

The Sociology of Scientific Knowledge and Actor-Network Theory

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Social constructionism

In the 1970s, **social construction** became a buzzword for treating a wide range of topics, following Berger and Luckmann's *The Social Construction of Reality* (1966).

While some things are obviously entirely produced by social forces – such as French law, Japanese universities, Cambridge mathematical culture, etc. – social constructionism focuses on things that are usually *assumed* to be **natural kinds**: gender, race, poverty, literacy, scientific facts, quarks, etc.

Social constructionist scholarship is a kind of **unmasking**. It argues that (1) something that we all assumed to be an essential fact of the world is (2) actually the result of social processes, and (3) *could* be different. It often goes farther and argues that the *constructed kind* is harmful and (4) *should* be different. In this latter form, constructionist scholarship can be *revolutionary*.

Social constructionism in science and technology studies

Some of the strongest cases for social constructionism have been made in STS, which has always been the central locus of arguments over **constructionism versus realism**.

- L. Fleck (1935) and T. Kuhn (1962) made strong arguments for social constructionism before the term was even coined.

If the structure and content of scientific facts and objects are effected by social forces, then the traditional line between **society** and **nature** begins to become blurred.

This realization led to numerous studies which attempted to sort out to what extent the *content* of scientific knowledge itself was determined by society and to what extent by nature.

This became a highly controversial question and led, in the mid-90s, to the so-called **Science Wars**, which was a jurisdictional dispute between scholars in the sciences and others in the humanities over who has the right *to say what science is*.

1: The contingency or determinism of scientific knowledge

Ian Hacking (1999) identified three key disagreements between constructionism and realism, claiming that they were very old.

The first of these is the question of whether or not the content of scientific knowledge is **contingent** on human culture, or **determined** by the natural world. We can identify both soft and hard contingency.

Soft contingency, which most people accept, is the claim that human society develops in a contingent manner and that it could have been that certain theories would never have been developed, or certain facts never produced. That is, the *questions* we ask about the natural world are contingent. **Hard contingency**, which is controversial, is the further claim that even if we assume the same sorts of intellectual conditions a totally different sort of science could be produced. That is, even when the questions are asked, the *answers* are contingent.

2: Nominalism or realism

The debate between realists and nominalists goes back at least as far as the Middle Ages.

Realists hope that the natural world has an **inherent structure** that we are able to discover and describe. They believe that even if we have not got things right at the moment, that at least in principle it should be possible to do so, because the facts of the matter are simply there to be discovered.

Nominalists, on the other hand, believe that the world is so **autonomous**, so unique, that it may not even have what we call structure – that all the structure we perceive is simply the structure of our own representations. Our representations are not purely arbitrary, however, they are restrained by the various types of perceptions and experiences we are able to produce, with our bodies or with our tools.

3: External or internal explanations of stability

The debate here is over what causes **long-term stability** in scientific knowledge: Why do we believe that, for example, (a) Maxwell's equations of electrodynamics or (b) the 1st law of thermodynamics (conservation of energy) are here to stay?

The **internalist** position is that we believe these are stable claims because they represent true facts about the world, which we have discovered.

The **externalist** position is that the stability of scientific claims must, in principle, involve elements that are external to the content of science: social and historical factors, interests, networks, and so on. When a new discovery is made, or a new theory advanced, technoscientists must engage in social engineering, reorganization of vested interests, and the production of new networks of knowledge.

Where do you stand?

Hacking claims that these three “sticking points” are “real issues on which clear and honorable thinkers may eternally disagree.” That is, at the end of the day, we will have no purely empirical, or purely logical basis for taking one side over the other: sound, well-founded, and intellectually honest arguments can be advanced for either position.

Hacking goes on to present a rating system for each sticking point, with 1 as strongly realist and 5 as strongly constructionist. He rates T. Kuhn as {*contingency* : 5, *nominalism* : 5, *stability* : 5}, that is, extremely constructionist. He gives himself the rating {2, 4, 3}, that is somewhere in the middle.

How would you rate yourself? It's okay if your rating changes over time.

The Sociology of Scientific Knowledge: Introduction

In the 1970s, a group of scholars in Edinburgh began to apply sociological ideas to explaining the production of *scientific knowledge*. Prior to this, scholars generally thought that non-scientific beliefs should be explained *sociologically*, while scientific beliefs should be explained *scientifically*. (L. Fleck, in the 1930s, argued that scientific ideas are also produced socially.)

The Edinburgh group argued that this set up a strange *asymmetry*: the grounds for “non-scientific” beliefs must be explained away using external reasons, while those for “scientific” beliefs must be justified using internal reasons. But, they argued, the truth or falsity of a belief cannot be the *the reason for believing it*, for which external factors must be considered.

The sociology of scientific knowledge attempts to explain the social processes that produce scientific belief. It attempts to open up the *black box* of the scientific method.

The strong program: Causal

The best known branch of SSK is known as “The strong program.”

D. Bloor, *Knowledge and Social Imagery*, 1976

“1. It would be **causal**, that is, concerned with the conditions which would bring about beliefs or states of knowledge. Naturally, there will be other types of causes apart from the social ones which will cooperate in bringing about the beliefs.”

- Beliefs are treated as *objects* that come about by certain causes. We want to understand these causes.
- If we want to understand why a belief is successful in winning adherents, it does no good to argue that it is correct or rational.
- We have to look at a broad basis of conditions that brought about a certain belief. These include both social and non-social conditions.

The strong program: Impartial

D. Bloor, 1976

2. It will be **impartial** with respect to truth and falsity, rationality or irrationality, success or failure. Both sides of these dichotomies will require explanation.

- A full explanation of a state of beliefs will require an explanation that is independent of claims about truth, rationality or success.
- For example, we **don't** argue that after WWII the US became a powerful nation *because* it was founded on true ideals, had a rational constitution and was based on sound economic principles, so why should we invoke these kinds of “explanations” to describe the progress of science?
- We need to explain why some ideas succeed and others fail using similar types of processes.

The strong program: Symmetrical

D. Bloor, 1976

3. It would be **symmetrical** in its style of explanation. The same types of cause would explain, say, true and false beliefs.

- We need to use the same sorts of resources to explain all beliefs, those we regard as true as well as those we regard as false.
- We must reject the idea of using internal, rational explanations for “correct” beliefs and external, sociological explanations for “incorrect” beliefs.
- Since ideology, idiosyncrasy, political and religious pressures are used to explain “false” beliefs, they should also be used to explain “true” beliefs.

The strong program: Reflexive

D. Bloor, 1976

4. It would be **reflexive**. In principle, its patterns of explanation would be applicable to sociology itself.

- We should be able to apply the methods of the strong program to the sociology of scientific knowledge itself.
- That is, when trying to understand why we believe things in science and technology studies, we must be impartial with regard to truth and look for symmetrical causes of our beliefs.
- Bloor: “All knowledge, whether it be in the empirical sciences or even in mathematics, should be treated ... as material for investigation.”

Interest explanations

The sociology of scientific knowledge placed an emphasis on using the **interests of actors** as a way of explaining not only *how they behave* but also *what they believe*.

Socially determined interests are more obvious.

- Phrenology (19th century) challenged established medicine, and was mostly practiced by people from the lower classes.
- Chinese physicians practicing Western medicine have a social interest in belittling the efforts of Chinese physicians practicing traditional methods.

But there are also internalist interests, which may be less obvious to a non-specialist.

- Natural philosophers, such as R. Boyle and T. Hobbes (17th century), argued over the value of observation versus experiment, which produce different ideas and procedures.
- Different mathematical methods lead to different theories.

Objections to SSK

[A] Interest-based analysis is often **over simplified**: (1) actors are usually interpreted as having only one social interest, (2) the social conflicts are often over-simplified and made two dimensional, and (3) it is difficult to prove that there is a casual link between social position and scientific belief.

[B] Another major concern is that the social world is **taken as fixed** and used to explain the construction of facts and theories about the natural world. But surely the social context is just as much constructed as anything else, and hence, should also be treated as flexible.

Nevertheless, the use of interest-based rational choices, especially choices based in local, material culture, have remained an important explanatory tool.

Actor-Network Theory: Introduction

Responding especially to the final objection raised to SSK, [B], a number of scholars began to advocate a new theory of technoscience known as **actor-network theory** (ANT).

ANT was meant to be **completely symmetrical**, such that beliefs and claims about the social world would be understood as causally constructed in just the same way as those about the natural world. There was to be no fundamental distinction between science and technology, nature and society, facts and values.

Although ANT started out as a theory of technoscience, it is in fact a **general social theory**, which is adapt at recognizing the fundamental importance of technoscience in modern society.

The composition of networks

Technoscience is the result of the creation of larger and stronger **networks**. Just as a political actor develops a network to wield political power, so technoscientists create networks to produce scientific facts and beliefs.

Networks are made up of all kinds of different things: humans, institutions, machines, objects of study, laws, ideas, elections, theories, mathematical methods, and so on. These various things form **associations** and **allegiances**. Both human and non-human actors have “interests” that cause them to act or to react.

- In order to bring an electric car to market, engineers have to both design the car and produce social and political networks.
- The Diesel engine was originally designed to work with *any* fuel. But it failed except with a special type of fuel. So Diesel “shifted his system of alliances.”

The effects of networks

Actors make up networks, and networks produce effects. Networks make **machines**, they turn beliefs into **well-established facts**, and they produce **agency** (this is a way of understanding the volitional aspect of technology). Established networks act as black boxes.

The work of technoscientists can be characterized as an attempt to understand the “interests” of various actors in the network and then **translate** them, so that they work in agreement.

This translation work extends the network from local interactions in a controlled environment, via manipulation of machines, and uses techniques of summarizing and grouping to produce abstract theories. Universal scientific knowledge is produced by applying new sets of manipulations that allow us to adopt the knowledge to our local circumstances, using tools that reproduce the world on the human scale – like telescopes, microscopes, thermometers.

A materialist approach

ANT is a fully materialist approach. Even ideas and theories are understood materially: scientific representations are the result of mechanized material manipulations.

We use our tools to codify the world and to organize it. We extend the reach of the lab by producing tools on an industrial scale and distributing them around the world.

When we talk about any scientific fact, the network that supports it is a **black box**:

- We can look at a thermometer to know what temperature it is. This works because people analyzed boiling water in a lab, then they made thermometers in various labs and distributed them, then they made factories with controlled lab-like settings so that thermometers could be mass-produced. Everyone was educated to understand these numbers. The simple fact of temperature requires a vast network.

The Pasteurization of France

One of the most extensive examples of ANT is found in B. Latour's *Pasteurization of France*, 1988.

In order to convince people of the germ theory of disease, Louis Pasteur developed a network that included his laboratory, his assistants, the apparatus, the microbes, field laboratories, public demonstrations, farmer groups, medical associations, politicians, military officers, and so on.

He made the microbes appear in his isolated lab, and he tested their properties. Then he extended the network of his lab back into the field, with portable labs. He staged public demonstrations, with the backing of farmer's groups and the military, to perform already-completed experiments. He enlisted the support of the French medical establishment in introducing new public health measures. Government regulators put into place measures based on Pasteur's idea of the microbe as the causal agent of disease.

Objections to ANT: Practices and cultures

An objection to ANT is that because it is purely materialist it doesn't take account of overriding sociological phenomena such as **practices** and **cultures**.

Gentlemen and trust: In the 17th century, natural philosophers transferred the cultural trust that one gentleman supposedly had for another to their claims about experiments and facts.

The mathematical tripos: The 19th century mathematics exams at Cambridge provided a set of mathematical practices that were common to all British exact scientists.

Engineering schools: The graduates of elite schools, such as MIT and École Polytechnique, shared the same educational culture, and hence framed and solved engineering problems in a similar way.

Objections to ANT: Agency and realism

In ANT, actors are things which are *made to act* by the network in which they exist. Hence, agency (a form of volition), is the effect of the network and doesn't exist independently from it. Some people feel that this way of thinking takes away too much agency from humans and gives too much to "non-human actors."

ANT has been criticized both for being *too constructionist* and for being *too realist*.

- The essence (reality) of things is constituted by the network.
- Allowing non-human actors to affect the network assumes they have some reality.

Latour (1990): "A little bit of constructivism takes you far away from realism; a complete constructivism brings you back to it."

Final Remarks

- We have looked at the general concept of **social construction**.
 - This can be divided up into a *constructionist* or *realist* stance on the following “sticking points:” (1) contingency, (2) nominalism, and (3) internal or external explanations of stability.
- We have looked at some ideas related to the sociology of scientific knowledge (SSK) research program.
- We have looked at the actor-network theory (ANT) of scientific and technological activity.