

Theory and observation: Carnap, Hanson

TWO KINDS OF LAWS. Carnap begins by drawing a distinction between empirical theoretical laws. We understand that empirical laws are generalisations from observations. Examples may include (generalised) Boyle's law $P \times V = k \times T$ or Snell's law $\sin \theta_1 \times v_2 = \sin \theta_2 \times v_1$. Theoretical laws cannot be obtained from observations *alone*. This is because they of necessity refer to unobservables. Carnap gives an example of field equations, but a more basic example would indeed be Newton's Second Law.

NATURE OF OBSERVATION. By 'observation' we do not mean only observations with the naked eye. We adopt the physicists' usage and also include measurement. Readings off measuring devices would also qualify as observations.

Some entities acceptable in scientific theories cannot be measured 'directly'. There must be more complex ways of detecting their influences on measuring devices. In the kinetic theory, gas temperature may be such indirect influence measurable in a normal way. Another example is electromagnetic field which, if constant, can be measured, but if changing and of small dimensions, cannot be.

THEORETICAL LAWS AND EXPLANATION. Theoretical laws have the purpose of explaining empirical laws. This is achieved, in effect, by unification. Previously unrelated, apparently irrelevant empirical laws are seen, with the aid of theoretical laws, as related. The motion of molecules explains both the behaviour of gases and the behaviour of heated iron. Molecular theory belongs in the category of theoretical laws. It now connects the two empirical laws (i.e. mere empirical generalisations). The connection, Carnap thinks, is achieved by derivation: 'If there are molecules in this piece of iron, they would behave in such-and-such way.' Moreover, theoretical laws can *predict* new empirical laws. The form of prediction is the same as that of explanation, except that no empirical laws have previously been discovered.

This capacity of deriving empirical laws—whether new or previously known—is a criterion of acceptance of theoretical laws. Herein lies their link with experience, even though their content taken in isolation, so far as they refer to unobservables, might not be empirically testable.

SEEING AND SEEING AS. Consider the pictures below. You might see two people staring at each other, I see a goblet. Do we have different sense-data? or different images on our retinas? Apparently they are same, but still we *see* different things.

You do not see the Russian word-token put in front of you (think of Japanese or Arabic!). So there is a sense in which you and a Russian speaker see *different things*. One condition for being able to see these different things (a word or a goblet) is that we have already been exposed to their instances.

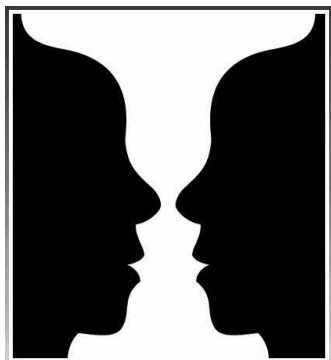


Figure 1: Love or wine?



Figure 2: Old or young?

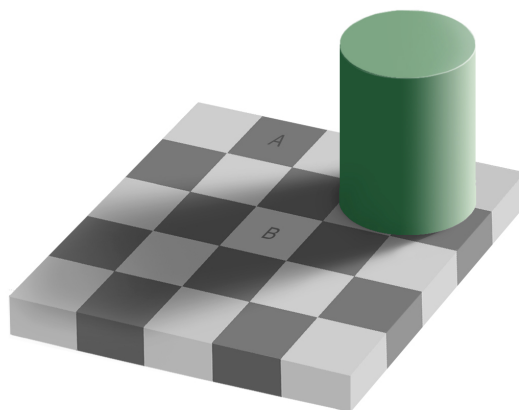


Figure 3: Black or gray?

PHENOMENAL SEEING. There are circumstances where seeing seems to involve little conceptual organisation. A scientist may record the experimental results in his laboratory. But this typically happens when a stable conceptual framework is absent. It is appropriate then to ask, 'Just what exactly are we seeing here? what's going on?' So we perhaps could say that phenomenal seeing takes place (usually) at the time of a mini-crisis in scientific theorising when a major theory is under threat. It also requires advanced scientific training. Phenomenal seeing is nevertheless an unusual kind of seeing: usually, we see *this* and *that* as something *X*.

PHILOSOPHICAL IMPLICATIONS. Seeing *X* requires some knowledge of *X*. There is no level of observation that can be purified of theoretical assumptions. Or at least, if there are instances of phenomenal seeing, then they are abnormal, likely to be practiced at a particular stage of scientific development ('unsettled experimental situation', p. 336). Therefore, the positivist distinction between observation sentences and theoretical sentences is not sustainable.

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