



## Evaluating Twin, Family and Adoption Studies

This factsheet aims to explain and evaluate the methodology of twin, family and adoption studies. These research methods are used throughout psychology, and they all have the aim of assessing the degree to which a particular behaviour or trait is determined by genes. These research methods have been used to investigate phenomena as diverse as **IQ**, mental illness, aggression, and even predispositions toward criminal behaviour and alcoholism. Words in bold are defined in the glossary and the worksheet allows the opportunity to practice what you have learned.

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The examiner expects you to be able to:

- Understand how a researcher would carry out a twin, family or adoption study
- Understand and interpret a **concordance rate**
- Draw conclusions about the genetic or environmental basis of a behaviour from a study
- Evaluate the methodology in terms of strengths and weaknesses

For traits such as mental illnesses, it is more accurate to say that a concordance rate is the probability that a person will develop a mental illness given that a particular family member already has it.

- For example, McGuffin et al (1996) found a concordance rate for depression of 46% for identical twins. This means that if one twin has depression, there is a 46% probability that the other twin will also have depression.

A high concordance rate between people who are genetically similar may imply that a particular trait is determined (at least in part) by genes. On the other hand, a high concordance rate by people who share an environment (regardless of whether they share genes) may suggest that a particular trait is determined by the environment. Because of this, twin, family and adoption studies can provide findings that help address the **nature-nurture debate** in psychology. In other words, what has the greatest effect on our behaviour; genes or environment?



[http://upload.wikimedia.org/wikipedia/commons/c/c2/Nature\\_nurture\\_%28cropped%29.jpg](http://upload.wikimedia.org/wikipedia/commons/c/c2/Nature_nurture_%28cropped%29.jpg)

**Exam Hint:** Make sure to check the specification of the exam board you are studying to know exactly which studies you are expected to learn.

**Exam Hint:** You should try to become familiar with interpreting a concordance rate, as the examiner may expect you to interpret a finding and write a conclusion.

### 1: Introduction

Twin, family and adoption studies apply a **non-experimental method** in psychology. This means that unlike an **experiment**, there is no **independent variable (IV)** that is being manipulated by the researcher or **dependent variable (DV)** that is measured. In all three types of study, participants are measured on a particular trait or behaviour, and their results are then compared to those of genetic relatives. This comparison is calculated as a concordance rate.



**Twin, family and adoption studies are a non-experimental method, unlike laboratory studies**

<http://upload.wikimedia.org/wikipedia/commons/0/0c/Laboratory.jpg?uselang=en-gb>

#### What is a concordance rate?

A concordance rate is a number expressed as a percentage which shows the degree of similarity between two people on a particular trait. A low number would suggest little similarity, while higher numbers suggest higher similarity.

- For example: McGue, Brown and Lykken (1992) found a concordance rate for aggressive behaviour of 43% for identical twins. This means that on average, a person is 43% similar to their **identical twin** with regards to the aggressive behaviour they show.

### 2: Twin Studies

#### A: What is a twin study?

This research method involves investigating the two types of twins. Identical twins, also referred to as **monozygotic twins (MZ)** are formed by one **sperm** from the father and one **egg** from the mother. This fertilized egg or **zygote** then splits to form two genetically identical zygotes, which separately develop into two identical babies (always of the same sex). Identical twins therefore have 100% of the same genes. **Non-identical twins**, also known as **dizygotic twins (DZ)** on the other hand are formed when two sperm from the father fertilize two different eggs from the mother. These two zygotes then develop separately into two babies. Non-identical twins share around 50% of their genes with each other, and are therefore no more closely related genetically than normal **siblings**. Non-identical twins can be the same sex, or of different sexes.

In a twin study, a researcher will measure both individuals of a set of twins on a given trait. These results will then be compared, and a concordance rate calculated. Typically, researchers compare the concordance rate of identical twins to non-identical twins. In some studies, concordance rates are compared between twins reared together and twins reared apart. This is the ideal format for a twin study, as children who are reared apart will still share genes, but will no longer share an environment. Therefore, it is easier to see the effect of genes.

**B: Why do we use twin studies?**

When psychologists use twin studies, they are usually interested in investigating the genetic basis of a trait. The researcher will compare the concordance rate between the two sets of twins. If the concordance rate is higher for identical twins, it is likely that the trait is at least partly genetic in nature, as this may be due to their shared genes. This is particularly the case in studies that have found a high concordance rate in identical twins reared apart. Twin studies can also tell us what effect the environment may have on behaviour. If the concordance rate for identical twins is not 100%, there must be an environmental influence, as differences cannot be due to genes alone.



**Identical twins allow psychological researchers to understand the effect of genes on behaviour**

[http://upload.wikimedia.org/wikipedia/commons/9/99/Redhead\\_twins.jpg?uselang=en-gb](http://upload.wikimedia.org/wikipedia/commons/9/99/Redhead_twins.jpg?uselang=en-gb)

**C: Example of a twin study**

Bouchard and McGue (1981) were interested in the genetic basis of intelligence. They gave IQ tests to both identical and non-identical twins reared together and apart, and calculated the concordance rates. They found the following results.

Twin Type	Concordance
Identical twins reared together	86%
Identical twins reared apart	76%
Non-identical twins reared together	55%
Non-identical twins reared apart	35%

These results seem to suggest that intelligence is determined to a large extent by genetic factors. This is because identical twins (who share 100% of their genes) have a higher concordance rate than non-identical twins, regardless of whether they were raised together or apart. However, we can also see that the environment does play a part, as for both types of twins the concordance rate was higher when they were reared together. However, it is worth noting that even for identical twins reared together, the concordance rate is less than 100%. If intelligence was determined solely by genes, the concordance rate should be 100%. The fact that it is lower than this means that there are other factors to consider.



**Research suggests that intelligence may be determined in part by our genes**

<http://upload.wikimedia.org/wikipedia/commons/1/1c/Artificial.intelligence.jpg?uselang=en-gb>

**D: Evaluating twin studies****Strengths**

- Often, twin studies are the only way to investigate the genetic basis of behaviour. Research such as Bouchard and McGue above would be impossible to conduct in an experimental setting.

- As identical twins share 100% of their genes, we can be reasonably certain that any differences between them is due to the environment. This allows us to make some reasonably reliable conclusions about the effect of non-genetic factors.
- Twin studies can often point towards a genetic explanation for behaviour. This can be the starting point for future research.

**Weaknesses**

- The biggest weakness of twin studies is that it is difficult to untangle the effects of nature and nurture as the twins not only share genes, they often share an environment. Twins reared together will probably attend the same school, live in the same house, have the same family members and be raised in the same parenting style. Therefore, psychologists are limited in their ability to separate the effect of the genes from the environment. This may account for the high concordance.
- Because twin studies are a non-experimental method, we cannot establish a cause and effect relationship. In other words, a high concordance rate may not necessarily be due to the shared genes. There may be **extraneous variables** that interfere with the results.
- In studies that have used twins who have been reared apart, we may not be able to completely remove the effect of shared environment. Children are often placed into families that are similar to that which they came from. They are also often reared by different branches of the same family, and may still be in regular contact with each other as well as their birth parents. They also may have been separated after a long period of time together.
- It is uncommon today for children to be separated and placed into different families. Effort is made to keep siblings, particularly twins together. While this is obviously beneficial to the children involved, it does mean that there are limited opportunities for psychological researchers to conduct the most useful types of twin study (twins reared apart) today.
- Twin studies often aim to generalise their findings to all people. This can raise issues of **generalisability**. Both identical and non-identical twins may differ from non-twins in a number of ways. For example all twins share a **pre-natal environment** before birth. Any similarities may be due to exposure to hormones before birth. Twins also share the same place in the family's birth order, and they experience their parent's at the same time in their parent's lives. Therefore, it may not be appropriate to generalise between twins and non-twins.
- A final issue is with regards to assumptions made about identical twins. Studies that compare identical with non-identical twins assume that the only difference between the two types is the higher percentage of genes shared by the identical twins. However, Joseph (2004) points out that identical twins are often treated more similarly than non-identical twins, for example being dressed the same, and being referred to as "the twins" rather than as two separate people. They also experience much more identity confusion than non-identical twins. He argues therefore that the higher concordance rate may be nothing more than the effect of a shared environment rather than genes.



**Twins don't just share genes; they nearly always share an environment too**

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**Exam Hint:** The evaluation points listed here are general to most twin studies. However, make sure to read the twin study you are aiming to evaluate carefully, as depending upon the trait being measured, some evaluation points may be more relevant than others.

## 2: Family Studies

### A: What is a family study?

A family study is similar in procedure to a twin study. However, in a family study, concordance rates are drawn not just between two individuals, but between an individual and all of their family members. As with twin studies, an individual will be measured on a particular trait or behaviour, but in a family study concordance rates will be calculated for a number of relatives. Twins may be included as part of a family study.



**Family studies provide more concordance rates than twin studies**

[http://upload.wikimedia.org/wikipedia/commons/3/34/Family\\_S.jpg?uselang=en-gb](http://upload.wikimedia.org/wikipedia/commons/3/34/Family_S.jpg?uselang=en-gb)

Our relatives can be categorised into first, second and third degree relatives depending upon what percentage of genes we share with that person.

- Our first degree relatives are those with whom we share 50% of our genes. These are full siblings, our parents and our children.
- Second degree relatives are those with whom we share 25% of our genes. These are half-siblings, grandchildren, grandparents, aunts, uncles, nephews and nieces
- Third degree relatives are those with whom we share 12.5% of our genes. These are our first cousins, great-grandparents and great-grandchildren.

In a family study, concordance rates are typically calculated for a range of first, second and third degree relatives.

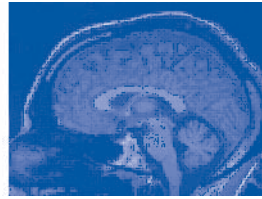
### B: Why do we use family studies?

As with twin studies, family studies can provide information about the genetic basis of a trait. If a trait is genetic, we would expect to find a higher concordance for first degree relatives rather than for second or third degree relatives. However, family studies provide much more data than twin studies, as an individual is compared against a number of relatives rather than just one. They are also easier to conduct as you can use a range of people rather than having to find a sample of twins. They can also provide information about whether a particular trait is linked to gender; if an illness for example seems to have a genetic basis, but only with male relatives, that illness may be linked to a person's sex.

### C: Example of a family study

Gottesman (1991) conducted a **meta-analysis** of family studies into the rates of **schizophrenia**. In this family study, concordance rates were calculated between schizophrenics and their family members. The results below show the probability that an individual will have schizophrenia based on their relationship to the person already diagnosed (the rate of schizophrenia in the general population is 1%). The results seem to strongly suggest that schizophrenia has some genetic basis. There is a strong connection

between degree of relatedness and concordance rate for schizophrenia.



**About 1% of the population have schizophrenia**

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Degree of Relative for Schizophrenia	Relative	Concordance
Third degree relatives	First cousins	2%
Second Degree Relatives	Uncles/Aunts	2%
	Nephews/Nieces	4%
	Grandchildren	5%
First degree relatives	Half Siblings	6%
	Parents	6%
	Siblings	9%
	Children	13%
100% genes in common	Non-identical twins	17%
	Identical twins	48%

### D: Evaluating family studies

#### Strengths

- The strengths of twin studies can apply to family studies too.
- A further strength of family studies over twin studies is that they are not limited to one type of relationship so we can gain a broader insight into the genetic basis of a trait. This could be the starting point of further research and also makes the findings more generalisable.

#### Weaknesses

- Some of the weaknesses of twin studies apply here. In particular, it is difficult to untangle the influence of genes and environment. Not only do family members share genes, they often share an environment. Families tend to live in the same area, may be in close contact with each other, and be of the same socioeconomic background. Therefore, similarities may arise from the shared environment.
- A particular problem arising from family studies is that the closer that you are genetically to someone, the more likely you are to share an environment. For example, children are highly likely to live with their parents and siblings, and less likely to live with grandparents or cousins. This is an issue when attempting to draw conclusions as it may be the similar environment rather than the similar genes which causes the high concordance rate.
- Another weakness is that, as with twin studies, we cannot definitely establish a cause and effect relationship, as it is a non-experimental method.

**Family studies can tell us more about what traits might be genetic**

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**Exam Hint:** It is important to acknowledge in your evaluation the issue that it is almost impossible to separate genes and environment in family studies, and what this means for any conclusions we may draw.

### 3: Adoption Studies

#### A: What is an adoption study?

In an adoption study, concordance rates for a trait are calculated between adopted children and both their biological parents and their adoptive parents. A child's biological parent (sometimes called birth parent) is the parent whose genes they share. An adoptive parent raises the child, but will most of the time share no genes with them.

<http://upload.wikimedia.org/wikipedia/commons/a/a3/Adoption-Symbol.png?uselang=en-gb>



#### B: Why do we use adoption studies?

With twin and family studies, one of the main weaknesses is that people tend to share an environment with people that they are genetically related to. In adoption studies a child is raised by parents that they are not usually genetically related to which allows us to isolate genes and environment as separate factors. If the adopted child is similar to their birth parents we can assume a genetic explanation. If they are similar to their adoptive parents, it is likely to be due to the environment.

#### C: Example of an adoption study

Mednick et al (1987) was interested in the genetic basis of criminal behaviour. They studied over 14,000 adoptees. They collected data on the percentages of both biological and adoptive parents who had criminal records, and the percentage of their sons who also had a criminal record.

Parents with a criminal record	% of sons with a criminal record?
None	13.5
Biological only	20.0
Adoptive only	14.7
Biological and adoptive	24.5

The results here seem to suggest that there is some genetic basis for criminal behaviour, as sons who have a biological parent with a criminal record are more likely themselves to also have one. It is reasonable to argue for a genetic explanation as it cannot be due to the shared environment. However, we can also argue for some environmental influence, as sons with an adoptive parent with a criminal record are also more likely to have one than sons with no parent with a criminal record.

#### D: Evaluating adoption studies

##### Strengths

- Unlike twin and family studies, adoption studies allow us to draw more concrete conclusions about the effect of genes and the environment. This is because in adoption, children are not

raised (and therefore not sharing an environment) with their biological relatives. Genes and environment have been isolated and separated.

- It is often the only way to investigate certain phenomena, such as crime in the study above. This would be impossible to do as an experiment.

##### Weaknesses

- As a non-experimental method, we cannot establish clear cause and effect relationships.
- There are methodological issues with adoption studies. Some children are adopted at birth; others are adopted months, or even years later. For such children, they have spent some time in a shared environment with their biological parent. Therefore, we may not be separating genes and environment as clearly as would be ideal.
- Even children who are adopted at birth may still have been shaped by their biological mothers while in the womb. If a woman smokes, drinks or takes drugs during pregnancy, long term effects may occur in her child.
- There are issues with generalising from adopted to non-adopted children. Being adopted may cause greater stress than being raised by birth parents. Children who grow up knowing that they are adopted may have different experiences than the vast majority of people who do not go through that experience. This will limit generalisability.
- There is also the issue that people who place their children for adoption may be more likely to suffer from mental illnesses. Therefore, care needs to be taken when using adoption studies to investigate the genetic basis for mental illness as we may find a high concordance between biological parents and their children on this factor. This may come simply from this **sample bias**.
- Related to the point above is that people who adopt may be less likely to suffer from mental illnesses. The adoption process requires rigorous assessment and background checks. Adoptive parents are therefore less likely to be able to adopt if they have a mental illness. This again is a problem for drawing conclusions about mental illness. If we find a low concordance rate between adoptive parents and their children for a mental illness, this could be due to a sample bias.
- A big issue with adoption studies is that often children are placed in families that mirror closely their family of origin in terms of ethnicity, socioeconomic background and education level. This **selective placement** policy means that high concordance rates between biological parents and their children could be due to the similar environment. Children are also sometimes adopted within the same family; sometimes a grandparent or aunt adopts a child of a relative. In such cases, are we really separating the genes and the environment?

##### Some adopted children may have spent time with their biological family prior to adoption

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**Exam Hint:** In twin, family and adoption studies, it is easy to interpret results as “genes” or “environment”. Remember that very few behaviours or traits are likely to be due to just one of these factors. The real question to have in mind is “Which has the greatest effect on our behaviour; genes or the environment?”

#### 4: Epigenetics

The three research methods above all aim to uncover the genetic or environmental root of our behaviour. But is it really that simple? What if the environment can change our genes?

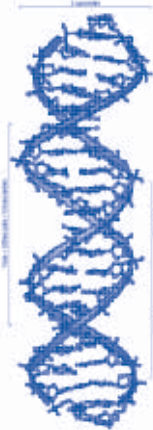
Biologists have recently discovered that our genes can get switched on and off in response to our experiences. These on/off “settings” then can be passed down to future generations. This is called **epigenetics**. For example recent research has found that mice conditioned to fear a particular smell then produce offspring who also show an aversion to that smell, even though they have never come in contact with it before (Nature Magazine, 2013). If the same is true for humans, a parent’s experiences can affect their offspring without the need of a shared environment.

Epigenetics is an issue for twin, family and adoption research as a high concordance rate between parents and children may not be due specifically to genes, but due to environmental experiences which can alter the expression of genes.

**Exam Hint:** Epigenetics is a very new field of science which is still in its infancy. If you decide to use epigenetics to evaluate the findings of a twin, family or adoption study, do so acknowledging that epigenetics is a theory with growing evidence.

#### The expression of our genes can change over our lifetime

[http://upload.wikimedia.org/wikipedia/commons/f/f0/DNA\\_Overview.png](http://upload.wikimedia.org/wikipedia/commons/f/f0/DNA_Overview.png)



#### GLOSSARY:

**Concordance rate:** A number expressed as a percentage which shows the probability that a pair of individuals will both have a certain characteristic, given that one of the pair has the characteristic.

**Dizygotic twins (DZ):** Another term for identical twins.

**Dependent variable (DV):** Dependent variable. The variable measured by the experimenter

**Egg:** A sex cell produced by a female in her ovaries. Fertilized by sperm

**Epigenetics:** the study of changes in gene activity that can be passed on to offspring

**Experiment:** Any research method where at least one IV is manipulated and one DV is measured e.g. lab experiment

**Extraneous Variables:** variables that can get in the way of a clear interpretation of our results, such as age, socioeconomic status etc.

**Generalisability:** The ability to apply the results of a study to a setting or population that was not part of the study. Results that cannot be generalised are of limited use

**Identical twin:** Twins that share 100% of their genes. Formed from one zygote.

**Independent variable (IV):** Independent variable. The variable manipulated by an experimenter.

**IQ:** Intelligence Quotient. A score on a standardised test that measures intelligence. Most people have an IQ of between 80-120

**Meta-analysis:** a research method which involves collating the results of many other studies and looking for over-all trends.

**Monozygotic twins (MZ):** Another term for non-identical twin

**Nature-nurture debate:** The controversy within psychology as to what has the greatest effect on our behaviour and personality. Are we determined by our genes (nature) or are we a product of our environment (nurture)?

**Non-experimental method:** any research method that does not have an IV.

**Non-identical twin:** Twins that share a womb, but are no more genetically related than normal siblings. Formed from two zygotes. Sometimes called “fraternal” twins.

**Pre-natal environment:** the environment that an infant has before birth in the womb

**Sample bias:** when a sample of participants in a study may not be representative of the target population the results will be applied to.

**Schizophrenia:** A psychotic mental illness, characterised by symptoms such as hearing voices and delusions, as well as a detachment from reality.

**Selective placement:** the process of matching adoptive parents to adopted children with regards to traits such as ethnicity, socioeconomic background and education level.

**Sibling:** Another term for brother or sister

**Sperm:** Sex cell produced by males in the testicles. Fertilizes the egg cell

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### Worksheet: Evaluating Twin, Family and Adoption Studies

Name \_\_\_\_\_

1. Look at the results in table below which shows the findings of a twin study that investigates concordance rates for depression (McGuffin et al, 1996). Interpret the results, stating whether genes or environment has the greatest effect on depression in twins.

Twin Type	Concordance for depression
Identical twins	46%
Non-identical twins	20%

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2. Give two weaknesses of studies into intelligence (e.g. Bouchard and McGue, 1981)
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3. Why would a concordance rate of 80% for identical twins not be enough to state a purely genetic explanation for that behaviour?
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4. Why could we argue that adoption studies lack generalisability?
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5. How could epigenetics provide an alternative explanation for the findings of family studies into schizophrenia (e.g. Gottesman, 1991)?
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6. What advantage do adoption studies have over twin and family studies?
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