

The philosophy of science.

Ever since ancient times, the thinkers and philosophers have considered how they can understand themselves, and the world better. The word itself, philosophy, can be understood as meaning 'passion for wisdom'. In the last couple of centuries, this goal have been taken over by the professional, organised science.

In this essay, I deal with the problems and questions arising when investigating the theory of science. Among the first questions arising are: What is theory of science? What is a theory, and why do we need it? What is empiricism, and why do we need it? And what is the optimal way of merging theories and empiricism into a meaningful whole? In other words, what is the optimal way to perform science. I will look into what solutions are provided by various researchers and schools of thought, e.g. positivism and social constructionism and attempt to deal with some of the above questions, some more elaborately than others.

So what is theory of science?

Theory of science can be called the science of science. Some of the elements within this is the relation between; scientific theory and practical appliance, theory and reality, theory and empiricism and scientific argumentation, reasoning and methods (Politikens filosofleksikon, 1983, 'videnskabsteori'). One way of illustrating what theory of science is, is performed by Lesche and Madsen (Lesche and Madsen, 1976), who is dividing it into several levels: The physical or psychological phenomena which the scientist is studying, is on the first level, the so-called reality level. On the next level, is the entire branch of science, including its theories, methods, tools, results and ways of applying these (e.g. therapy or reports). So the objects of study for the scientists on level two, is the reality on the first level. On the third level, is the meta-scientific researchers, looking at the scientific phenomena on the second level. So the object of research on the third level, is e.g. the theories and methods on the second level, and not really the objects on the reality level. Since there are various interpretations of what theory of science is, one can also compare these various schools of meta-science. That is done from a fourth level. So the point is that there are various levels, or layers, constituting objects, science and meta-science (and 'meta-meta-science').

But what is the purpose of science? According to Kaare Pedersen, the Danish sociologist Heine Andersen asked Danish social scientists what they believed was the 1st priority of science. They answered: "*At danne grundlag for praktisk handlen*" (Pedersen, 1997, p. 4). This is of course only representing the social scientists (in Denmark), but it seems as a reasonable and well defined goal.

The next question arising is then, how is this ‘grundlag for praktisk handlen’ obtained? There are a number of answers to that.

The tradition of empiricism, including the logical positivism is one of them. The modern positivism is mainly connected to the Vienna Circle. One of their objectives was to stop considering the traditional philosophical reflections of e.g. metaphysics, cognition, moral and art as science.

Instead, science should, according to the positivists, consist of a pure empirical/observational exploration of the world. This would be achieved by research that is e.g. focusing on sense data and the observations reflecting them, and then afterwards make generalisations upon these data, while still keeping a sharp distinction between theory and observation. Physics was the ideal of the logical positivists, since physics observed the smallest parts of nature, and made generalisations and conclusions upon larger entities, based on the observations of these smaller fragments of the world.

The logical positivists acknowledged that some entities are not observable, like quarks, or personality. *“It is of course unacceptable to abandon these as ‘meaningless’. Their [the logical positivists’] solution to this problem is aptly summarized in the label ‘logical positivism’: science consists of statements describing positive objective facts, plus logical relations between these statements”* (Bem and Jong, 2002, p. 43). Despite their acknowledgement of logic relations, they did still not consider metaphysics as real, valid science. Another interesting claim of the positivists (or logical positivists) is that the context of discovery (e.g. the historical or social processes) has nothing to do with the validity of scientific products. Only the context of justification counts.

Karl R. Popper was one of the philosophers connected to, but not a part of, the Vienna circle. With them, he shared the meta-scientific goal of being able to identify real science, like physics, from non-science/pseudoscience, like astrology. Popper did, however, not agree with the logical positivists’ idea of verification - it actually seems like he was a bit inspired by scepticism, which can be explained as a belief that one should avoid declaring final truths. Instead, Popper proposed that one should pose theories that could be falsified. “All swans are white”, is a falsifiable theory since if you just find one swan that is black, the entire theory would fall. Theories that does not stand the trial of falsification are, according to Popper’s demarcation, unscientific, meaningless and useless. That could be a statement like ‘God is Love’ or ‘The Id is a part of the unconscious mind’. By stating falsifiable theories instead, one would be able to quickly diminish the wrong theories, or evolve the falsified theory into a better theory. This requirement is not only directed at the theories, but also at the practical application of them, since a theory would loose its status as scientific, if it’s believers stopped making new experiences within it. One makes new experiences within a theory by

accepting the risk of recognising that the theory might be wrong. So according to Popper, all knowledge and science is fallible. He does still believe, though, that it is possible to develop and advance science if done correctly. One should first cast out daring theories, and then try and verify or falsify it. Even if it is disproved, you have still gained valuable knowledge, and then you can afterwards redevelop your theory further, but one should never expect to reach a final, verified theory. Popper's falsification criterion can also be regarded as an answer to the problem of induction that Hume pointed out. For example, Hume stated that just because the sun has risen every day we know of, it doesn't necessarily do it again tomorrow, in other words, there is no rational way to conclude that things will reoccur, just because they have happened before. Popper then claims that while there is no way to prove that the sun will rise, we can make a theory that claims that it will. If the sun does not come up, then the theory will be disproved. But since the theory at the moment seems consistent with reality, it is not disproved (yet, luckily).

So what is all this talk about theories, one might ask. Do we really have to struggle with finding the optimal theory of science? I mean; as long as one obtains applicable results, does it then really matter how these results were obtained. By applicable results, I mean something that someone outside the science world can apply to improve, e.g. education, social treatment or production. As long as this is fulfilled, it does not really matter whether the methods used were positivistic, hermeneutic, or non-theoretic. Why not just make the empirical observations and stick to the facts, without filling the gaps with theoretical assumptions?

There are however some problems with this idea. Believers in the above, are called 'anti-theorists' by K. B. Madsen. He states that a theory is a perfect way of arranging and preserving results in a systematic form. The anti-theorist will therefore be unable to take advantage of the entire collected scientific knowledge from previous theories. This would force the anti-theorist to be on his own, practically, and the anti-theorist would not really benefit from his/her academic education.

Furthermore, Madsen claims that upon closer investigation of the anti-theorists, it is always revealed that they are not completely open-minded or non-theoretical in their empirical research. *"...de har visse ubevidste, teoretiske og filosofiske forudsætninger, der styrer deres forskning. Det er derfor bedre at få 'bevidstgjort' sine teoretiske forudsætninger, for kun derved kan de blive eksplicit formuleret, kritiseret og revideret, således at der kan foregå en stadig vækst og udvikling i den pågældende videnskab"* (Madsen, 1980, p. 10-11).

In other words, we need to make theories to organise facts, and be conscious and aware of the personal and ideological biases we may possess. One meta-scientific school that especially focuses

on these personal and social connections to science and interpretation is the social constructionism. Social constructionism¹ is a more modern field where the basic assumption is that since humans are social beings who are living together in societies, our knowledge and behaviour is reflected by these social interactions, or constructions. These discourses creates and is a part of our structures of reality, in a meaningful way that gives our existence form and content. Some (e.g. Favrholt), regards social constructionism as divided in two, a soft and a hard/radical social constructionism. The hard social constructionism states that literally everything, even the physical world, is a social construction. One of the most extreme versions of this is presented by Søren Favrholt (Favrholt, 2001). He refers to the social constructionist Steve Wolgar, who in his book 'Science, the very idea' claims that America did not exist before Columbus discovered it. There was no physical landmass, in the place where what we today call America is, before year 1492. His claim is that it is not the physical elements which is represented in the discovery, but the social representation that creates the physical elements. This thesis is interesting, but it seems a bit far out. Favrholt argues that if everything, even the physical world, should be social constructions, then what about the other people surrounding us, or their bio-chemical processes in their bodies and the laws of physics controlling them? Should all this be social constructions too? That is obviously not the case, so the hard social constructionism can therefore be declared as a self-contradiction in terms.

The soft and more normal version of social construction seems more reasonable since it claims that knowledge and meaning (but not the physical world) is formed and maintained through social and cultural processes. Kenneth Gergen describes how he (before his social constructionist days) in his university days were a psychologist devoted to empirical psychology, and how he later realised something was wrong. Gergen starts by expressing his eager for the positivist methodologies: "*As a trained scientist, I could establish experimental settings in which precise causal linkages could be traced... ..Observations of these causal sequences could also be evaluated statistically so as to ensure their broad generality.*" (Gergen,1997, p. 114). These methods seems very coherent to the positivistic ideals of science, since his work was based on experiments and observations. Gergen continues: "*I could then make these findings available to my colleagues for further study, and as weaknesses and limitations were discovered in this work, further research would be invited. Over time, aided by my participation, the field would generate highly sophisticated and well-tested*

¹ Social constructionism is sometimes called social constructivism, or sometimes just constructionism (e.g. by Gergen). It seems like most authors use the terms interchangeably, while others state that there is a difference. I will use the term social constructionism consistently, which refers to my definition.

theoretical accounts (principles and explanations) of broad generality.” (Gergen, 1997, p. 114). His colleagues are able to find weaknesses and limitations in his work, and as a consequence, his scientific work evolves into ‘well tested theoretical accounts of broad generality’. In other words, he is among other things showing how his theories would withstand Popper’s falsification criteria. Gergen merrily finishes the section by stating that *“These accounts would not be biased by any particular ideology, political position, or ethical commitment. In effect, these accounts could be made available to all people, so that policy makers, organizational decision makers, community leaders – indeed, any private citizen – could benefit in their attempts to improve the human condition”*. (Gergen, 1997, p. 114).

Much of the above is resting on the belief that knowledge accumulates. But what if social life is unstable, and the social patterns are in a continuous state of transformation? If this is so, science does not accumulate knowledge, but is only representing a small and perhaps not very important history of specific subjects’ behaviour in artificial settings. For Gergen, these doubts arose during an experiment he designed, where an interviewer interviewed subjects on their self-esteem, by giving positive feedback when the subjects showed high self-esteem, and giving no or negative feedback if the subjects showed low self-esteem. In a subsequent experiment, the subjects who were exposed to positive feedback displayed higher self-esteem than a control group.

He then worried that if the feedback from the interviewer seemed insincere, the feedback would have little effect. To test this, Gergen conducted an extra experiment, where the subjects were informed that certain interviewing techniques were being tested, which, as anticipated, produced subject self-esteem matching that of the control group. The feedback was inefficient since the subjects did not interpret it as sincere. Gergen then realised that none of the feedback in the previous study was really sincere, all of it was just experimentally arranged. *“This meant that it was not what the interviewer actually did in the interchange that mattered, but the interpretation that was placed on it.”* (Gergen, 1997, p 116).

So if interpretations come and go throughout cultural history, and if interpretations vary from person to person, then there is more or less an infinite different interpretations of the results of the study. What are these results good for then, if no one can agree on how to interpret them?

The above considerations were what launched Gergen’s interest and research into social constructionism and made him abandon the simpler positivistic methodologies. Today the theory is usually thought to consist of the above mentioned, but also more aspects are included: What we call knowledge, truth, identity and the conception of self, are created through social interactions with

others, and are therefore weaved into the culture and lingual understandings we possess and use. Furthermore, language receives special social constructionist attention, since language is the primary element in our social relations, and we learn to interact and think via language (Some disagree with this and claim that language is non-cultural, e.g. Favrholdt, 2001). Language should in social constructionist terms not only be understood as spoken language, but also written texts, body language, symbols and meanings. Furthermore, some of the institutions in society have been created by and must be explained solely via social constructions. Examples of these inter-socially constructed institutions could be traffic laws, the monetary system (e.g. banks, stocks, etc.), religion, codes of conduct and so on.

So the point is, for example, that I on more than one occasion seem to interpret study results or theories in the same way as my fellow students. But someone from another social institution might possess other social constructions, which, according to social constructionism, makes them interpret differently than people outside their own social institutions. An example of the above could be that a RUC student interprets texts differently than a 90-year-old Nepalese rice farmer, because they reside within non-compatible social contexts. But the examples do not have to be so extreme, it could also be that the RUC student interprets texts differently than students from Copenhagen University, since they too, have been created by, and think via differing social constructions. Routledge Encyclopedia of Philosophy's definition of social constructionism seems to sum up the claims nicely: The thesis of social constructionism is "*that scientific knowledge is 'produced' primarily by scientists and only to a lesser extent determined by fixed structures in the world*". (Routledge Encyclopedia of Philosophy).

Taken to extremes, the social constructionism seems very pessimistic towards the future of science. If all science production is biased, and everyone interprets differently from their own little socio-cultural standpoint, then there is no way, or reason, to perform empirical investigations or create theories.

Gergen has attempted to counter these claims²: He claims that there is nothing about social constructionism that rules out empirical research. However, only certain forms are meaningful, the rest are a waste of time and resources, e.g. empirical investigations of the mind. "*More positively from a constructionist perspective, traditional empirical research is most effectively deployed in (1) illustrating interesting or challenging ideas, and (2) tracing patterns of conduct of major*

² The reader should be aware that Gergen in this text is primarily dealing with social psychology as social constructionism. Nevertheless, I have attempted to wring out some of the more general meta-scientific/methodological parts of his argument.

significance to the society.” (Gergen, 1997, p 120). The data from such experiments can be used for bringing provocative ideas to life, and thus generate debate and dialogue. They can furthermore be used to illustrate cautious generalities, but they will always be threatened to be contaminated by ideologies or personal ethics.

It is also possible to use discourse analysis to investigate particular habits of constructing the world and ourselves. *“The chief aim is to demonstrate the problems created by these discursive conventions and to open discussion on alternative intelligibilities”*. (Gergen, 1997, p. 121)

To sum Gergen’s idea up, it is possible to perform a social constructionist science, which in many ways can create dialogue and debate, and even reliable results (since many social constructs are widely shared in our culture), while still remaining careful to its own assumptions.

Popper and the social constructionism share the scepticist fear of final truths, but opens up for research and dialogue, which will evolve our science, and thereby society. They furthermore seem to share the idea that, in lack of better, we can use our theories until better are found. Science is a never ending quest of moving closer to possess perfect knowledge and methods, but it is never possible to reach this destination of final, indubitable knowledge of the world.

The positivist theory of science, presupposes that every subjective element is eliminated from science. But in the sciences that deal with the actions and cognition of human beings (and maybe all science), subjective phenomena like intention and meaning will be central. So a pure positivist science seems inapplicable to human and social sciences. Maybe the natural sciences is included in this, since even though they study non-social elements (an atom is not a social construct which meaning and characteristics can be negotiated and altered via discourses), their experiments are still only performed by human beings, whose interpretation and discourses can contaminate their results. As a consequence, the logical positivism seems incomplete since it does not take the above into consideration.

So in an attempt to combine all the latter ideas into a conclusive argument, I have proposed this summary:

- Empirical observations seems like a somewhat reliable way for gathering data, in lack of better methods.
- Science needs theories for structuring these data and to open these for criticism.
- This criticism can evolve your theories towards better theories.

- If knowledge, theories and criticism are social constructions, one should beware of the form and context of their theories and products, and therefore take some of the results with a pinch of salt.

I know that I have only involved some of the philosophical voices in this essay, there are many alternative questions and answers out there. I think it would have been relevant and interesting to furthermore involve more of the criticism and solutions for example from the humanistic science tradition (e.g. qualitative research methodologies), Kuhn, Vygotsky, Habermas, Heidegger, and more epistemological questions of e.g. justified, true belief, but unfortunately I ran out of time (and space).

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RUC, ICS 2006

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