Philosophy of Science: Introduction

Kristina Rolin 2012

What is philosophy of science?

- Philosophy of science is a study of the *normative* conception of scientific knowledge: What criteria should research and knowledge fulfill in order to count as *scientific* research and knowledge?
- Method: The goal is to find a *reflective equilibrium* between normative principles (e.g. the goal of scientific inquiry should be truth or empirical success) and actual practices in the sciences.
Normative versus descriptive

- A descriptive theory is an attempt to describe what actually goes on without making explicit value judgments.
- A normative theory makes explicit value judgments (e.g., judgments about what things should be and what should be done).
- Notice that a description can be value-laden (e.g., a terrorist - a freedom-fighter) and value judgments can be implicit.

Basic concepts

- **Ontology** is a philosophical study of existence itself (apart of the nature of any specific existing thing).
  - Natural kinds (e.g., H₂O)
  - Social constructivism (e.g., gender)
- **Epistemology** is a philosophical study of knowledge.
- **Methodology** is a philosophical study of research methods.
- **Research ethics** is a philosophical study of moral questions in science.
Philosophy of science and science and technology studies (STS)

- STS aim to understand and explain actual practices in the sciences.
- A philosophical study of the *normative* conception of scientific knowledge cannot be reduced to *empirical* study of science and technology.
- Empirical studies of science and technology are *relevant* to a philosophical study of scientific knowledge → different versions of “naturalism” in philosophy of science.

The naturalistic fallacy

- Example: The use of child labor is common in many countries even today. Therefore, we should accept this practice.
- This is a fallacy because ‘being’ does not imply ‘ought to’.
- The use of child labor is morally unacceptable because it violates justified moral principles (e.g. human rights).
Why is philosophy of science useful?

Science is a *reflective* practice:

When academics are engaged in the practice of science, they make, more or less tacitly, judgments about “good” science. Philosophy of science aims to make reflection on “good” science systematic and critical. It enables one not only to understand scientific practices better but also to take a critical stance towards some activities in academia.

What is a practice?

“By a ‘practice’ I am going to mean any coherent and complex form of socially established cooperative human activity through which goods internal to that form of activity are realized in the course of trying to achieve those standards of excellence which are appropriate to, and partially definitive of, that form of activity, with the result that human powers to achieve excellence, and human conceptions of the ends and goods involved, are systematically extended.” (MacIntyre, Alasdair. 1981. *After virtue*, 187)

- What are goods internal to science?
- What are its standards of excellence?
- Is science one practice or many?
Goals in philosophy of science

One goal is to understand the *epistemic* rationality embedded in actual activities in science (insofar as there is an epistemic rationality in these activities).

Another goal is to understand what activities are *morally* acceptable or unacceptable (research ethics).

In some cases, the *epistemic* goes hand in hand with the *moral* (e.g., honesty is both an epistemic and a moral virtue).

Philosophy of science is applied in paradigm debates

The so called paradigm debates are controversies about what is good science. Example:


Knowledge: A classical analysis (Episteme)

S knows that p if and only if

p is true,
S believes that p, and
S is justified in believing that p.

The concept of truth

- What does it mean to say that a proposition p is true?
- The correspondence theory of truth: “p is true” if and only if p corresponds with “the way things are”.
- Truth is a relational property (e.g., a relation between a proposition and a fact).
- Correspondence can be defined formally as a relationship between a sentence in a formal language and a model (Alfred Tarski, 1902-1983).
Alternatives?

- The coherence theory of truth: p is true if it is "coherent" with a particular set of propositions.
- The pragmatic theory of truth: p is true if it "works in practice".
- Criticism: alternative theories confuse a criterion for recognizing a true proposition (coherence or instrumental success) with the meaning of truth.

Fallibilism

- It is not a necessary condition of scientific knowledge claim that it is true.
- Nevertheless, claims need to be justified so that we have a reason to believe that they are likely to be true.
- Epistemic justification is at the core of what it means for a hypothesis, a representation or a theory to be scientific.
Doing Science, Writing Science

“There are two complementary aspects to scientific activity... In their presentations—papers in proceedings, journal articles, text books, and more—researchers usually do not tell their readers in any detail how they obtained their results. Rather, they present their findings embedded in a web of arguments and reasons, thereby changing the order and justification of their research steps. In short, there is a mismatch between what scientists do and the presentation of results in scientific publications.”


Scientific realism

- Not only empirical claims but also theoretical claims in current scientific theories are true (or approximately true).
- One actual and reasonable aim of science is to provide accurate descriptions (and other representations) of what reality is like (including those aspects of reality that are unobservable).
Anti-realism

- *Empiricism* is the view that we have good reasons to believe that empirical claims in current scientific theories are true (that is, theories are "empirically adequate"). We do not have sufficiently good reasons to believe that also theoretical claims are true.

- *Constructivism* (in one of its many senses) is the view that we do not have sufficiently good reasons to believe that any claims in current scientific theories are true.

Argument for realism

The no-miracles argument:

Scientific realism is the only view that does not make the instrumental success of science into a miracle.

Argument against realism

The pessimistic induction from the history of science:
Scientific theories have changed so often in the history of science that we do not have a reason to expect most of the current theories to be true.


Are there any truths in science?

What is a scientific theory and how does it relate to the world?

- In the traditional view, scientific theories consist of statements that can have truth values (theoretical and empirical statements). The epistemic goal of science is thought be *significant* truth (or empirical success).
- In the alternative view, scientific theories include *models* that are non-linguistic entities (and therefore, they cannot have truth values). What is a model? How do models differ from theories and how do they relate to the world?
Scientific representations as “maps”

“A theoretical hypothesis asserts the existence of similarity between a specified theoretical model and a designated real system. But since anything is similar to anything else in some way or other, the claim of similarity must be limited … to a specified set of respects and degrees” (93).


Knowledge: A classical analysis (Episteme)

S knows that p if and only if

p is true,
S believes that p, and
S is justified in believing that p.
Who has knowledge?

- In the classical analysis of knowledge, an individual knower has knowledge.
- Scientific knowledge includes theories that no individual knower can know alone because no individual knower can have direct access to all relevant evidence and reasoning. The production of scientific knowledge requires a division of labor (or distributed cognition) and an aggregation of views.

Who has scientific knowledge?

Two competing views:

1. Some knowledge claims can be properly attributed only to collectives (groups or communities), not to individual scientists.
2. Only individual scientists can have scientific knowledge. They can have access to a group’s or community’s pool of knowledge by relations of trust.
Do values and social positions matter in science?

- **Diversity of values** is thought to be epistemically beneficial because it is easier to recognize when idiosyncratic values are influencing scientific research when the values in question are different from one’s own.

- **Diversity of social positions** is thought to be epistemically beneficial because individuals from diverse social positions and backgrounds are likely to have had different experiences, and some of these experiences provide access to evidence that has implications for the plausibility of background assumptions, models, and methods.

Knowledge: A classical analysis (Episteme)

\( S \) knows that \( p \) if and only if

- \( p \) is true,
- \( S \) believes that \( p \), and
- \( S \) is **justified** in believing that \( p \).
Epistemic justification

- The traditional approach focuses on empirical evidence and reasoning that aims to show that empirical evidence gives support to a hypothesis or a theory (analysis of arguments in science).
  - logical empiricism
- Social epistemology: Epistemic justification is also a social practice.

Justification versus discovery

- The context of justification is to be distinguished from the context of discovery. The latter is the domain of psychology (history and sociology) of science.
- The proper domain of philosophy of science is the context of justification: “a relation of a theory to facts, independent of the man who found the theory” (Reichenbach 1938, 382).
- The proper task of philosophy of science is “rational reconstruction” of scientific knowledge.

Reichenbach, Hans. 1938. Experience and Prediction.
Justification/discovery

Five different versions of the distinction:
- Discovery and justification are temporarily distinct processes.
- The distinction concerns the process of discovery versus the methods of justification.
- The analysis of discovery is empirical whereas the analysis of justification is logical.
- History, psychology, and sociology of science differ from philosophy of science in their methodology: empirical versus logical.
- The distinction is about different research questions.


Justification/discovery

"As much as this assumption has been taken for granted in (some parts of analytic) philosophy, it is by no means philosophically innocent. – All epistemically substantial disagreements, therefore, are caused by error. – In other words, a rational disagreement concerning justification is conceptually impossible. Put in a different idiom, the justificatory part of science is a one-person-game. This implies that in this part of science, there is no fundamental epistemic role for scientific communities, as opposed to individually working scientists." (Hoyningen-Huene 2006, 124)
Justification/discovery revisited

- The context of justification includes the ways in which scientific hypotheses and theories are actually argued for. This is important when we aim to understand the structure of a research paper ("writing science").
- The context of discovery includes the ways in which scientists actually arrive at certain hypotheses and theories. This is important when we aim to understand the structure of a research process ("doing science").
- Philosophy of science is concerned with the doing of science and the writing of science.
- Yet, we can make a distinction between two perspectives: descriptive and normative/evaluative.

Today’s message

Put **empirical evidence** into a large mixing bowl. Add **reasoning** and rhetorical spices. Mix and pour the filling into a journal paper crust. Bake until the pie is ready for the **social** practice of epistemic justification.
Tentative program: part I

- September 5: Introduction
- September 12: Scientific reasoning
- September 19: Empiricism
- September 26: Post-positivist philosophy of science: Quine
- October 3: Post-positivist philosophy of science: Kuhn
- October 10: Contextual empiricism
- October 17: NO CLASS

Tentative program: part II

- October 24: Explanation and Causality
- October 31: Philosophy of the Social Sciences
- November 7: Values in Science
- November 14: Models in Science
- November 21: Ethics and Political Philosophy of Science
- November 28: FINAL EXAM