

Lewis 1
T-terms and O-terms; Realizations

(pp. 427–431)

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David Lewis

“How to Define Theoretical Terms”

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([Available online](#) free with a uiuc internet connection)

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Most philosophers of science agree that, when a newly proposed scientific theory introduces new terms, we usually cannot define the new terms using only the old terms we understood beforehand. On the contrary, I contend that there is a general method for defining the newly introduced theoretical terms. (p. 427)

T-terms and O-terms

Carnap's definitions

- O-terms are observation terms. They designate observable things, properties, or relations. Examples: "blue," "hard," "hot," "temperature of 80 degrees centigrade."
- T-terms are theoretical terms. They designate unobservable things, properties, or relations. Examples: "molecule," "atom," "electron."

Carnap's assumptions

- 1 Sentences containing only logical and O-terms are about observable things. They can be tested directly by observation.
- 2 Sentences containing T-terms refer to unobservable things. They can't be tested directly by observation.

Carnap's assumptions are wrong

- ① Sentences containing only logical and O-terms can be about unobservable things and not directly testable by observation. Example:
 - “Bodies are composed of hard unchanging parts that are too small to see” (Democritus's atomic theory).
- ② Sentences containing T-terms may be testable by observation after the theory is accepted. Examples:
 - “This bottle contains H₂O.”
 - “There is an electron microscope in the next room.”

Lewis's definitions (p. 428)

- A T -term is “a theoretical term introduced by a given theory T at a given stage in the history of science.”
- An O -term is “any *other* term, one of our *original* terms, an *old* term we understood before the new theory T with its T -terms was proposed . . . Any old term can be an O -term, provided we have somehow come to understand it.”

Example (not in Lewis)

- If T is the atomic theory of matter, then “atom” would be a T -term.
- If T is the theory that the atom has a nucleus composed of protons and neutrons, then “atom” may be an O -term and “proton” and “neutron” may be T terms.

Definition (p. 430, simplified)

Suppose theory T has T -terms τ_1, \dots, τ_n . Lewis writes T as:

$$\top[\tau_1 \dots \tau_n]$$

A *realization* of T is an ordered set of n entities:

$$\langle \text{entity}_1, \dots, \text{entity}_n \rangle$$

such that $\top[\tau_1 \dots \tau_n]$ would be true if τ_i designated entity_i , for $i = 1, \dots, n$.

Example with one T -term (not in Lewis)

Let T be Newton's second law of motion:

$$\text{force} = \text{mass} \times \text{acceleration}$$

Suppose “force” and “acceleration” are O-terms but “mass” is a T-term. Then T is written as:

$$\top[\text{mass}].$$

A realization of this (assuming the law is correct) is:

< the property of mass >

This is *not* a realization of it:

< the property of weight >

Example with two T -terms (not in Lewis)

Let T be a theory of the atomic nucleus in which the T -terms are “proton” and “neutron.” Then T can be written as:

$$\top[\text{proton, neutron}]$$

A realization of this (assuming the theory is correct) is:

< the property of being a proton, the property of being a neutron >

This is *not* a realization of $\top[\text{proton, neutron}]$:

< the property of being a neutron, the property of being a proton >

- The Ramsey sentence of T is:

$$\exists x_1 \dots x_n \top [x_1 \dots x_n]$$

It says that T has a realization.

- The Carnap sentence of T is:

$$\exists x_1 \dots x_n \top [x_1 \dots x_n] \supset \top [\tau_1 \dots \tau_n]$$

It says that if T has a realization then T is true.

Carnap's proposal (p. 431)

Carnap proposes to take the Ramsey sentence as the synthetic postulate of T and the Carnap sentence as the analytic postulate of T . They divide the labor of the original postulate, which both systematized O -sentences and partially interpreted the T -sentences. (Here and henceforth, when I speak of Carnap's proposal it should be understood that I mean Carnap's proposal minus Carnap's stipulation that the O -terms belong to an observation language.)

Questions

- 1 Carnap thought the language of science can be divided into two parts: (1) An observation language, which contains only logical and observation terms, and whose sentences can be tested directly by observation. (2) A theoretical language, whose sentences contain theoretical terms and can't be tested directly by observation. Is this correct? Justify your answer.
- 2 What does Lewis mean by a " T -term" and an " O -term"?
- 3 How does Lewis write a theory T so as to show its T -terms? What is a realization of T ?
- 4 Use the concept of a realization to explain in English what the Ramsey and Carnap sentences of a theory T say.
- 5 Let T be the "theory" that all electrons have the same electric charge. Suppose "electron" is a T -term and "electric charge" is an O -term. Describe (a) two different realizations of T and (b) something that isn't a realization of T (according to currently accepted science).