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Bas van Fraassen, "**To Save The Phenomena**"

- Chapter 3 of *The Scientific Image* (1980)
- Logical Positivism is dead — now what?
- An account of scientific inquiry that's neither positivist nor realist
- Constructive empiricism:

science does not aim at *true* theories; rather, it aims at *empirically adequate* theories.

What is empirical adequacy?

- A *model* for a theory *T* is "any structure that satisfies the axioms of [*T*]" (p. 43).
- Take a formal language *L*. A function from *L*-sentences to {true, false} is called an *interpretation* of *L*. A model for a set of *L*-sentences Γ consists of (i) a set-theoretic domain, and (ii) an interpretation that assigns "true" to all of Γ.

A theory *T* is *empirically adequate* iff it has a model such that all appearances are isomorphic to empirical substructures of this model.

- Based on this framework, Van Fraassen intends to replace the old positivist view of theories as *syntactic* entities.
- The *semantic* view of theories: what matters is a theory's empirical import (what it tells us about observable phenomena) – *not* its truth as a whole.
    - Newton's physics as an example of a conscious distinction between "phenomena to be saved" vs. "reality to be postulated" (p. 44).
    - Scientific views that disagree over their theoretical assumptions but have no difference with respect to their observable consequences. Those theoretical conflicts, van Fraassen claims, do *not* really matter to working scientists.

The table below summarizes the contrast between the old syntactic view of theories (most clearly found in Carnap's work) and Van Fraassen's novel semantic view:

The syntactic view of theories	**The semantic view of theories**
A theory *T* as a formal system, consisting of rules, postulates, and theorems	A theory as a specification of a class of structures (its *models*)
The language in which *T* is formulated is an essential component of the theory	Models are independent of *T*'s vocabulary
"What matters" to scientists is whether the sentences of *T* are true – that leads them to **believe** the theory.	"What matters" to scientists is whether *T* is *empirically adequate* – that leads them to **accept** the theory.
The division between *T*'s observable & unobservable terms is determinable externally, by the philosopher of science	What is observable is relative to the theory; philosophers cannot impose any external distinction between *T*'s observable & theoretical vocabulary

Broader significance

Models are presented as a liberating new notion that:

(i) is independent of any syntactic restrictions (*T*'s models are independent of *T*'s vocabulary)

(ii) seems to be the "bright future" of the philosophy of science:

> "The main lesson of twentieth-century philosophy of science may well be this: no concept which is essentially language-dependent has any philosophical importance at all." (p. 56)

Are semantic notions over and above syntactic ones? (Not really.)

Van Fraassen's example:

A0: There is at least one line.
A1: For any two lines, there is at most one point that lies on both.
A2: For any two points, there is exactly one line that lies on both.
A3: On every line there lie at least two points.
A4: There are only finitely many points.
A5: On any line there lie infinitely many points.

Theory T_1 has axioms A0-A4; theory T_2 has axioms A0-A3 & A5.

Despite their inconsistency, T_1 and T_2 stand in an interesting relation: every model of T_1 can be *embedded in* (i.e., identified with a substructure of) a model of T_2.

Van Fraassen claims that such a relation of embedding cannot be captured syntactically. I do not think that this is true; here is a proposal:

> T_1-models can be embedded in some T_2-model iff: T_1 can be *translated* into a theory T' such that $T' \cup T_2$ is consistent.

This criterion is satisfied once we translate T_1-"points" into "endpoints of line segments." The translation of A4 will then simply say that: "There are only finitely many endpoints of line segments." The union of the translated theory and T_2 will consist of 9 axioms and will be consistent.

Translation is clearly a syntactic notion: it is a function that takes theoretical terms as its input and gives theoretical terms as its output.

Formal results for the duality between logical syntax and logical semantics:

- Awodey & Forsell (2013)
- Halvorson (2019)

Can we avoid being "suspended in language"?

- It seems a mistake to think of models as essentially language-independent entities. The class of models is not just affected but *determined* by the language of the theory.

- Even if we understand models as "the possible worlds allowed by theory" (p. 47), the language-dependence does not go away.
  - "A possible world is given by the descriptive conditions we associate with it." (Kripke, 1980, p. 43)

- Can we still save the phenomena even if we cannot "transcend" language?

Gems & Coal:


Moving away from earlier thinkers' obsession with technical results, and actively trying to be more faithful to actual scientific practice.


Using examples of scientific theories to inform and justify philosophical claims.


Carried away by the momentum of his rejection of the syntactic approach, Van Fraassen gets "too excited" and ignores the ways in which theoretical vocabulary is intertwined with model-theoretic notions.

References

Awodey, S., & Forssell, H. (2013). First-order logical duality. *Annals of Pure and Applied Logic, 164*(3), 319-348.

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