

Handout of Hempel's "Empiricist Criteria of Cognitive Significance: Problems and Changes"

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Main proposal: against logical empiricists' dogma that there exist clear and plausible distinctions between *cognitively significant assertions* and non-cognitively significant assertions.

Principle of Cognitive Significance in contemporary Empiricism:

A sentence makes a cognitively significant assertion (thus can be said to be either true or false) if either

(1) it is analytic or contradictory — to have purely logical meaning or significance

(2) it is capable (at least potential) of test by experiential evidence — to have empirical meaning or significance. ("*testability criterion of empirical meaning*")

(for convenience, we use "PCS" to represent Principle of Cognitive Significance; we say a sentence p is *cs* to represent that it is cognitively significant, and p is *n-cs* to represent that it is non-cognitively significant)

I. Argument against from a syntactic perspective

(A) If N is *n-cs*, then all truth-functional compound sentences in which N occurs non-vacuously as a component is *n-cs*.

corollaries:

(A1) If S is *n-cs*, then $\sim S$ is *n-cs*.

(A2) If S is *n-cs*, then $S \wedge N$ is *n-cs*, and $S \vee N$ is *n-cs*. (N is an arbitrary sentence)

definition: an *observation sentence* is constructed as a sentence which asserts or denies a specified object/group of objects of macroscopic size has a particular observable characteristic, which can be ascertained by direct observation.

Principle (2.1) **Requirement of Complete Verifiability in Principle**: A sentence has empirical meaning if and only if it is not analytic and follows logically from some *finite* and logically consistent class of *observation sentences*.

(2.1) is inconsistent with (A).

Similar principle arise from Popper's falsifiability theory:

Principle (2.2) **Requirement of Complete Falsifiability in Principle**: A sentence has empirical meaning if and only if its negation is not analytic and follows logically from some *finite* logically consistent class of *observation sentences*.

Similarly, (2.2) is inconsistent with (A).

(Ayer's Criterion: S has empirical import if from S in conjunction with *suitable subsidiary hypotheses* it is possible to derive observation sentences which are not derivable from the

subsidiary hypotheses alone.

Objection: This criterion is too broad that sentence like “If the absolute is good then this apple is red.” is of cognitive significance according to this.)

Comments.

II. Argument against from a semantic perspective

The alternative route: Instead of characterizing *cs* by the relation between observables and the whole sentence (I characterize this as *syntactic route*), we should characterize *cs* sentences by certain conditions which their *constituent terms* have to satisfy (I characterize this as *semantic route*).

The class of significant terms should be characterized by the condition that each of its elements is either a logical term or else a term with empirical significance (to stand in certain definitional or explicative connections to some observation terms).

Objection I: counterfactual terms

(Then a *prima facie* plausible principle (3.1) “**Requirement of Definability**” that *any term with empirical significance must be explicitly definable by means of observation terms* is untenable.)

Objection II: The requirement of direct observable sentences seem to rule out terms like “having length of $\sqrt{2} + 10^{-100} \text{ cm}$ ” as cognitive significant.

(A weaker principle, namely (3.2) “**Requirement of Reducibility**” that *every term with empirical significance must be capable of introduction, on the basis of observation terms, through chains of reduction sentences*, is also rejected henceforth.)

III. An Independent Argument

A single sentence in a scientific theory does not itself entail any observation sentences: Consequences asserting the occurrence of certain observable phenomena can only be derived from it by conjoining it with a set of other, *subsidiary hypotheses*.

example: GR theory of the deflection of light rays in the gravitational field of the sun entails assertions about observable phenomena only if it is conjoined with *astronomical and optical theory* as well as a large number of specific statements about the *instruments*. (p.112)

definition: an **isolated sentence** is neither purely formal truth or falsehood which is demonstrable or refutable by logical rules of the given language system; nor does it have any experiential bearing, *id est*, its omission from the theoretical system would have no effect on its explanatory and predictive power in regard to potentially observable phenomena (*id est*, the kind of phenomena described by observation sentences).

Claim: We cannot get a plausible criterion that a cognitively significant system contains no isolated sentences.

example of an isolated sentence: (S1) $(x)[P_1x \rightarrow (Qx \equiv P_2x)]$, where P_1 and P_2 are observational predicates, while Q is not, which only occurs in one primitive sentence of the theory (S1).

Principle (4.1) following logical empiricists: A theoretical system is cognitively significant if and only if it is partially interpreted to at least such an extent that none of its primitive sentences is isolated.

Hence, a cognitively significant theory should not include sentences like (S1), but (S1) can also be read as the definition of Q following Carnap. (Does Hempel want to illustrate that *whether a theory is of cognitive significance* is ambiguous?)

Discussions of a theory which contains (S1) $(x)[P_1x \rightarrow (Qx \equiv P_2x)]$ and (S2) $(x)[P_3x \rightarrow (Qx \equiv P_4x)]$: by conjoining (S1) and (S2) we can get (O) $(x)[\sim(P_1x \wedge P_2x \wedge P_3x \wedge \sim P_4x) \wedge \sim(P_1x \wedge \sim P_2x \wedge P_3x \wedge P_4x)]$.

Argument against (4.1) following this line: a theory which contains (S1) and (S2) is not cognitively significant, but a theory with (O) is under (4.1). (*Is this argument valid?*)

Following Hempel, (4.1) is untenable, and we may turn to

Principle (4.2) A theoretical system is cognitively significant if and only if it is partially interpreted to such an extent that in no system equivalent to it at least one primitive sentence is isolated.

Objection: this is obviously too strict that a theory with (O) will be ruled out.

Conclusion

The history of scientific endeavor shows that we need to rise above the level of direct observation. Theoretical constructs are needed for the formulation of such higher-level laws. (p.116)

Cognitive significance in a system is a matter of degree. (p.117)



The structure of this paper is very clear. (at least much clearer than van Frassen)



Inspirational proposal that we should not put too much energy to distinguish whether a statement is cognitively significant or not.



Not very charitable to the proposal he argues against, and several gaps in his arguments.