

What is science?

Science is a form of knowledge and a set of methods for obtaining that knowledge. Science develops explanations of the material world in the form of causal models that describe the relationships between the important variables in a particular phenomenon. These models/explanations are usually reductionist, in that the complexities of the world are broken down into more fundamental things like individual variables in order to understand them. The simple relationships that are discovered are then built back up into explanations of complex phenomena.

Scientific knowledge is always regarded as provisional, and therefore subject to change. Even when a theory is able to explain all the things we have observed there is still the possibility that in the future we might observe something new that our theories cannot explain. If this happens, then the theory has been falsified and it is necessary to amend it or come up with a new theory.

The scientific method therefore is all about finding weaknesses in our current understanding. Scientists look at the relationships posited by our current theories and form hypotheses about what *should* be observed if the theory is correct: if this theory is correct in saying that variable A affects variable B then if I manipulate variable A then I should be able to observe a corresponding change in variable B...and if I don't see such a change, then that means the theory is incorrect.

The scientific method is therefore very much bound up with the experimental method, where independent variables are manipulated by creating different conditions under which dependent variables are measured. The scientific method requires that we are confident in the conclusions we draw from our experiments, so a lot of thought goes into how to manipulate and measure the variables and isolate the independent variables from other variables that might confound our observations.

Scientific knowledge is intended to be a description of *what the world does*, rather than being based on our intuitions and beliefs about the world. Therefore, studies are only scientific if they are empirical, that is, based on evidence from our senses. The evidence must be objective, in that what is recorded is true independently of anyone's opinion.

Because scientific evidence must meet these high standards (the variables have been defined empirically; the independent variables have been isolated from other variables; the measurements are objective) each study must be carefully scrutinised and any weaknesses exposed. Only then, when we are confident that the observations are sound, can we say whether the evidence we have gathered supports or challenges our theory.

When the evidence supports the theory then we can be a little more confident that our model of reality has a degree of truth to it. But good scientists know that theory theories are still only models of maps of reality, and the map is not the territory. Eventually evidence will emerge that shows that our theory is wrong to some extent. This leads to the development of new theories, all of which require testing...