

## Note on Significance

In the Science in Society specification the mathematical requirements say that you have to: *understand the meaning of simple measures of significance*. This note is to help make it clear what the statement means for this course.

Much research looks for an effect which is recorded as a difference between two groups. This type of research helps to answer questions such as:

- Is there really a difference between the recovery of patients given a new drug and the recovery of those given the old drug?
- Has the number of species in a woodland changed in the last 20 years?

This research measures **sample groups** taken from the **populations of interest**, only some of the patients or a part of the woodland, in the examples above. Any population of living things will have natural variation between individuals. Even if you compare two sample groups of individuals from the same population you would expect to see differences between the two groups due to natural variation or 'chance'. So the measured difference could arise, not from a real effect, but because the normal variation in a single population happens, by chance, to lead to two sample groups with different characteristics.

All researchers must be very alert to the risk that the differences they find are due to chance. They therefore use a null hypothesis when they start to analyse their results. This means that they assume that any difference they find between sample groups is due to chance and does not represent a real difference between the populations. They then analyse the results using a statistical test to see how probable it is that the difference they recorded was actually due to chance.

In order to reject the null hypothesis researchers must show that there is a very low **probability** that a difference between samples at least as big as the effect recorded could have occurred by chance in a single population. This probability is given the symbol,  $p$ , and known as the **p-value**.

A **p-value** of 0.05 is the same as a probability of only 1:20 or 5% that the effect is due to chance. Researchers often decide that a result with a p-value of 0.05 or less is acceptable for them to reject the null hypothesis and claim that the difference is a real one. They then describe the effect as **statistically significant**. In some cases researchers decide to demand a p-value as low as 0.01 or even 0.005 before they can reject the null hypothesis. A low p-value means a low probability that the effect is due to chance. This is the same as a high probability that the observed effect is due to a real difference between the populations from which the sample groups were taken.

### Advice

You do not need to be able to calculate p-values. You should understand and be able to use the terms in **bold**.

### Warnings

Rejecting the null hypothesis does **not** mean that the researcher's hypothesis is true. It just means that there is a high probability that there is a real difference between the populations. We may describe a result as statistically significant. This does **not** mean that it is necessarily important or interesting.