

Underdetermination and Einstein's relativity

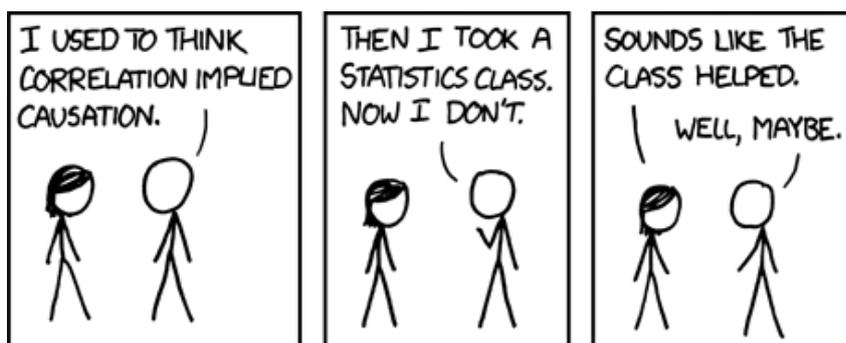
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Underdetermination is an issue that physicists often try to ignore mentioning and is left to the philosophers of science.

First, I will explain Underdetermination, from Stanford Encyclopedia of Philosophy [1]:

“At the heart of the underdetermination of scientific theory by evidence is the simple idea that the evidence available to us at a given time may be insufficient to determine what beliefs we should hold in response to it. In a textbook example, if all I know is that you spent \$10 on apples and oranges and that apples cost \$1 while oranges cost \$2, then I know that you did not buy six oranges, but I do not know whether you bought one orange and eight apples, two oranges and six apples, and so on. A simple scientific example can be found in the rationale behind the sensible methodological adage that “correlation does not imply causation”. If watching lots of cartoons causes children to be more violent in their playground behavior, then we should (barring complications) expect to find a correlation between levels of cartoon viewing and violent playground behavior. But that is also what we would expect to find if children who are prone to violence tend to enjoy and seek out cartoons more than other children, or if propensities to violence and increased cartoon viewing are both caused by some third factor (like general parental neglect or excessive consumption of Twinkies). So, a high correlation between cartoon viewing and violent playground behavior is evidence that (by itself) simply underdetermines what we should believe about the causal relationship between the two. But it turns out that this simple and familiar predicament only scratches the surface of the various ways in which problems of underdetermination can arise in the course of scientific investigation.”

There is a cartoon that might help explain it [2]:



So hopefully you understand that CORRELATION does not imply CAUSATION.

However, this is contrary to what people want to believe- if they have two things happening close together, then they usually think in terms of one thing causing the other thing.

In the case of theories, it means if you have data and theory#1 is correlated to that data, it does not mean theory#1 CAUSES that data; BECAUSE you might have theory#2, theory#3..., also correlated to that data.

In the case of Einstein's relativity, when dealing with Special Relativity we can have:

Theory#1: $t' = \beta t$ and $t = \beta t'$

Theory#2: $t' = \beta t$ and $t = (1/\beta)t'$

Note: there is a slight difference between these theories.

(There are issues like acceleration. Spacetime curvature et al., that when taken into consideration make things more complicated with more theories that can be constructed.)

We have the issue which theory is Einstein's relativity; I say it is ambiguous.

From experimental data, the Mainstream seems to be claiming theory#1 and theory#2 CORRELATED to data. (Depending on who you talk to depends what theory #1 or #2 or some mixture they believe.) However, they don't talk of it that way and start claiming Einstein's theory confirmed/proven by experiment.

So, from my perspective they are ambiguous in their claims and mixing up different theories. Ideally "Philosophy of Science" should have sorted this out, but the Philosophers got diverted onto issues like "underdetermination" and accept that the same data can be interpreted by different theories, and unfortunately never addressing the issue of ambiguity that the relativists have descended into. Thus, physicists end up thinking they are confirming a theory when really, they have something unclearly defined. i.e. Einstein's Relativity means different things to different people.

While answering the question on Quora of "How was Einstein's General relativity theory proven" [3] I realized that many people are probably not aware about an issue between Physicist and Philosophers over underdetermination.

My answer [3] was:

Well, some people will tell you that no theory can ever be proven; it's just a case of whether a theory is supported by the evidence or not supported by the evidence.

In the case of Einstein's relativity many people will tell you that it is supported by the evidence. But this has to be contrasted with - what some people say, others might say something else i.e. there is usually always opposing points-of-view. So, for Einstein's relativity there is also the point-of-view by some people that it is not supported by the evidence, for instance : "Three major pieces of misinformation in Einstein's Theory of

Relativity”[4] by Robert A Monti will tell you: “ The experimental results of the solar eclipse of 1919 never “proved” Einstein's theory of (General) Relativity. The “difference” between the Newtonian and the Einsteinian deflection of a beam of light was never “confirmed” after 1919. On the contrary in 1960 experimental results by Pound and Rebka showed that the energy (or mass) of light is subject to Newtonian gravitation in the same way as ordinary matter.”

Thus, the situation is more like some people will look at the evidence and think it supports Einstein’s relativity, and some people will look at the evidence and think it doesn’t.

It is what Philosophers of science call underdetermination: “Underdetermination is a thesis explaining that for any scientifically based theory there will always be at least one rival theory that is also supported by the evidence given, and that that theory can also be logically maintained in the face of any new evidence.” [5]

Often Physicists don’t like the Philosophers to point this out and prefer to ignore the issue of underdetermination.

The problem is: given a new theory that seems to match new evidence which an old theory seems to be failing to deal with, do we really need to abandon the old theory in favour of the new theory OR can we just update the old theory to the new evidence (?) In the case of Einstein’s general relativity versus Newtonian gravity theory, the physicists favoured abandoning Newton for Einstein instead of updating Newton’s theory. Often physicists will try to pretend that this is the correct methodology to abandon the old in favour of the new, but philosophically it seems dubious. When Einstein’s theory seems to need updates with fudge factors of dark energy and dark matter then it gets added without looking at abandoning the old in favour of something new.

Example of underdetermination: Galilean astronomy from Wikipedia [6]:

“The pioneering work of Galileo Galilei in the application of the telescope to astronomical observation met with rejection from influential sceptics. They denied the truth of his most startling reports, such as that there were mountains on the moon and satellites around Jupiter. In particular some prominent philosophers, most notoriously Cesare Cremonini, refused to look through the telescope, arguing in effect that the instrument might have introduced artefacts producing illusions of mountains or satellites invisible to the unencumbered eye. To neglect such possibilities amounted to underdetermination in which argument for optical artefacts could be urged as being of merit equal to arguments for observation of new celestial effects, whether the latter were more parsimonious or not. On a similar principle in modern times a prevalent view is that extraordinary claims demand extraordinary proof.”

Wikipedia refers to it as “clear example of how different bundles of (usually implicit) auxiliary assumptions could support mutually inconsistent hypotheses concerning a single topic.” [4]

Reminder: Underdetermination refers to situations where the evidence available is insufficient to identify which belief one should hold about that evidence.

What was true in Galileo's day as regards underdetermination is no less true in relation to Einstein's relativity. Resources need not have been given to look at Galileo's claims if one is stingy; similarly, resources need not be applied to looking at alternatives to Einstein's relativity if one is stingy, such as seeing if Newtonian physics can be made in better agreement with observations. i.e. block looking at alternatives by not allocating money to them thus saving money.

References

[1] <http://plato.stanford.edu/entries/scientific-underdetermination/>

[2] <http://www.statisticshowto.com/wp-content/uploads/2014/12/correlation.png>

[3] https://www.quora.com/Has-Einstein-s-theory-of-relativity-been-proven-1?redirected_qid=43018777

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[4] Acta Scientiarum 21(4):789-794, 1999. ISSN 1415-6814. "Three major pieces of misinformation in Einstein's Theory of Relativity" by Robert A Monti

[5] quine home: underdetermination

<https://www.rit.edu/cla/philosophy/quine/underdetermination.html>

[6] https://en.wikipedia.org/wiki/Duhem%E2%80%93Quine_thesis

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