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Four epistemological paradigms on Nature of Science – Presentation

Data · April 2015

DOI: 10.13140/RG.2.1.1507.5360

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Four epistemological paradigms on Nature of Science (NOS)

**Science according
to ...**

**Scientific method
according to ...**

**Scientific theories
according to ...**

**Scientific
advancement
according to ...**

Previous warning

The slides that follow are very simplified schemes and, therefore, limited to the most general features. Within each paradigm, positions of the several authors differ to a greater or lesser extent. For example, we have cataloged Kuhn, Feyerabend and Glasersfeld as relativistic, knowing that his relativism is not exactly the same. Another example is the realistic positions; those of Popper, Tuomela and Niiniluoto can be regarded typical of the strong realism, but there are other positions realistic, as the transformative realism (Hacking) and the constructive realism (Giere).

“The travel by previous paradigms shows the complexity of the philosophy of science, and warn of the need to be wary of adopting an epistemological framework and the consequences of this decision for science teaching. However, although prescriptions from a particular author may be very respectable, they must confront with the other streams of epistemology of science previously to consider them appropriate ...” (Vázquez, Acevedo, Manassero y Acevedo, 2001, p. 159).

Vázquez, A., Acevedo, J. A., Manassero, M. A. y Acevedo, P. (2001). Cuatro paradigmas básicos sobre la naturaleza de la ciencia. *Argumentos de Razón Técnica*, 4, 135-176.

Science according to ...

Positivism (Reichenbach, Carnap, Hempel, Nagel ...)

- Science is attempt to codify and anticipate experience.
- Science is the only valid way to knowledge (scientistic reductionism).
- The basic material of science include observational data (measurements) and logical reasoning.

Realism (Popper, Tuomela, Niiniluoto ...)

- The aim of science is to seek true theories according to a criterion of rationality, through overcoming many attempts of falsifiability.
- Science is the only valid way to knowledge for the traditional realism (scientistic reductionism).

Pragmatism (Peirce, Putnam, Rorty ...)

- Science is a functional knowledge of world, whose rejection or support is determined by fertility of description made by that knowledge.
- The purpose of science is to produce increasingly reliable theories, able to overcome most demanding empirical tests.
- Science is not the only valid way to achieve knowledge.

Relativism (Feyerabend, Glasersfeld, Kuhn ...)

- Science is a social and human activity that achieves knowledge from several ways.
- Empirical evidence is not critical to generate scientific truths (the historical turn and the crises of rationalism).
- Relativism is an extreme way of skepticism. The skeptics do not make any positive claim about knowledge generation.

Scientific method according to ...

Positivism (Reichenbach, Carnap, Hempel, Nagel ...)

- The method is unique and universal (methodological absolutism). Demarcates science vs. non-science.
- The method consists in a set of objective and universal rules for design of experiments and evaluation of theories, which ensure success and progress.
- The rules are normative, but not declaratives. Also not are true or false, because they nothing assert about the world.

Realism (Popper, Tuomela, Niiniluoto ...)

- The method ensure the success and progress. Demarcates science vs. non-science through falsifiability's criterion.
- Methodological rules are means to achieve purposes of scientific research. The purposes determined the method.

Pragmatism (Peirce, Putnam, Rorty ...)

- If research continues long enough, the method establishes what is true.
- Methodological rules are not simple conventions, are in the same level with scientific theories. Science proposes theories about the world, and theories on how to guide research.
- Empirical evidence is relevant to theories and methodological rules. The rules of method are accepted if they show their ability to choose more reliable theories, and the theories are accepted when they work.

Relativism (Feyerabend, Glasersfeld, Kuhn ...)

- Scientific method is not the more valid or reliable criterion of demarcation, there are other smart perspectives that get success and progress.
- Methodological rules are subjective; are subject to personal preference, and can vary from a scientist to another. But may be accepted by a local community. At most, are constrained to scientific community values. If the rules of method are subjective conventions, elections based on them lack rational.
- Methodological rules and substantive theories of a paradigm are not inseparably entwined; theories do not always support the methodological rules associated with a paradigm.

Scientific theories according to ...

Positivism (Reichenbach, Carnap, Hempel, Nagel ...)

- There is continuity between its observational and theoretical. But empirical evidence precedes theory.
- Theories and laws are developed to correlate empirical data. There are observational theories and target theories.
- True theories are reached by a rationality criterion applied to empirical adequacy.
- True theory is the theory best tested, i.e., adjusted to all observational data (verificationism).

Realism (Popper, Tuomela, Niiniluoto ...)

- Empirical evidence is theory-laden (or competent practice, according to transformative realism).
- Theories correct the observational statements.
- Any theory will be surpassed by another theory, then is false, though we do not know yet.
- The best theory is one that has overcome a greatest number of attempts stringent of falsifiability.

Pragmatism (Peirce, Putnam, Rorty ...)

- Theories are useful tools that related observables to each other.
- Best theories are those that have been best tested.
- Empirical evidence is theory-laden.

Relativism (Feyerabend, Glasersfeld, Kuhn ...)

- Empirical evidence is theory-laden; methodological rules that connect the empirical with the theories are ambiguous.
- It is necessary to distinguish between the content of a theory and what is tested. Scientists decide what is tested by a theory. Therefore, theory has a relative value.
- Empirical evidence is not sufficient to choose between competing theories (strong relativism).
- The falsity of a theory affects the falsity of observations. However, some observational protocols are not tainted when theories linked with them are falsified.
- Different theories may have the same observable consequences.

Scientific advancement according to ...

Positivism (Reichenbach, Carnap, Hempel, Nagel ...)

- Science advances in so far that new theories can predict and explain more and better than its predecessors.
- Scientific advancement is cumulative and linear. New theories retain the successes of preceding theories and revise their errors (greater generality); new theory includes the preceding as a limiting case.

Realism (Popper, Tuomela, Niiniluoto ...)

- Science advances through theories that resist more tests of falsifiability.
- The positivist concept of case limiting of theories is valid only for quantitative data, not for qualitative statements.

Pragmatism (Peirce, Putnam, Rorty ...)

- Scientific advancement depends on the greater or lesser degree of approximation to science purposes. It is not cumulative neither linear, because there are gains and losses.
- Loss of empirical content (or explanatory content) of a theory says nothing, *per se*, about scientific advancement.

Relativism (Feyerabend, Glasersfeld, Kuhn ...)

- Scientific advancement is not an absolute concept. Theories resolved problems in different ways; therefore, scientific advancement depends on view of those who evaluated solutions of different theories (subjectivism).
- To decide about scientific advancement, we should know the set of explanatory and predictive achievements (potentials and futures) of a theory; this is impossible because such a set is infinite.
- Ways of scientific advancement are local; is not a global scientific advancement.
- The purposes of science are not permanent, so the pragmatist concept of scientific advancement is necessarily relative and changing.

Philosophers of Science



Carl
Hempel



Karl
Popper



Hilary
Putnam



Thomas
S. Kuhn



Philosophers of Science



Ronald
Giere



Larry
Laudan



Stephen
Toulmin



Paul
Feyerabend



Philosophers of Science



Ilkka
Niiniluoto



Imre
Lakatos



Charles S.
Peirce



Ernest von
Glasersfeld



Epistemological positions of selected authors about NOS

