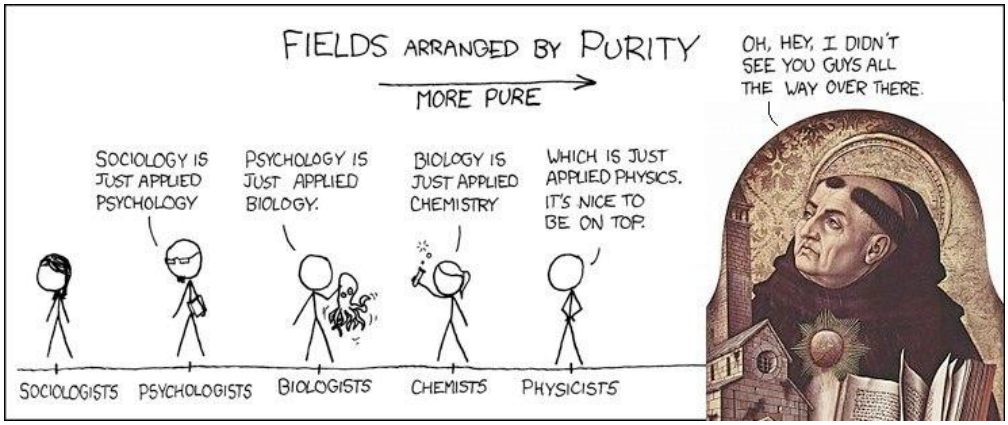
The Fragility of Physics

by Luke Smith

Physics has a reputation of being a uniquely "scientific" field. In other fields, you might hear of the concept of "Physics Envy" which is supposed to be a deep-seated desire of academics of other disciplines for the rigorousness and elegance of physics. Only physics, so the popular understanding goes, is truly able to abstract away from the messiness of detail and create truly beautiful and solvent models of their subject matters. Physics is thus the queen of the "hard sciences."

I object to the very idea of "hard vs. soft sciences" for reasons that will soon be clear, but I think it is most important to remember that for all its pretensions, **physics is the most fragile science**. That isn't necessarily *bad*, but it's true.

Why "fragile?"



Put simply, physics, partially due to its somewhat abstract nature, is exactly that domain where our interpretation of the universe is *most likely* to change *radically* in the event of any kind of theoretical sea change. That is, while in other more terrestrial sciences, the data is well-known and the theory is in debate, in physics, the opposite is arguably true. In astrophysics, quantum mechanics, the study of gravity or relativity, this should all be obvious.

Even without departing the cuddling embrace of mainstream physics, we can actually see this clearly. What is the ultimate fate of the universe to be? A continuous expansion of the universe until heat death? Perhaps gravity or some other force will pull everything back in a Big Crunch? The correct alternative is a statement of very specific and tendentious data which changes quite a great deal with any kind of new interpretations of what we see.

It's worth it to remember that for most of man's history, including the initial development of what we nowadays call physics, the "normal state" of the universe was assumed to be the state of affairs we're familiar with on the surface of the Earth: everything falls down to the ground and things propelled in space will slow down until they stop.

But modern physics now looks at the nature of our life on Earth as an exception to the general rule of frictionless and continuous movement in the vacuum of space. A valid question to ask is *how much more that we take to be normal is a special case of reality?* As we encounter more and more abberrant data, such as quantum mechanics, we might soon find ourself unifying seemingly disparate forces in the same was that Newton in a novel and seemingly absurd way the fact that objects fall to the ground

with the apparent fact that the Earth orbits the Sun into one new concept: *Gravity*. Such a unification religates all our universals to a special case.

Does light really go the speed of light?

Physics is fragile because it is like a game of Jenga. Pull out or change one piece and the whole thing is either reordered or simply collapses.

As an example, say that within several years, we realize that the speed of light, for some known or unknown reason, doesn't function with the universality we assumed. Suppose that there is some kind of interaction of light and gravity such that light is faster in some parts of the universe. The reason isn't important. Or suppose we merely find out that in the past, there has been a systematic principle (similar to the Heseinberg Principle) that has miscalibrated all of our measurements of light.

Even if we have minutely mismeasured, the Jenga piece of light will radically alter everthing: our ideas of how old the universe is, our relationships with other planets, the solvency of general relativity, etc. You might say that there is a "concordance of evidence" that attests to our single known speed of light, but another way of putting that is that we have many other things tied into our interpretation of light that will have to change if we realize our models of it are flawed.

Poverty of data

Especially in the astronomical domain, it's worth remembering exactly how circumstantial our ideas of space are. We sometime speak of the traits of other solar systems' planets as if we've been there. But in reality, astrophysicists guess the chemical compositions of foreign planets based on their light frequencies and other fragile data. Any systematic error in observation over those thousands or millions of lightyears and we have been counting angels on pinheads the whole time.

People have the idea that because astrophysicists make extraordinary claims about planets, galaxies and time periods far beyond our mortal ken that they must have extraordinary evidence for them. That is frankly not the case. We have a piece-meal and jury-rigged set of circumstantial reasoning leading us to these claims. Seeing them computerized in full color in a science documentary doesn't make them more real. It just makes them look more official.

Physics vs. "soft sciences"

I remember talking to someone over the internet who accused me of having a low view of institutionalized science and being a dreaded epistemological anarchist because one of my degrees is in the "soft science" of linguistics. While I have a lot of bad things to say about the current state of linguistics, as a field, it is substantially more advanced and its findings are substantially more solid than physics. At that, formalizing ideas in math doesn't just make something a better or a more rigorous science anyway, which is the assumption of many people have.

While linguistics undergoes theoretical changes every several generations, the *data*, or really more importantly *the phenomenology* of linguistics is as secure as ever across all theoretical frameworks. That is, we know how language works. We can see abstract relationships between morphemes and syntactic structure. Even if we totally rewrite our narratives and theories about linguistic basics, there is no debate about the structure of language and how basic data relates to other data. This is absolutely the opposite of physics.

Physics is pretty solid on earth, and solid when you are running objects at each other in a vacuum, but once we broach the territory of astrophysics, relativity, gravity and more or less *anything else that we as humans lack direct intuition of* most of the "facts" of physics are theory-internal facts, and will fade away or be rendered obsolete when the next theoretical fad comes around.

My standard for theoretical frameworks

I think any serious scholar needs the ability to operate cognitively with multiple different theoretical frameworks in mind.

For example, (on linguistics) I don't really take Generative Grammar very seriously, in fact, despite it being on of the most well-funded dialects of linguistics nowadays, it's pretty inert. Despite that, I view it as very important for me to be able to process linguistic problems within Generative Grammar and word explanations within its ideas. It's nice to be able to say to someone "this alternation is accounted for if this DP occupies the spec of CP." I don't *believe* in CPs or specifiers as being psychologically real, but I can recognize the language as communicative.

A good theoretical framework is one that can produce facts and observations that can be recognized and explained outside of its framework as well.

That is, a framework should cue us in to finding utterly novel observations and thus a new *phenomenology*. This goes against the egocentric motivations of a lot of scientific frameworks whose practitioners are trying to edge out "the competition." Fields that spend most of their time trying to formalize previous observations within their own theoretical language are mostly a waste of time (this is Generative Grammar, frankly, although due to historical ignorance, many people in GG do not know they are re-treading steps).

One of the biggest issues of modern post-war institutionalized science is that the funding and peer-review mechanism is self-reinforcing: all fields converge to be "unipolar": only one methodology or framework is deemed "scientific." This creates a community of "scientists" who are more an more incestuous and generally oblivious not just to other possibilities of inquiry, but don't even have to be aware of their own priors or assumptions.

The blinders of positivism

As I've interacted with physicists more, I'm often *surprised* by how irrelevant they think even the most basic theoretical awareness is. That's "philosophy" for them. It's not uncommon to hear zingers like these:

1. "Science isn't about truth, it's about creating models."
2. "Physics is about fitting equations."
3. "We don't do philosophy."

Things like these are said as if they are some kind of statement of universal and well-consented-to truth, when in reality they are absurd Zen koans of the positivist religion. This was a loony opinion a hundred years ago and people saying these things now *know* that they are ludicrous. They have just become identifying marks of the social club.

Yep, science is about creating models... models that replicate reality, i.e. Truth.

A scientists who doesn't do philosophy isn't a scientist: he's a meter-reader. A philosopher who doesn't do science isn't a philosopher: he's just a stoner. The attempt to sever these two words from each other is part of the problem.

Physicists seem to be particularly touchy on this point. On one hand, they insist that philosophy is "not their thing" and "not related." On the other hand, they get incredibly angry when *anyone else* dares to either put the methodology of modern physics to any kind of philosophical tests *or even* to look into philosophical ramifications of their work.

In reality, modern scientists and positivists have their own metaphysics, it is just an *implicit* one that they advertently or inadvertently sneak into their theories. They can only do it because its clumsy sterile "materialism" is the background-radiation of the modern world.

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