Papineau 1
Causal Theory; Imprecision

(pp. 1–12)

Patrick Maher
Philosophy 471

Fall 2006

The article

David Papineau

"Theory-Dependent Terms"

Philosophy of Science 1996

(Available online free with a uiuc internet connection)

The main puzzle about theoretical definitions is that nothing seems to decide which assumptions contribute to such definitions and which do not. I argue that theoretical definitions are indeed imprecise, but that this does not normally matter. (p. 1)

Review

Suppose theory T has T-terms $\tau_1, \ldots, \tau_n$.

Lewis's definition of the T-terms

- If T has a unique realization, then τ_i denotes the ith entity in that realization.
- If T doesn't have a unique realization, then τ_i doesn't denote anything.

The problem:

- If the T-terms are defined using the current version of T, then they all change their meaning every time any part of T is changed.
- If the T-terms are defined using the original version of T, then the meaning of T-terms depends on historical facts that may be unknown to all competent current users of the terms.

The causal theory

One response to this problem is to give up on the idea that theoretical terms get their meaning from the postulates of a theory. Alternative approach:

The causal theory of reference (p. 4)

- The referent of a term is fixed, not by speakers' beliefs about the referent, but by some original occasion where (a sample or manifestation of) the referent was dubbed with the term.
- Later uses of the term refer to whichever entity was present at the dubbing.

Neutrino example (not in Papineau)

- Beta decay is the decay of a neutron into a proton and an electron.
- In the 1920s it was found that the proton and electron together have less energy than the original neutron, apparently violating conservation of energy.
- In 1930, Pauli suggested that there was an invisible neutral particle that carried the missing energy. Fermi called this particle the "neutrino" (Italian for "little neutral one").
- The first experimental detection of neutrinos was not until 1956.
- The causal theory would say that "neutrino" refers to whatever caused the missing energy in the beta decay experiments known to Pauli and Fermi.

Advantages over Lewis

If Lewis uses the current version of T to define T-terms:

- On Lewis's theory, the meaning of the T-terms changes whenever T changes.
- On the causal theory, the meaning of T-terms is not determined by T, so the meanings don't change when T changes.

If Lewis uses the original version of T:

- After T has been revised we will think the original version is false and hence that T-terms defined using the original version of T do not refer to anything. So Lewis must use "the nearest near-realization" of the original version T, and this may not exist or be well defined.
- On the causal theory, the reference of the T-terms is fixed independently of T, so there is no need for a "nearest near-realization" of T.

Papineau's objections to the causal theory (p. 4)

1. On the causal theory, terms from mistaken theories that intuitively don't refer to anything would refer to something.
   - "Phlogiston" would refer to absence of oxygen.
   - "Spirit possession" would refer to psychological disturbance.
2. Some terms are introduced to refer to hypothetical entities which are conjectured to play certain theoretically specified roles, before any direct experimental manifestation of these entities is available; the causal theory can't account for these.
   - Dirac formulated an equation to describe electrons, and it implied that there were also particles like electrons but positively charged; these were called "positrons," before there was any experimental evidence of their existence.

Papineau's solution

Basic idea

- T-terms are defined using the current version of T.
- Only *some* of the assumptions of T are used to define any particular T-term. (Lewis assumed that the whole of T is used.)

How this improves on Lewis:

- T can change without changing the meaning of the T-terms (unlike with Lewis using the current version of T).
- The meaning of T-terms doesn't depend on historical facts, or on having a nearest near-realization of T (unlike Lewis using the original version of T).

Objection (p. 2)

Science does not distinguish between theoretical assumptions that determine the meaning of T-terms and those that don't.

Papineau's response: The division can be imprecise (pp. 10–12)

- Let T_y ("yes") be the assumptions that are unquestionably in the definition of T-term F.
- Let T_n ("no") be the assumptions that are unquestionably not in the definition of F.
- Let T_p ("perhaps") be the remaining assumptions; it is unclear whether these are in the definition or not.
- If T_y has a unique realization, and it also realizes $T_y \cdot T_p$, then no matter how the ambiguity is resolved, F will refer to the same thing.
- Hence sentences involving F can have determine truth values, even though their definition is imprecise.

Example (adapted from pp. 7, 13)

Suppose that for "atom," T_y is:

- Atoms are the smallest parts of matter separable by chemical means.
- Atoms are different in different elements.
- Atoms combine in simple whole number ratios.

Suppose that T_p is:

- Atoms have nuclei.

It follows that other beliefs about atoms are in T_n, e.g.:

- Atoms of gold contain 79 protons.
- Molecules of water contain 2 hydrogen atoms and 1 oxygen atom.

Questions

1. What is the causal theory of reference? What are Papineau's objections to this theory?
2. What are the advantages of Papineau's approach to defining theoretical terms, as compared with Lewis's?
3. (a) What does Papineau mean by T_y, T_p, and T_n? (b) What problem is he trying to solve by introducing T_p? (c) What is needed for a theoretical term have an unambiguous reference, on Papineau's account?