Van Fraassen's Constructive Empiricism and the Pragmatic Theory of Explanation

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Epistemology and Philosophy of Science – Module 2, Seminar 4

12 November 2024

U LISBOA | UNIVERSIDADE DE LISBOA

FCT
Fundação para a Ciência e a Tecnologia
MINISTÉRIO DA CIÊNCIA, TECNOLOGIA E ENSINO SUPERIOR

Outline

- Scientific Realism In a Nutshell
- van Fraassen I: Constructive Empiricism
- van Fraassen II: The Pragmatic Theory of Explanation

Scientific Realism In a Nutshell

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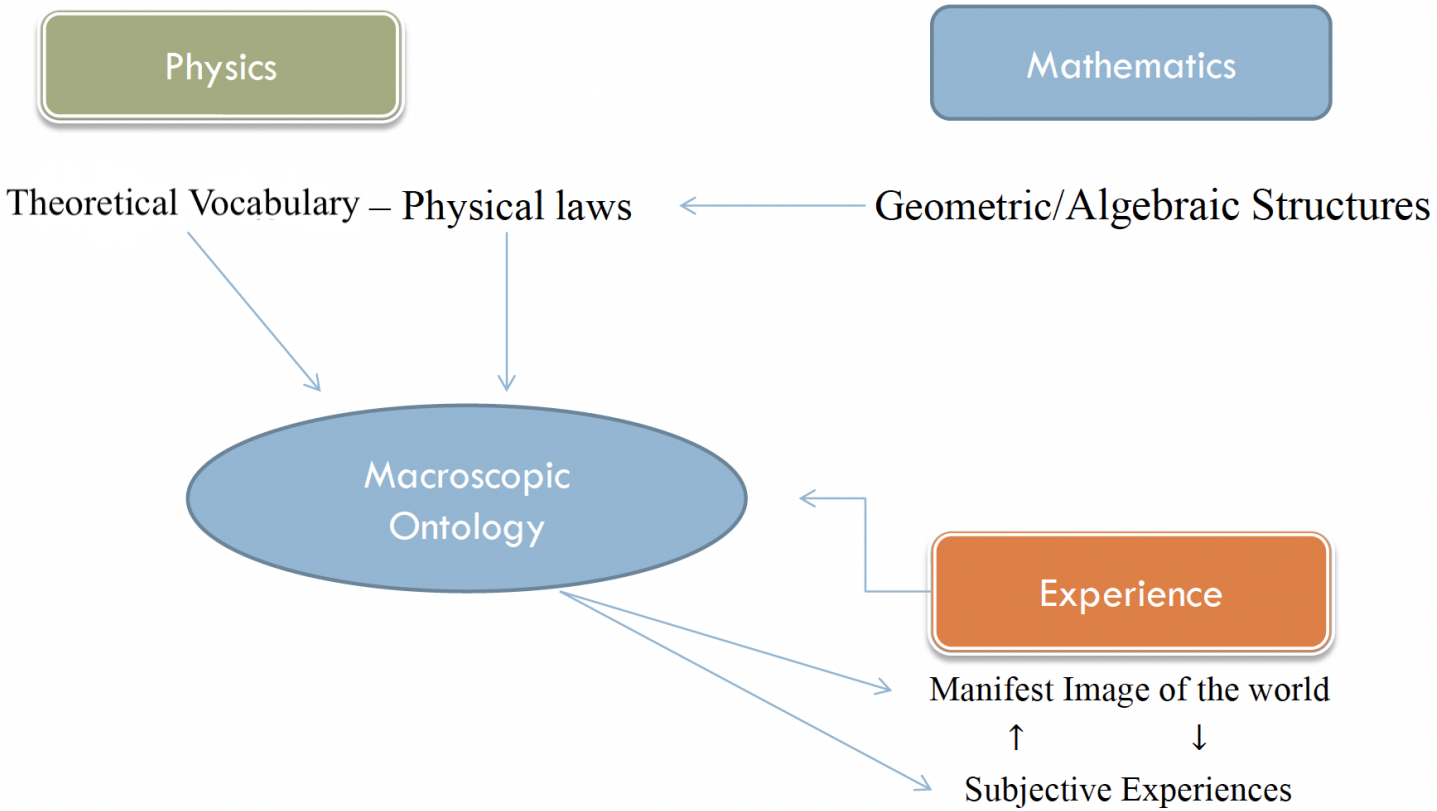
Towards Scientific Realism:



Towards Scientific Realism:

- How theory meets the world?
- A theory starts with a phenomenology

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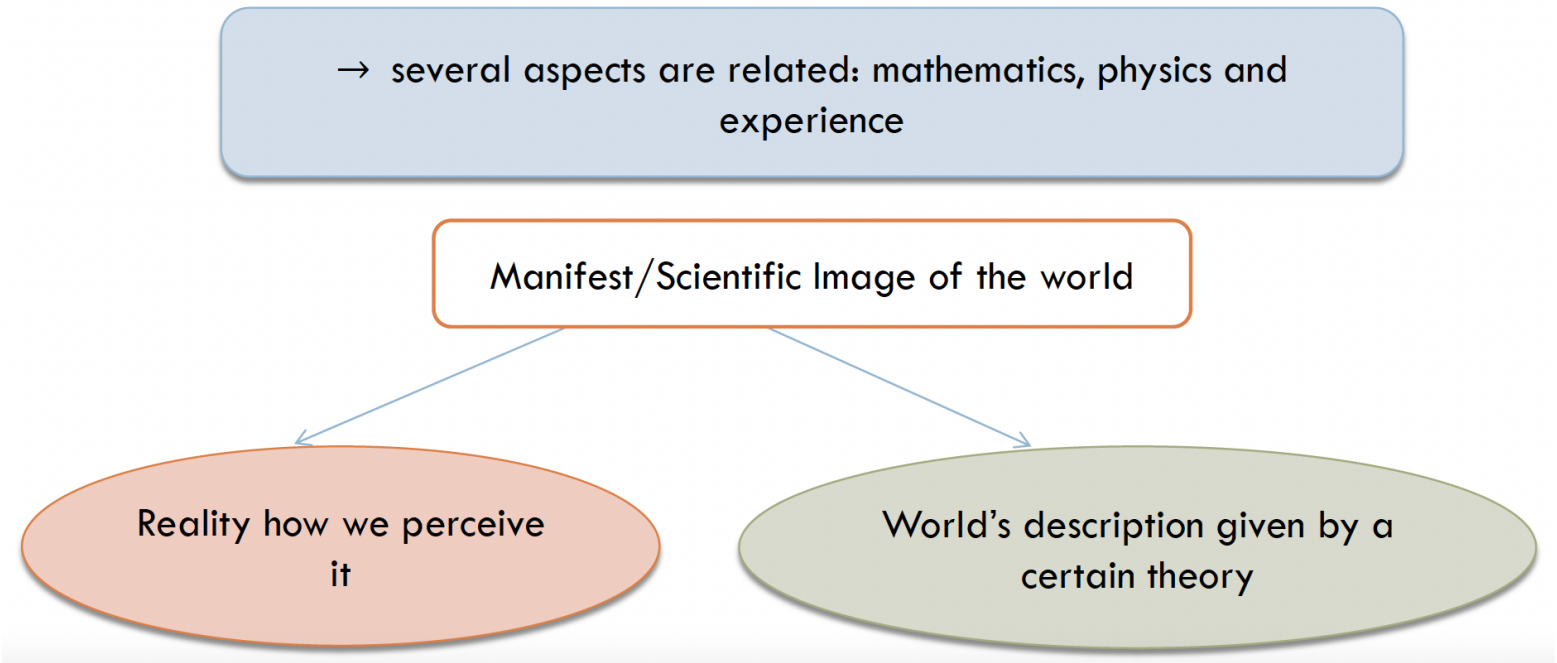
The domain of physical facts that a theory should be able to explain;



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Towards Scientific Realism: Wilfrid Sellars

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- NB: The manifest image is not a pre-scientific conception of the world
- It constantly evolves employing aspects of the scientific method
- E.g. induction and statistical inference are used to *explain* our experiences and/in the world around us
- However, the manifest image does not postulate unobservable entities and laws to explain realty.

Scientific Realism In a Nutshell

- Sellars thinks that the every scientific theory must answer a crucial question about what objects are fundamentally in the world
- Such fundamental objects are not reducible to other concepts (they are elementary, primitive), and must explain a certain portion of experience.

Scientific Realism In a Nutshell

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Contrary to the latter, the former

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- postulates unobservable (theoretical) entities in order to explain the experiences of the manifest image
- laws are given to govern the behavior of such entities (ex. laws of mechanics, Maxwell's equations, etc.)
- provides a foundation for empirical reality.

Scientific Realism In a Nutshell

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- These images provide a unique coherent scientific image of the world that explains the manifest one
- In order to construct a single scientific image, a reductionist hypothesis is introduced
- The macroscopic objects of common experience are dependent on the those entities postulated by the fundamental sciences and every property or phenomenon is explained in terms of these items and the laws that govern their behavior in space-time.

Scientific Realism In a Nutshell

Main Argument for Scientific Realism

No-Miracles-Argument

"Scientific Realism is the only philosophy that doesn't make the success of science a miracle. That the terms in mature scientific theories typically refer [...], that the theories accepted in a mature science are typically approximately true, that the same term can refer to the same thing even when it occurs in different theories—these statements are viewed by the scientific realist not as necessary truths but as part of the only scientific explanation of the success of science"

Hilary Putnam in Curd & Cover (1998), pp. 1083–1084

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This argument provides a direct relation between empirical success and truth: the latter explains the success of scientific theories (if they were false, their success would be a miracle)

This is an instance of Inference to the Best Explanation (IBE)

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- **Semantic Component**: realism literally interprets scientific claims about the world.
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- **Epistemic Component:** the explanations of physical phenomena given by scientific theories provide knowledge of the external world.

Scientific Realism In a Nutshell

Different perspectives on Scientific Realism:

- Entity Realism
- Realism about laws (in connection with primitivism about laws)
- Experimental realism (e.g. Ian Hacking)
- Selective Realism (e.g. Stathis Psillos)
- Structural Realism (epistemic: John Worrall, Ontic: James Ladyman)
- ...

van Fraassen Part I: Constructive Empiricism

How to define *empiricism?*

Main Thesis of Classical Empiricism:

The only source for knowledge and for our concepts is sensory experience.

No knowledge of the world can be derived a priori.

- John Locke
- Bishop Berkeley
- David Hume
- ...

How to define *empiricism?*

Main Thesis of Empiricism in Philosophy of Science:

The primary source for scientific knowledge and for our scientific concepts is experimental experiences.

- Vienna Circle (Berlin Circle)
- Ernst Mach
- Bas van Fraassen
- ...

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Main Thesis of Empiricism in Philosophy of Science:

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Experiments and observations are the most fundamental parts of the scientific method

Every scientific hypotheses and theory must be tested against observations of the natural world rather than resting solely on priori reasoning, intuition or revelation.

- Vienna Circle (Berlin Circle)
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- ...

van Fraassen Part I: Constructive Empiricism

van Fraassen's characterization of scientific realism:

> *Science aims to give us, in its theories, a literally true story of what the world is like; and acceptance of a scientific theory involves the belief that it is true.*

- "literally true" rules out those perspectives claiming that science is true if properly understood but literally false
- The second part of the statement concerns epistemology: theory acceptance $\longrightarrow$ belief in its truth.

Alternative to scientific realism: *Anti-Realism*

Anti-realism is a position according to which the aim of science can well be served without giving such a literally true story, and acceptance of a theory may properly involve something less (or other) than belief that it is true.

- claims for truth are substituted with claims concerning empirical adequacy, comprehensiveness, *etc.*
- van Fraassen says that the language of science should be literally interpreted, but its theories need not be true to be good (theories are not metaphors, tales, ...)
- for van Fraassen "literal" does not mean "truth-valued".

Alternative to scientific realism: *Constructive Empiricism*

Science aims at give us theories which are empirically adequate; and acceptance of a theory involves as belief only that it is empirically adequate.

- Not every perspective insisting on a literal construal of scientific language must be realist: such insistence is not related to our epistemic attitude towards theories, but only to the correct understanding of what a theory actually says

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- Not every perspective insisting on a literal construal of scientific language must be realist: such insistence is not related to our epistemic attitude towards theories, but only to the correct understanding of what a theory actually says
- A literal interpretation of scientific statements does not necessarily entails that they must be true (e.g. that the entities and laws appearing in them are real)
- A theory is empirically adequate if what is says about **the observable things and events in the world** is true, i.e. if it *saves the phenomena*.

van Fraassen's objections against the NMA:

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- The success of science is no factor for its truth. A theory can be empirically adequate and hence explain the observed regularities found in nature
- The fierce competition among scientific theories relies on the capacity of a theory to accurately describe the observable world, not on their truth
- Thus, it's no miracle if science arrives at empirically adequate, scientifically successful yet false theories.

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- "The scientific realist thinks that theories can only adequately explain regularities in nature if we take the theories to be true. But theories can explain if we merely take the theories to be empirically adequate. So even if we allow IBE as a legitimate rule of inference, the realist has to offer some additional reason to think "T is true" is a better explanation than "T is empirically adequate" (van Fraassen (1980), p. 21)

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- It may be that all the potential explanations we have are bad, and hence we would be unwise to believe that one of those explanations is the true one.

Why Constructive Empiricism?

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- Beliefs in the empirical adequacy of accepted theories entails a weaker attitude one can attribute to scientists while at the same time making sense of their activity
- Constructive empiricists underline that theories are key factors in experimental design. They suggest that the reason a scientist turns to a theory is that it is needed to guide experimental inquiry. But scientists aim to discover only "facts about the world—about the regularities in the observable part of the world" (van Fraassen 1980, p. 73).

Why Constructive Empiricism? The Pragmatics of Theory Choice

- Some criteria we employ to choose a theory over another are pragmatic virtues, showing that scientists use values other than truth

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- Some criteria we employ to choose a theory over another are pragmatic virtues, showing that scientists use values other than truth
- Examples: Simplicity, elegance, explanatory power, etc. (NB: van Fraassen aptly claims that one can assign explanatory power to theories known to be false, as e.g. Newtonian mechanics, Newton's theory of gravity, Bohr's theory of the atom)

van Fraassen Part II: The Pragmatic Theory of Explanation

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- van Fraassen thinks that an explanation of a certain phenomenon is a linguistic activity, done by language users in certain linguistic contexts
- Such questions are called *Why-questions*

The Pragmatic Theory of Explanation

van Fraassen, *The Scientific Image*, 1980, p. 134:

An explanation is not the same as a proposition, or an argument, or list of propositions; it is an answer. [...] *An explanation is an answer to a why-question. So, a theory of explanation must be a theory of why-questions.*

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The Pragmatic Theory of Explanation

- In this model is crucial to provide a criterion to identify an adequate explanatory context in which a given why-question is formulated
- According to van Fraassen why-questions are defined by a triple $Q = \langle P_k, X, R \rangle$
- P_k is the topic of the question (explanandum) , X is the contrast class, and R the relevance relation.

The Pragmatic Theory of Explanation

- It should be noted that the contrast class X defines the context that gives meaning to Q, and in X the only true statement is P_k (each P_j, with $j \neq k$ is false in X)

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- There is at least one true proposition A (the answer) that bears the relation R to the pair $\langle P_k, X \rangle$
- The explicative structure of van Fraassen's model can be formulated as follows (direct answer to Q): P_k in contrast with the rest of X because A.

van Fraassen Part II: The Pragmatic Theory of Explanation

The Pragmatic Theory of Explanation, an example

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- The topic is "the Bunsen flame turned yellow"
- X = The Bunsen flame remained blue (P_1), the B. flame turned green (P_2) ..., the B. flame turned yellow (P_k)
- R is the cause-effect relation: place a piece of rock salt in the flame, rock salt is a sodium compound, and all sodium compounds turn B. flame yellow.

The Pragmatic Theory of Explanation, another example

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  This happens when different X are involved

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  This happens when different X are involved
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- "Why did Adam *eat* the apple?" (X= (Adam ate the apple, Adam threw the apple, ...))

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- "Why did Adam *eat* the apple?" (X= (Adam ate the apple, Adam threw the apple, ...))
- "Why did Adam eat the *apple*?" (X= (Adam ate the apple, Adam ate the orange, ...))

van Fraassen Part II: The Pragmatic Theory of Explanation

According to van Fraassen an explanation of a certain phenomenon is called "scientific" only because it relies on scientific theories to provide an answer

van Fraassen, *The Scientific Image*, 1980, p. 155:

Since an explanation is an answer, it is evaluated vis-à-vis a question, which is a request for information. But exactly what is requested, by means of the interrogative 'Why is it the case that P?', differs from context to context. In addition, the background theory plus data relative to which the question is evaluated, as arising or not arising, depends on the context. And even what part of that background information is to be used to evaluate how good the answer is, qua answer to that question, is a contextually determined factor