

HPSC 1001/1901/2101/2901

***WHAT IS THIS THING CALLED SCIENCE?***

Semester 2, 2020

**Lecture 24: Scientific Realism - 2**

"Scientific Realism": The standard discussion: does science tell us (sometimes, when things go well) about the hidden nature of the real world? A world that exists in a mind-independent way? Does it tell us (sometimes) how things really work?

Scientific realism: yes.

Opponents: no.

Perhaps theories can't "reach beyond" observables in what they say, *or* they can try to do this but we can't ever think they succeed, *or* it is not the business of science to do this, *or* the world itself does not exist mind-independently.

*Phenomenalism:* All we can think and talk about is patterns in our sensations.

*Instrumentalism:* Scientific theories are tools for prediction. Anything beyond that is unnecessary and perhaps too hard in any case.

*Metaphysical Constructivism:* There is no mind-independent world that our theories could describe.

Terminology. "Metaphysics" refers to questions and claims that are about the most general nature of reality.

Metaphysical questions include: does the world exist independently of our thought about it? Does God exist? Etc.

"Constructivism" /construction, etc.... terms used in a great variety of ways.

Initial idea: our scientific ideas are not "given" to us by nature, stamped on us by data. Instead, we actively construct theories and concepts. We make choices rather than being compelled. (Influential theme in the years after Kuhn.)  
OK; that is not yet in opposition to realism. It is opposed (maybe) to some kinds of empiricism.

But in some discussions: reality itself is constructed by us.

Does this just mean: our *ideas about* reality are constructed?  
That is not controversial and not a move away from realism.  
But that is not all that people meant.

The *world as we know it* is partly (entirely?) a human product or construction. The ways things are, or "the facts," are dependent on our beliefs, language, theories, and/or paradigms.

Construction of reality, as well as construction of our ideas about it: Kuhn (Chapter X), Latour (though he has

recanted?)\*, Nelson Goodman (*Ways of Worldmaking*, 1978). Stephen Woolgar (*Science: The Very Idea*)

\* Latour: [http://www.sciencemag.org/news/2017/10/latour-qa?utm\\_campaign=news\\_daily\\_2017-10-10&et\\_rid=35137912&et\\_cid=1596541](http://www.sciencemag.org/news/2017/10/latour-qa?utm_campaign=news_daily_2017-10-10&et_rid=35137912&et_cid=1596541)

Kuhn's version, in *Structure*:

I have argued so far only that paradigms are constitutive of science. Now I wish to display a sense in which they are constitutive of nature as well.

After a revolution, “scientists work in a different world”

At the very least, as a result of discovering oxygen, Lavoisier saw nature differently. And in the absence of some recourse to that hypothetical fixed nature that he “saw differently,” the principle of economy will urge us to say that after discovering oxygen Lavoisier worked in a different world. (1996, 118)

Influence of Immanuel Kant's philosophy here. Late C18.  
See T&R.

A line of argument I think has had even more importance:  
Attempt to *reject* a different family of views. But the  
rejection gets out of hand, and leads to a *reversal* of the view  
to be rejected.

That reversal does not really make much sense, but in some  
discussions, it is seen as important that the rejection of the  
alternative picture be as definite and forthright as possible.



The view that people think should be rejected:  
The world "stamps itself" on the mind of an observer or  
investigator.

Steven Shapin: reality acts on scientific belief with  
“unmediated compulsory force” (1982).

Especially after Kuhn, this was rejected in increasingly  
emphatic ways.

Woolgar (the person who wrote *Laboratory Life* with Latour),  
in his book *Science: The Very Idea* (1988):

The argument is not just that social networks mediate between the object and observational work done by participants. Rather, the social network constitutes the object (or lack of it).

The implication for our main argument is the **inversion of the presumed relationship** between representation and object; the representation gives rise to the object. (p. 65).

Part of the problem here: a false dichotomy.

Shapin and Schaffer, in *Leviathan*. Quoted in T&R:

“It is ourselves and not reality that is responsible for what we know” (1985, 344).

Roughly speaking, it is both.

You don't have to choose between two simplified, cartoon-like views – either the world stamps itself on us, or we stamp ourselves on the world.

Once you move away from both the oversimplified views, is there any reason to reject realism?

## **Idealization, Approximation, Modeling**

What relationship do theories and theoretical language have to the world, when things go well?

Simple view: they *describe* it. A theory contains terms, like "electron," "ion," "gene," "species" that refer (when things go well) to real things -- real parts of the world. The theory will attribute properties of various kinds to these objects. "Carbon atoms have 4 outer-shell electrons, and that is why carbon, in chemical interactions, has valence of 4."

This ignores idealization and approximation.

Approximation: closeness to truth.

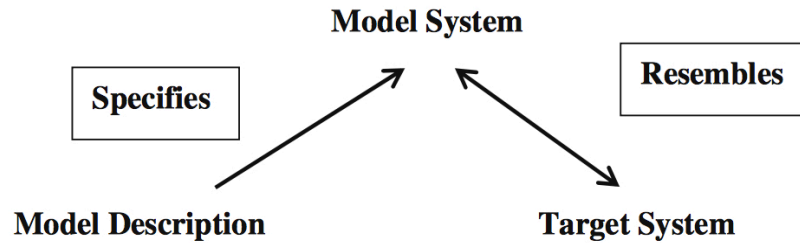
Idealization: deliberately simplifying.

How important are they?

On some views, they are everywhere.

Here is a very different view of how theories work.

Giere 1988, *Explaining Science*, 1988 (modified by me).



His example: Ideal pendulum in physics.

Other examples: Movement over frictionless planes  
Infinitely large populations in biology  
Ecologies with only two species interacting  
Perfectly rational agents within economic markets  
Neural networks where the neurons are influenced only by  
(a few) synaptic connections.  
Many climate models.

This is model-building.

Is all science like this?

Are *all* theories models? (Some have said so.)

No. Consider Darwin.

--> Several different styles or strategies of theoretical work.  
And several ways that "theories" can relate to the parts of the world we are trying to understand.

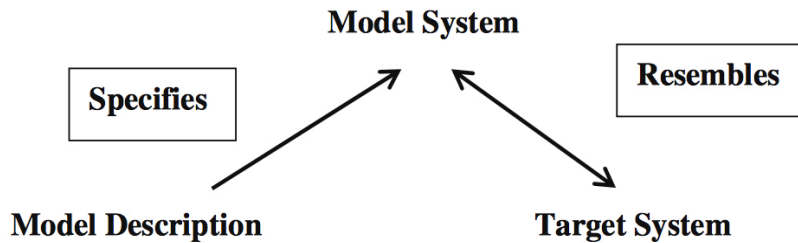
See my "Strategy of model-based science," 2006.

"Models and Fictions in Science," 2009.

Also Weisberg's book *Simulation and Similarity*.



What *are* the things at the top of the diagram?



They seem, in many cases, to be fictional scenarios. Some unwillingness in philosophy to describe them this way -- except that Covid modeling has led to a franker discussion of how this works.

## Examples:

"Special report: The simulations driving the world's response to COVID-19" by David Adam. *Nature*, April 2010.

<https://www.nature.com/articles/d41586-020-01003-6>

Using detailed information on population size and density, how old people are, transport links, the size of social networks and healthcare provision, **modellers build a virtual copy of a city, region or an entire country using differential equations to govern the movements and interactions of population groups in space and time.** Then they seed this world with an infection and watch how things unfold.

....

Modellers also simulate people’s activities in different ways. In ‘equation-based’ models, individuals are sorted into population groups. But as the groups are broken into smaller, more-representative social subsets to better reflect reality, the models get increasingly complicated. An alternative approach is to use an ‘agent-based’ method in which each individual moves around and acts according to their own specific rules — **rather like the simulated characters in the video-game series The Sims.**

“You have a couple of lines of code, and those drive how your agents act, how they go about their day,” says Elizabeth Hunter, who works on models of disease transmission at Technological University Dublin.

Agent-based models build the same kinds of virtual world as the equation-based ones, but each person can behave differently on a given day or in an identical situation.

Another - in Victoria.

Later in August, the state government asked Dr. Thompson and his team for the models and, based on their projections, established a timeline for when Victoria could safely end the containment measures. ...

The model Dr. Thompson and his collaborators produced – which involved creating an “artificial society” and having a supercomputer determine what would happen if restrictions were altered in different ways and at different times – predicted the coronavirus would roar back by Christmas if the hammer were lifted before Victoria got to an average of fewer than five new cases a day over two weeks.

<https://www.theglobeandmail.com/canada/article-how-an-australian-state-beat-its-second-wave-of-covid-19/>

A reason that philosophers have sometimes resisted this view of models: how could this sort of thing help us understand the real world?

Also: "fictions" are not objects that can have similarity relations to systems in the real world. They are not objects at all!

I think: a model is (in many cases) a fiction which we can use to learn "if A, then B" statements. Conditionals.

A special kind of conditional: counterfactual conditionals.

The A (antecedent) did not (or does not) actually happen.

"If you have a community of completely rational individuals buying and selling, then it will behave like this..."

"If you have an ecological situation with just two species interacting, one eating the other, then the system will behave like this...."

Part of the art of modeling: picking an "If you have..." (a set-up) that is usefully close to the real world.

Then, maybe, things are like this:

*If A, then B* -- we learn that from a model.

*A* never actually holds. We know that.

But *approximately A* sometimes holds.

Can we say, via the model plus other information:

*If approximately A, then approximately B?*

Not in general, but sometimes we can.

This is what guides a lot of the modeling going on now with Covid, with climate, etc.

The fact that fictions are used as a stage in the work doesn't mean the work can't teach us things. Though we do need to keep an eye on the fictional elements that are used to keep things simple.

A model is (in many cases) a fictional scenario used as a tool to help us learn useful conditional statements.

See my "Models, Fictions, and Conditionals" (front of my website).