# TOPIC #7: IS IT A SIMPLE MATTER TO DISTINGUISH A SCIENTIFIC ARGUMENT FROM A PSEUDO-SCIENTIFIC ARGUMENT?

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## ABSTRACT

The purpose of pseudoscience is to justify ideas that already exist, not to uncover new ones. The flaws of pseudoscience – including logical fallacies and non-verifiability - are so great, and the fundamental differences with true scientific method so apparent that it is easy to distinguish a pseudoscientific argument from a scientific argument.


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It is simple to distinguish a pseudoscientific argument from a scientific argument. Pseudoscientific arguments are views that claim to have a scientific basis when in actuality they do not. This explanation, however, is not helpful unless we know what it means for something to be scientific. For something to be scientific it must involve observation of the physical world and experimentation that is unbiased and reproducible. In order for a claim or explanation to be considered scientific it must have been reached by using the scientific method. The scientific method requires that an idea proceed through a number of phases. It begins as a hypothesis, which is then tested, and if it is shown to be supported it then becomes a theory. A hypothesis – which is Greek for *foundation* – should be preceded by information gathering, which means that even though it is a guess or a question, it is a researched or educated one. That hypothesis is then tested using controlled physical experiments which yield data. A controlled experiment is one in which as many variables as possible are accounted-for. The nature of the experiment should be such that it could be repeated by anyone – so long as they recreated

all of the same conditions that were noted – and they would get the same results. The data is then analyzed to see whether the hypothesis is true, whether any revisions should be made, or whether it is false. If the hypothesis is true, then a theory is constructed. So, to contrast the two ideas: a scientific hypothesis is a question or basis for a series of experiments, while a scientific theory is an explanation for a series of observed phenomena. In conclusion, it can be said that a claim is scientific when it has passed through the process of the scientific method. However, this conclusion is problematic, as we will see later.

Pseudoscience is literally "false science". A pseudoscientific argument is one that contends to be scientific when in actuality it is not. It often occurs that experiments are performed in order to justify and support views that are already held, and this is often the case with claims that are found in the realm of pseudoscience. It is important to briefly mention that there is also the area of non-science, in which math resides. Math involves theorems and proofs which require evidence, but it is not considered scientific because it has no basis in physical experimentation.

One of the tell-tale characteristics of pseudoscientific arguments is that they contain logical fallacies. A logical fallacy is a flaw that vitiates an argument (The New Fowler's Modern English Usage, 1998). An example of a fallacy often found in pseudoscience is that of Appeal to Motive in Place of Support with the use of prejudicial language. Creationists use the fact that the Bible is a moral authority to justify its use as a source for evidence for their theories, when moral goodness and value have nothing to do with accuracy or any sort of physical truth. Science has an inherently anti-dogmatic nature and it is part of the scientific process to question authority and pre-conceived

notions. Another fallacy that appeals to motive is the fallacy of Appeal To Popularity which is found with claims of the extra-terrestrial and intelligent nature of Unidentified Flying Objects (UFO). The argument is made that because there have been tens upon thousands of UFO sightings all around the world, they necessarily must be true. It has been demonstrated numerous times that it is erroneous to accept the approval of the majority as evidence for a claim – with the idea of a flat world being another example. One final logical fallacy important to this discussion is that of an Unrepresentative Sample. An example of this type of fallacy is assuming that a drug is safe to use because it had no harmful side-effects in one person. A scientific theory tries to account for all situations and – in the previous case – people. An unrepresentative sample size also allows greater room for bias, because it makes the results more exclusive rather than inclusive. This goes against the idea of unbiased experimentation which is necessary for a successful scientific argument. Another major and very important characteristic that almost all pseudoscientific arguments have is that they begin with a theory, and then gather evidence to support it. This is accentuated by the fact that most pseudoscientific texts and ideas go through very little change. An example is Reiki, which is the laying of hands for supposed healing purposes, whose proponents sometimes claim has a scientific basis. It draws its ideas and methodologies from the writings of Mikao Usui who "rediscovered them from ancient Sanskrit texts," (Reiki, 2000) in the 1850s. To compare, the world of physics has been almost completely transformed since that time, with relativity and quantum mechanics revolutionizing our ideas about our physical world. It is thanks to the anti-dogmatic nature of scientific thinking that this progress has come about. A claim can quickly be revealed to be pseudoscientific if it has any of the above-

mentioned flaws in logic. As has been shown, by virtue of the scientific method, a truly scientific argument would have no need for prejudicial language, appeals to popularity, nor would it be considered a proper experiment if it didn't clearly explain and justify its choice of sample size in experimentation. However, logical fallacies are not always present in all pseudo-scientific arguments, and there are many problems with some of the characteristics of science described above.

If there is anything that history has taught us, it is that it is not a simple matter to distinguish between scientific and pseudoscientific arguments. The line delineating the two subjects is constantly moving and changing, and has been throughout history. Some of the terms I used above were problematic. For example, what is a "proper experiment"? The question of what the sample size should be, which steps should be taken, these are all issues which can be very-much based on opinion. Also, ideas that were once considered scientific and highly popular are no longer seen as such. Doesn't this show that the scientific method is not successful is telling apart what is scientific and what is not? The argument for the healing benefits of acupuncture was once considered absurd and pseudoscientific. However, there is now some evidence to support that acupuncture may, for example, release endorphins that reduce blood pressure and help with heart disease (Porterfield, 1999). Cases like this lead some people to argue that most of the things we believe to be absurd or non-scientific today will become rational and scientific at some point in the future, as we gain more knowledge. We simply do not know everything, and so we cannot clearly put something into a category as being scientific or pseudoscientific.

The fact that ideas that used to be considered absurd and non-scientific are now considered scientific is not a flaw with science, but a vindication. It is evident with the ideas we consider to be pseudoscientific, such as reiki, that they are fundamentally dogmatic and unchanging. Science, on the other hand, is founded on the principle that nothing is ever certain, and that we never know anything for certain. There is an endless process of testing and verifying that allows ideas to change and flow and be modified. The purpose of pseudoscience is to justify ideas that already exist, not to uncover new ones. Most pseudoscientific arguments are also non-falsifiable. Creationism is an example of people trying to use physical science to justify their religious beliefs. Some of them assert, for example, that the Earth was created 10,000 years ago, and when fossils are found that are shown to be significantly older than that, they say that they were placed their by God or Satan. This is an argument that is both non-verifiable and non-falsifiable, and by our standards non-scientific.

It is simple to distinguish a pseudoscientific argument from a scientific argument if we know the full story of the development of the argument. If we have detailed information about the way the experiment(s) were conducted, all of the variables involved, then we can reproduce them ourselves. If the theory matches our experiments, and there are no causal fallacies or fallacies of explanation – which can be avoided through careful observation and control of experimental variables – then the scientific process has been kept intact and we are presented with a valid scientific argument.