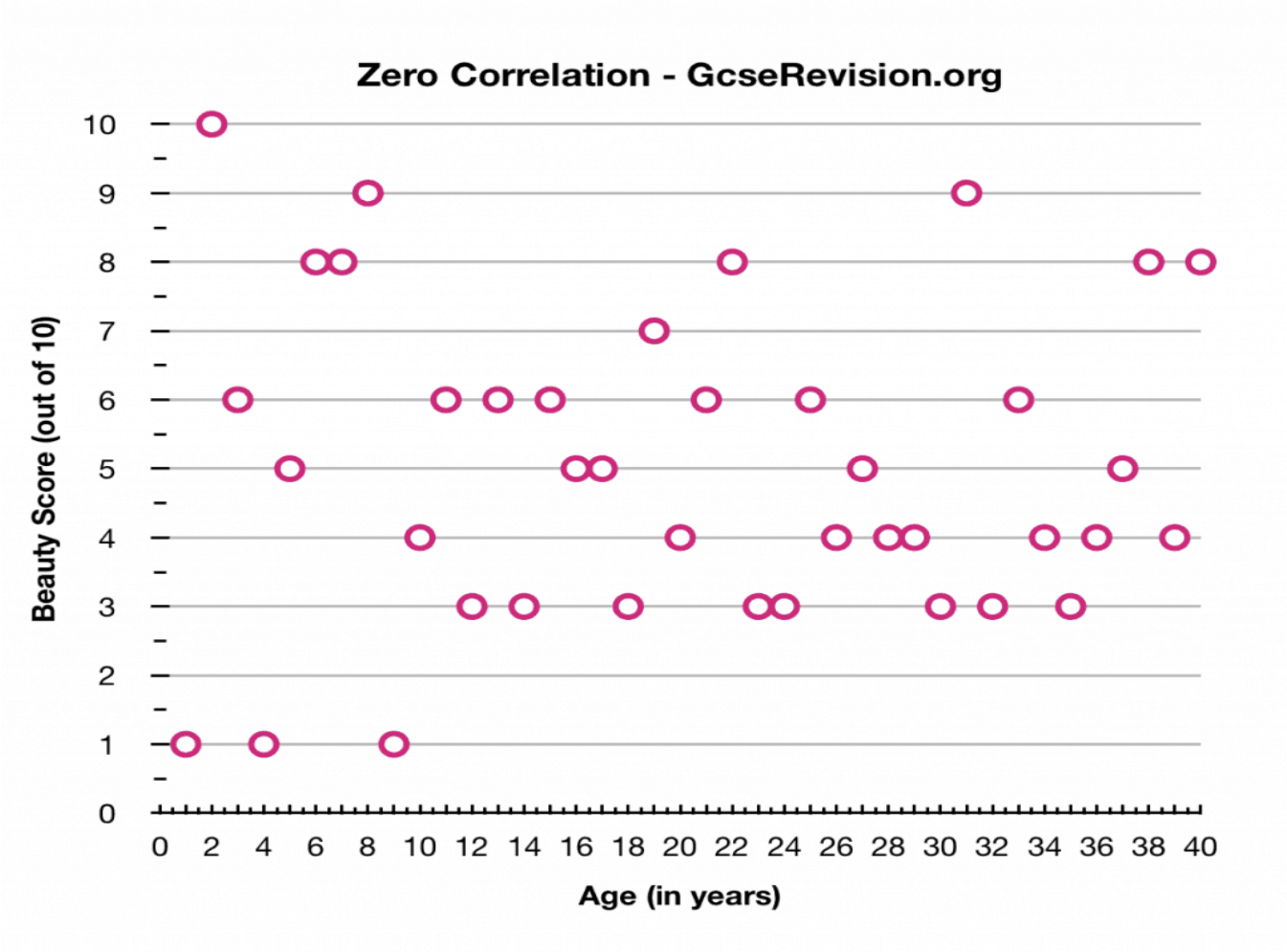
EXAMPLES OF POSITIVE CORRELATIONS IN SCATTERGRAMS



EXAMPLES OF NEGATIVE CORRELATIONS IN SCATTERGRAMS



EXAMPLES OF ZERO CORRELATION IN SCATTERGRAMS



STRENGTHS AND WEAKNESSES OF CORRELATIONS

- Correlational research can be very useful as they allow a researcher to see if two variables are connected in some way. Once a relationship has been established between two variables, a researcher can then use an experiment to try and find the true cause of the correlation.
- Correlational research can be used in situations where it may be unethical or impossible to carry out an experiment. For example, if we wanted to check for the relationship between smoking and cancer, this would be unethical to test (asking people to smoke to see if they develop cancer). However, plotting the rates of cancer developing in people who already smoke can help us establish links between these two variables. This knowledge can then be helpful in influencing future research.
- A weakness of using correlations is although this type of tool can tell us if two variables are related, it does not tell us which of the two variables caused the relationship. It is also possible that there may be third unknown variables that lay in between and influence the two we measure in research which may be the actual cause.

- For correlational research to be helpful, we first need to gather large amounts of data to establish the pattern in the scattergraph. This means researchers are required to make lots of measurements of both variables so that the patterns in the data can be reliably established. Using correlational research for small populations is not reliable so it can be very time-consuming establishing a large data set.

R

RESEARCH PROCEDURES

This next section looks at standardised procedures, instructions to participants, randomisation, allocation to conditions, counterbalancing and extraneous variables (including explaining the effect of extraneous variables and how to control for them).

STANDARDISED PROCEDURES

When conducting experiments, researchers need to ensure that standardised procedures are used. Standardised procedures are a set of sequences which apply to all the participants when necessary to ensure the experiment is unbiased. Standardised procedures allow the researcher to try and control all the variables and events so the results of the experiment can be safely attributed to the independent variable.

INSTRUCTIONS TO PARTICIPANTS

When standardising procedures, another issue researchers need to be mindful of is how instructions to participants are put across to make sure they know what to do but without biasing the study in any way. This can include verbal and written instructions.

Instructions can be interpreted in a way that can influence their performance and these can become extraneous variables. For example, if instructions were worded with leading questions, this may cause participants to answer in one particular way. If instructions are ambiguous, this can also affect the results of the study.

To address this issue, the usual practice is to write as much information as possible for participants and ensure they all receive this same information. This is usually done in sections:

- **Briefings** – This is where participants are encouraged to participate with a log of what is discussed to gain their consent. This can include ethical information about consent, anonymity, the right to withdraw etc.
- **Standardised instructions are given** – these are clear instructions given to each participant explaining their role and what they need to do.

- **Debriefing** – At the end of the study, participants are given a detailed explanation about the aims of it, what their role was and why they were given their tasks or roles. Ethical issues are also raised again with participants given the opportunity to withdraw their data/contributions if they feel unhappy about their performance or participation.

RANDOMISATION

Randomisation simply means to make sure there are no biases in the procedures. Let's use our music and learning example again for a moment to highlight how randomisation may be implemented in a psychological study.

Participants are being tested on their ability to learn through the use of 20 random words they are presented. All the words are considered to be of equal difficulty because they are everyday nouns with only six letters. The researcher has to decide which order they should be presented to each of the participants in the study however instead of the researcher determining the order, randomisation is used.

All 20 words are written down on a piece of paper and put into a hat. They are then randomly selected one after the other with their order being written down in which they have been selected. This order is then determined to be the order which all participants will be exposed to within the experiment. Using randomisation, all the words had an equal chance of selection and now with an order established, all participants will be exposed to them in the same way.

RANDOMISATION CAN BE IMPLEMENTED IN A NUMBER OF WAYS WITHIN AN EXPERIMENT TO FILTER OUT BIASES AND YOU MAY BE GIVEN A QUESTION ON HOW TO BEST IMPLEMENT THIS OR ITS BENEFITS.

ALLOCATION OF PARTICIPANTS TO CONDITIONS

Another major issue researcher face, is how to allocate the participants to the experimental condition or control group. To reduce researcher bias, two methods used are **random allocation** and **counterbalancing.**

RANDOM ALLOCATION

When the design of the study uses an independent group design, the researcher can use random allocation to avoid any potential researcher bias. Participants can be randomly selected in turns for either condition A or condition B by pulling their name out of a hat for example. A similar method can be employed if the design of the experiment is a matched pairs design. Participants can be randomly allocated to their pairs by them pulling out the letters for each pair from a hat e.g. the two people who pull out A+a from a hat form a pair, the same with B+b, C+c etc and so forth.

COUNTERBALANCING

For experimental designs such as the repeated measures design, all the participants are required to take part in the experiment for both conditions. The problem with this is that **order effects** can occur whereby participants learn from experience and thus do better in all the following conditions after their initial one. Counterbalancing helps balance out order effects by splitting the group of participants into two groups. One half will then complete condition 1 while the other half complete condition 2.

After completing this, they swap and complete the opposite condition so those who completed condition 1, then move on to complete condition 2, those that completed condition 2, go on to complete condition 1.

Using counterbalancing does not get rid of order effects but allows for the effects of it to be balanced out equally between the two conditions for participants and thus providing more valid results.

ETHICAL ISSUES

This next section focuses on all the ethical considerations based on the British Psychological Society guidelines and ways in which each can be dealt. Ethical issues arise when there are two conflicting points of view; 1) One is what the researcher needs to do in order to conduct a useful and meaningful study and 2) the second is the rights of the participants which need to be considered.

Ethical issues are therefore all the conflicts that arise about what is acceptable to do as part of the research. As part of your GCSE psychology course, you need to be able to highlight ethical concerns and generate ways in which to deal with them. You may also be given a scenario where you need to highlight the relevant concerns and comment on how to deal with them.

The **Code of Ethics and Conduct (2009)** and **Code of Human Research Ethics (2014)** from the British Psychological Society underpin the activities of all practising psychologists.

THE CODE OF ETHICS AND CONDUCT (2009) AND CODE OF HUMAN RESEARCH ETHICS (2014)

When research is conducted by any practising psychologists, The Code of Ethics and Conduct (2009) and Code of Human Research Ethics (2014) will underpin their work. The British Psychological Society (BPS) guidelines explain what is required:

RESPECT

Participants should be respected as individuals and unfair or prejudiced practices are to be avoided. The data collected should also be confidential and anonymised so participants cannot be identified from the research.

Participants should have also given informed consent and know fully what they are consenting to.

They should also be told at the beginning what the study is about prior to taking part. Deception must be avoided although the BPS recognises that some studies are not possible without this to gather meaningful results. Any deceptions that do take place must be explained to participants as soon as possible once the study concludes. They should also be aware of their right to withdraw from the study at any time.

COMPETENCE

Psychologists should maintain high standards in their professional work. They should only give advice if they are qualified to do so.

RESPONSIBILITY

Researchers must protect participants from physical and psychological harm. The risk of harm should be no greater than what they would expect from everyday life and their wellbeing should not be at risk. At the end of the experiment, participants

Some of the key ethical issues and ways in which they could also be dealt with are below.

INFORMED CONSENT

Informed consent means revealing to the participant the real aims of the study or telling them what will happen within the study. This becomes an ethical issue because revealing the true aims or details may lead to the participants to adjust their behaviour which could lead to invalid results. For example, if we wanted to study whether people are more likely to obey a male or female as part of research into obedience, revealing the aims of this study will almost certainly affect their behaviour and invalidate findings. Researchers may therefore not always give out the full details of the study however this means participants can not give their full informed consent.

From a participants points of view, they should be told what they are required to do in the study so they can make an informed decision about whether they wish to take part. This became a basic human right which was established during the Nuremberg war trials after the second world war. During the war, Nazi doctors conducted various experiments on prisoners without their consent and the war trials afterwards decided that consent should become a basic human right for participants to be involved in a study.

Epstein and Lasagna found that only a third of participants volunteering for experiments really understood what they had agreed to take part in despite giving informed consent. This demonstrates that even if researchers sought to and obtained informed consent, this does not always guarantee that participants understand what they are involved in or doing.

HOW TO DEAL WITH ETHICAL ISSUES OF INFORMED CONSENT

- Participants are asked to formally indicate their agreement to take part based on information concerning the nature and purpose of the study and how their role fits in.
- Presumptive consent may also be gained; this can be done by asking a group of people whether they feel a planned study is acceptable and assume that the participants themselves would have felt the same if given the opportunity to say so.
- Researchers can offer the right to withdraw at any stage of the study.

DECEPTION

Some experiments require deception about the true aims of research otherwise participants might alter their behaviour and the study's findings become meaningless. A distinction could be made in some cases between withholding some details about the study (reasonably acceptable) compared to deliberately providing false information (less acceptable).

From the participant's point of view, deception would be unethical and thus they should not be misled without good reason. An issue with deception is it prevents participants from giving informed consent. Participants may agree to take part without fully knowing what they have agreed to and become quite distressed by the experience.

Baumrind (1985) argued that deception was morally wrong based on three generally accepted ethical rules within Western society: the right of informed consent, the obligation of researchers to protect the welfare of participants and the responsibility of the researcher to be trustworthy.

Others have argued that deception can be harmless in some studies i.e. testing memory and deception may be necessary to gain meaningful insights that would not be otherwise possible.

HOW TO DEAL WITH ETHICAL ISSUES OF DECEPTION

- The need for deception in research needs to be approved by an ethics committee which weighs up the potential benefits of the research, against the costs to participants.
- Participants should be fully debriefed after the study and given the opportunity to request that their data is withheld.

THE RIGHT TO WITHDRAW

Participants would deem the right to withdraw from an experiment as important. If a participant begins to feel distressed or uncomfortable, they should have the right to withdraw from the study. This becomes more important particularly if they have been deceived about the nature of the study or their role.

From a researcher's point of view, participants being able to withdraw midway through a study could bias the results in some way when comparing the results of those that stayed. Within some experiments, participants are offered financial payments for completing the study and withdrawing is compromised because they may not get paid and thus feel like they cannot withdraw.

HOW TO DEAL WITH ETHICAL ISSUES ON THE RIGHT TO WITHDRAW

- Participants should be informed at the beginning of the study that they have the right to withdraw at any point in the study.

PROTECTION FROM PHYSICAL AND PSYCHOLOGICAL HARM

Researchers may believe that to benefit society ultimately, some experiments may require participants to experience some level of distress. Some experiments can also be difficult to fully assess in terms of what the outcome is likely to be or the effects on participants e.g. Zimbardo's Stanford prison experiment.

Therefore, for some research studies, it is difficult to guarantee that participants will be completely protected from harm in some way.

From participant's points of view, they should not be exposed to any harm during a study that they wouldn't be exposed to in ordinary day to day life. Experiments can cause harm in many ways including physical harm by encouraging them to smoke or drink (health risks) or psychological harm (embarrassment, making them feel inadequate). Participants should leave the experiment in the same state as they entered unless they have given informed consent to be treated otherwise.

HOW TO DEAL WITH ETHICAL ISSUES ABOUT PROTECTION FROM PHYSICAL AND PSYCHOLOGICAL HARM

- Researchers should avoid putting participants in situations where the risks are higher than they would expect from everyday life and stop the study immediately if this presents itself.

CONFIDENTIALITY

A researcher may find that maintaining confidentiality can be difficult as they wish to publish the findings. They may guarantee anonymity and withhold the participant's names, but even then it may be evident for some who the participants are. In some locations or communities which are remote or the population is low, naming even the geographical area can identify the individual.

The Data Protection Act makes confidentiality a legal right and it is only acceptable for a person's data to be recorded if it does not make it available in a form that can make the people identifiable.

HOW TO DEAL WITH ETHICAL ISSUES OF CONFIDENTIALITY

- Researchers should not record any names or personal details about the participants using numbers or fake names instead.

PRIVACY

Privacy may be difficult to accomplish from a researcher's point of view, particularly when studying participants without their awareness. Participants may feel that they should not be expected to be observed or watched by others in some situations e.g. within the privacy of their own homes although not when in public areas such as a park.

HOW TO DEAL WITH ETHICAL ISSUES OF PRIVACY

- Researchers should not observe anyone without their informed consent unless it is in a public place where this may be expected to some degree.
- Participants can also be asked to give their retrospective consent or withhold the data entirely.

WHAT IS QUANTITIVE AND QUALITATIVE DATA

There are two types of data research studies collect and these are quantitive data and qualitative data. So what exactly are these?

QUANTITIVE DATA

Quantitive data is data that represents how much, how long, how many etc. there are of something. This dataset measures behaviour based on quantities and how much something occurs for example. The data is represented in a numerical form such as a score on a test or times taken to complete a task. The data tends to be easy to display and can be used to form percentages, averages or plotted on to a graph. This form of data is usually not able to explain why particular scores or measurements were achieved so they tell us little about the possible explanations for them.

- Within the context of experiments, the dependent variable is quantitive
- Closed questions on questionnaires (yes or no answers) collect quantitive data. Any form of numerical information collected would also be quantitive such as your age, height, ratings you give something.
- In observational studies, a tally of behavioural categories would be deemed to be quantitative as you are measuring how often something occurs.

STRENGTHS AND WEAKNESSES OF QUANTITIVE DATA

- Quantitive data tends to be objective and easy to measure for researchers.
- Precise measures are used
- The data is high in reliability and can be checked through replication.
- The data can be more easily examined to check for patterns through the use of correlations and presented in the form of scattergrams.
- Weaknesses of quantitive data include the possibility that meaningful details could be lost or lacking as researchers focus on a narrow set of responses or pre-defined questions people answer.

QUALITATIVE DATA

Qualitative data is descriptive data that is non-numerical. This type of data provides detailed information which can provide insights into the thoughts and behaviours of individuals because the answers are not restricted to yes or no responses. Qualitative data tends to be collected through the use of open questions (questions that begin with who, what, where, when, why or how) that encourage participants to explain themselves. This is done usually through questionnaires or unstructured interviews.

Qualitative data cannot be counted or quantified as easily although it can be placed into categories to count the frequency in which it is reported to occur. For example, we may be able to count how many times participants in Milgram's study reported to be stressed or worried.

However, as the responses from participants can be completely subjective to them, the data can be incredibly varied based on their responses and difficult to quantify or generalise with any meaning. In an observational study, researchers may describe what they see and this would be deemed a form of qualitative data.

STRENGTHS AND WEAKNESSES OF QUALITATIVE DATA

- A major strength of qualitative data is it tends to be rich in detail.
- Another strength is qualitative data can help researchers understand people's attitudes, thoughts and beliefs which may better explain their behaviour rather than them having to guess.
- A weakness of using qualitative data is it tends to be completely subjective.
- Qualitative data tends to also be an imprecise measure that is difficult to quantify.
- Another criticism of qualitative data is the difficulty in checking for reliability as participants all give subjective responses. This makes it difficult to generalise to other people.

WHAT IS PRIMARY AND SECONDARY DATA?

- **Primary data** is data that has been collected firsthand from the source (participants) directly by researchers. The majority of data collected in psychological research will be primary data.
- **Secondary data** is data that has been already published and simply used by researchers in their own wor

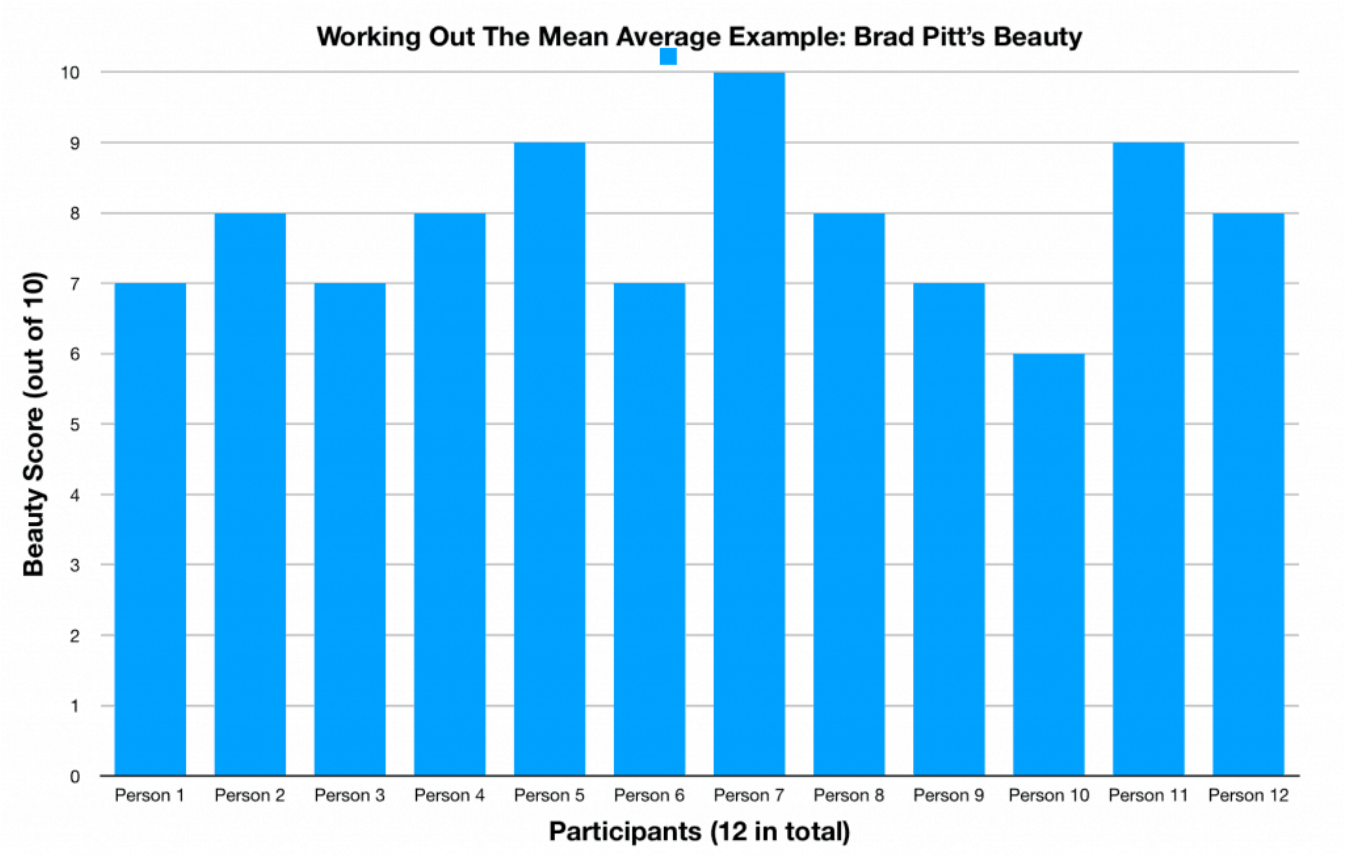
THE MEAN, MEDIAN, MODE AND RANGE

There are three types of averages that can be calculated from the raw data obtained from studies which allow researchers to identify patterns in the behaviour. These three are the **mean, median, mode and range.**

THE MEAN AVERAGE

- **The Mean Average:** is calculated by adding together all the values in a set of scores and then dividing that number by the number of values in the set. For example, if we wanted to work out the mean average for what Brad Pitts score would be on a beauty scale from us questioning 12 people, we would take their scores, add them up and then divide them by the number of people in the study (in our case, this would be 12).

Let's work through an example assuming that the beauty score is out of 10:



So to work out the mean average we would need to add up all the scores all 12 people have given – this would then be:

7 + 8 + 7 + 8 + 9 + 7 + 10 + 8 + 7 + 6 + 9 + 8 = 94

94 is the total score of all 12 participants. We then divide this by 12 (the number of participants)

94 / 12 = 7.83

Brad Pitt's mean average score would be 7.83/10 (out of 10)

The Median

- **The Median:** This is the middle value of a set of scores. To calculate the median, you must arrange all the values in order from the lowest to the highest. Then you must find the middle value. If there isn't an obvious middle value due to an even number set, you work out the midpoint of the of the two middle values.

Let's work out the median value using the example above; we must first order the numbers from lowest to highest.

6, 7, 7, 7, 7, 8, 8, 8, 8, 9, 9, 10

Having ordered the numbers, we can see that the midpoint is 8 either side. Therefore, the median in the example is 8.

The Mode

- **The Mode:** This is the most frequently occurring value in a set of scores. Sometimes there may be no mode (if no number occurs more frequently than another) or there can be more than one mode.

Let's work out the mode using the example above again by first writing down all the scores; we must first order the numbers from lowest to highest.

6, 7, 7, 7, 7, 8, 8, 8, 8, 9, 9, 10

We can see that the mode is 7 and 8 because they both appear the most which is 4 times.

The Range

- **The Range:** The range value is the numerical difference between the highest and lowest set of scores. So using our example above we can see that the highest score is 10 and the lowest score is 6. So we minus 6 from 10.

10 – 6 = 4

The range is therefore 4.

RATIOS, FRACTIONS, PERCENTAGES

This section focuses on recognising and using expressions in decimal and standard form. These include:

- **Ratios**
- **Fractions/decimals**
- **Percentages**

RATIOS

A ratio is a way of comparing the amounts of something between each other and this is usually expressed in its simplest form.

If we had 15 boys and 12 girls in one class and we wanted to compare this as a ratio, this would be **15:12**

When we break this down into its simplest form this would be **5:4** because we can divide both sides by 3.

FRACTIONS AND DECIMALS

A fraction is a way of expressing a part of a whole number.

For example, if we had a group of 20 boys and 15 of those produced the action of running which we wished to express, the fraction would be **15/20 or 3/4 in its simplest form.**

As a decimal, this may be expressed as 0.75 as the total or whole amount is always represented as 1. The number of boys that did not express running would, therefore, be 0.25

PERCENTAGES

Percentages are a way of expressing a fraction of a hundred which is considered the full amount. So 50/100 would be expressed as 50% (percent). This is sometimes used in psychology to express how often something happens e.g. running occurred 75% of the time.

So using the example before, if we had a group of 20 boys and 15 of them were seen to be running and we wanted to work out the percentage of this, we could calculate it in the following way:

15 x 100 divided by 20 (total no. of people) = 75%.

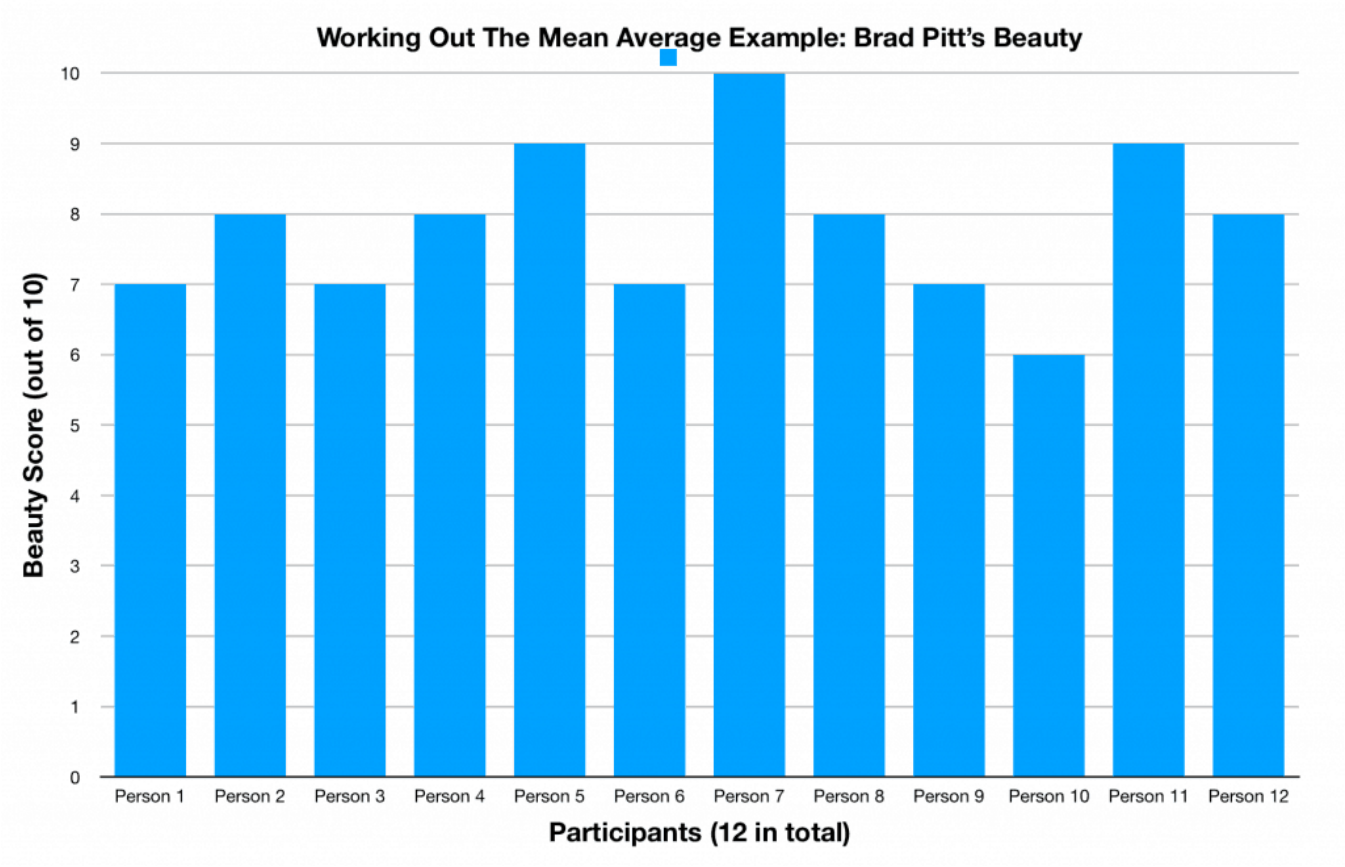
So to rephrase:

15 (boys) x 100 (the whole amount) divide by 20 (the total number of boys) = 75%

BAR CHARTS, HISTOGRAMS AND SCATTERGRAMS

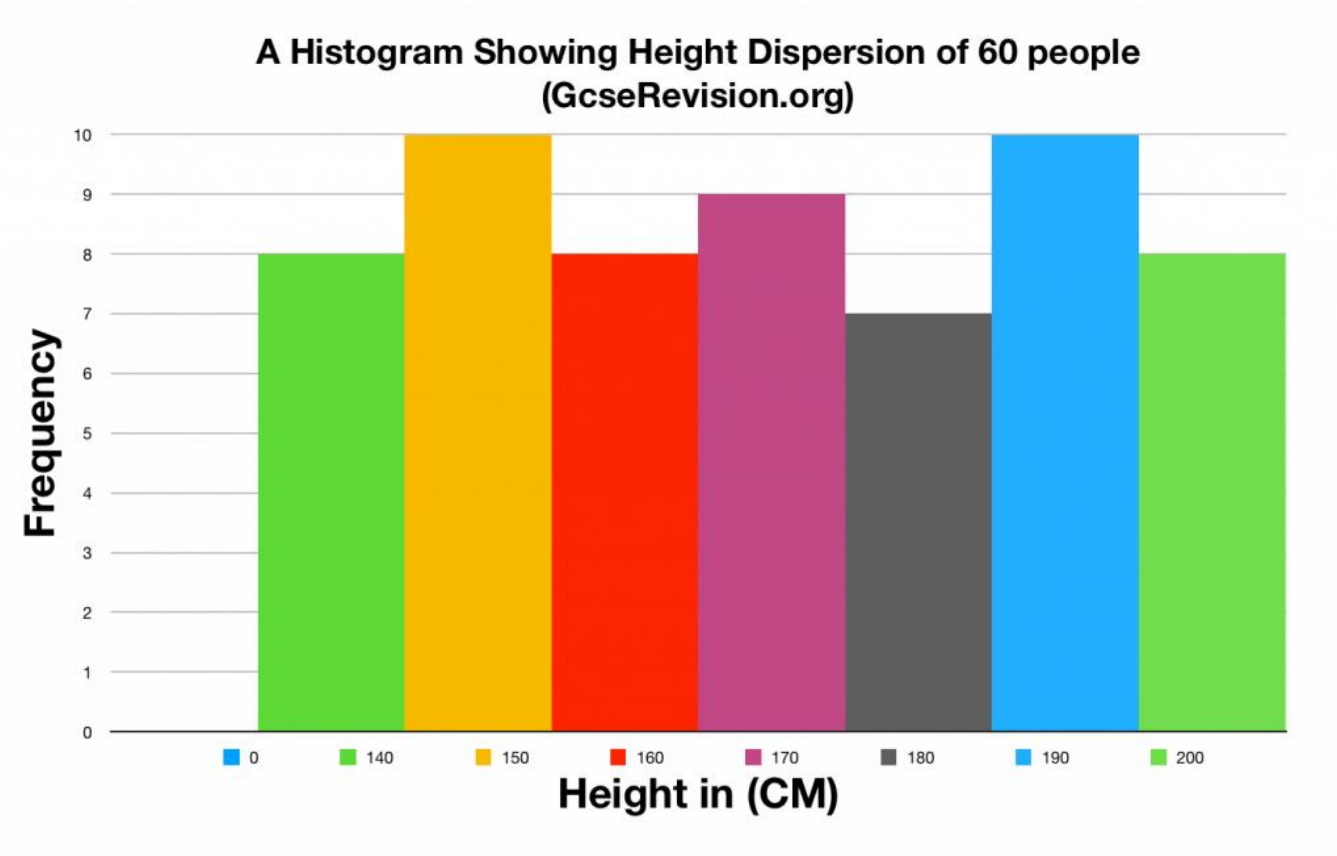
BAR CHARTS

Bar charts are used to display data that is in categories. Each bar represents a separate category with them labelled across the x-axis which is at the bottom (horizontal). The frequency or amount for each category is labelled on the y-axis which runs along the side (vertical). The bars drawn should not touch and be separated from one another. Here's a picture of the one we used earlier to measure the hypothetical study of beauty:



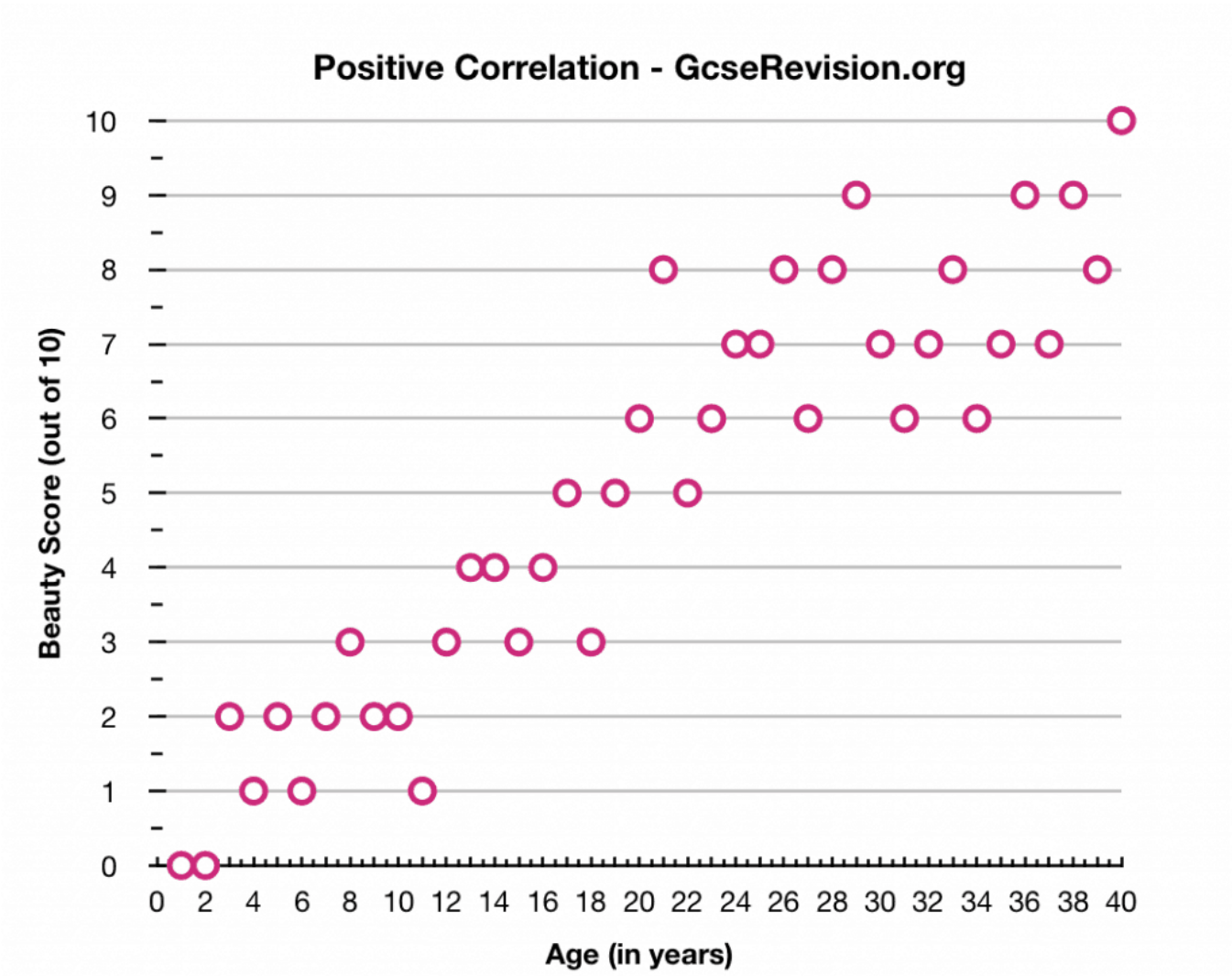
HISTOGRAMS

Histograms are used to present data that are continuous measurements such as test scores or even height. The continuous scores are on the x-axis across the bottom and the frequency of these scores are on the y-axis. Histograms have no spaces between the bars (unlike bar charts) as the data is continuous. Here's an example below:



SCATTERGRAMS

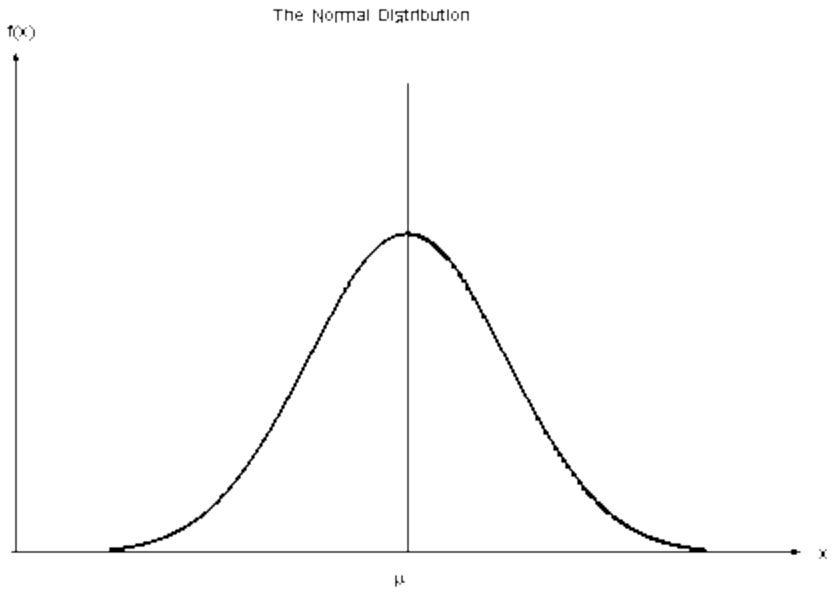
We've already looked at scattergrams when discussing correlations earlier. Here is an example of a Scattergram showing a positive correlation below – notice how all the recording measure along an invisible line almost going diagonally across:



NORMAL DISTRIBUTIONS

The normal distribution is the predicted distribution when considering an equally likely set of results. On a graph, this shows as a bell-shaped curve encompassing the mean, median and mode. For example, in an IQ test, most scores for the whole population would be around the mean average with decreasing scores away from this for those with lower IQ's as well as higher. In a normal distribution the mean, median and mode scores tend to be of very similar value when plotted to produce a distinctive curve. The curve shape is what we call the normal distribution curve.

Here is an example of a normal distribution curve below:


The Normal Distribution
f(x)
x
μ