Seminar 7: The Rise and Fall of the Empiricist Criterion of Meaning

According to logical empiricism, all meaningful sentences are either analytic, contradictory, or synthetic, contingent, and knowable only on the basis of empirical evidence. The empiricist criterion of meaning focused on this last class of sentences. The guiding idea was:

> A nonanalytic, noncontradictory sentence S is meaningful iff S bears relation R to sentences the truth or falsity of uses of which can be determined by simple observation.

The task facing the logical empiricists was to precisely define this relation R. At the outset, they underestimated the difficulty of this task. They thought they had discovered an insight that would transform philosophy, and put it on a solid foundation. The chief cause of past philosophical confusion, and the lack of more significant progress, was, they believed, that previous philosophers hadn't realized that all meaningful sentences have to be analytic, contradictory, or empirically verifiable. Thus, many philosophical works, particularly in ethics and metaphysics, were filled with meaningless sentences.

Metaphysical sentences aren't analytic, because the truth or falsity of uses of them is supposed to depend on more than their meanings. Since these uses purport to be about the world, their truth or falsity must be determined by whether or not they correctly describe it. Despite this, these statements were held to be necessary and knowable without the need to make any observations supporting their truth. Logical empiricists believed this combination was impossible. Any claim that purports to be about the world must be both contingent and capable of being verified or falsified by experience. Since uses of sentences to make metaphysical statements don't pass this test, such sentences, and their negations, were rejected as meaningless. So, in proclaiming that 'God exists' is cognitively meaningless, logical empiricists didn't take themselves to be committed to saying "God doesn't exist." Rather, they maintained that if 'God exists' is meaningless, then 'God doesn't exist' is too. In short, there are no genuine metaphysical controversies.

Similar points were made about ethics. Often, the most fundamental claims made by uses of ethical sentences had been regarded as necessary (and knowable a priori), if true at all. But sentences used to make those claims weren't taken to be analytic, because accepting them involved more than deciding how to use words. Rather, uses of ethical sentences were seen as playing important roles in guiding action by describing ethical facts, capable of being known apriori. Logical empiricists insisted this combination of properties was incoherent. For them, necessity and apriority sprang from analyticity, no statement could be a fact-stating description and also an action-guiding admonition. Most took ethical sentences to be cognitively meaningless, and so incapable of being used to make statements or express genuine beliefs. At best they were seen as disguised imperatives used to make recommendations, or to give orders.

No principle was more important for what was to be the new era of scientific philosophy than the empiricist criterion of meaning. The first attempts to formulate it were based on the idea that an empirical—i.e., nonanalytic, noncontradictory—sentence is meaningful if and only if the truth, or the falsity, the statement it is used to make could, in principle, be conclusively established by deriving it from true observation statements. Testing this idea involved (i) distinguishing sentences used to make observation statements from other sentences used to make empirical statements, and (ii) specifying the logical relationship between an empirical sentence S and a set O of observation sentences needed in order for uses of the sentences in O to verify, or to falsify, a use of S.

Observation Statements

The first step in trying to turn the informal idea behind verificationism into a precise criterion of meaning was to characterize the class of observation statements. This was controversial from the beginning. The central dispute was over whether observation statements should be taken to be statements about *one's own sense data* (that one could not possibly be mistaken about), or whether ordinary (fallible) statements about perceivable, medium-sized, *physical objects* should count as observational. The attraction of the former, phenomenalistic conception, lay in its minimization of any element of hypothesis in the content of observational claims, resulting in an increase in their certainty that, it was thought, eliminated *the need to verify them*. The attraction of the latter, physicalistic conception was in its intersubjectivity, which seemed vital if the observations of multiple agents were to be pooled in verifying scientific claims. Schlick (1934) advocated the phenomenalistic position, Neurath (1932/33) the physicalistic conception, and Carnap moved from being friendly to the phenomenalistic view in Carnap (1928) to being friendly to the physicalistic view in Carnap (1932/33b).

In time these disputes faded away, as it became more widely accepted that sentences used to make statements about the observational properties of physical objects could play the role of sentences in terms of which verifiability and falsifiability were defined. A little later, when severe problems inherent in attempts to formulate the empiricist criterion of meaning were recognized, it became apparent that difficulties in defining the relationship that sentences used to make nonobservation statements were supposed to bear to sentences used to make observation statements, in order for the former to count as empirically meaningful, would remain, no matter how the original disputes over observation sentences were resolved. Thus, we can make do with the following

Observation Statements
An observation statement is one that could be used to record the result of a possible observation. These statements assert that specifically mentioned observable objects have, or lack, specified observable characteristics—e.g., *The book is on the table, The chalkboard isn't green, The cup is empty, The glass is full.*

We here leave aside such questions as *Observable by whom?* and *Observable by what means?* Instances of ordinary, unaided observation by normal human beings count as possible observations that may be recorded in observation statements. Whether or not observations involving magnifying glasses, binoculars, telescopes, microscopes, radio telescopes, electron microscopes, etc., should be counted as observations for these purposes is a vexed question. On one hand, logical empiricists didn't want to include among the observational any statements the verification of which required both sense experience and substantial theoretical assumptions to interpret that experience. On the other hand, it was up for grabs what should count as substantial theoretical assumptions. It was also up for grabs whether there is a single, principled way of drawing the distinction between observation and theory, or whether, instead, there are different, context-sensitive, ways of drawing the line in different situations, for different scientific or philosophical purposes.

These potentially important questions would have to be addressed, if we could construct otherwise unproblematic versions of the empiricist criterion of meaning. As it turns out, formidable obstacles prevent us from doing that, no matter how observation statements are defined. For this reason, we may proceed as if there were a principled distinction between observational and non-observational claims, without worrying too much about how or precisely where, the line is to be drawn.

Empirical Meaningfulness as Conclusive Verifiability or Falsifiability

Conclusive Verifiability
A *use* of a sentence S in conformity with the linguistic conventions that govern S is conclusively verifiable iff there is some finite, consistent set O of sentences which, when used in conformity of the linguistic conventions governing them, predicate observational properties of things, such that *O entails S*.

Conclusive Falsifiability
A *use* of a sentence S in conformity with the linguistic conventions that govern S is conclusively falsifiable iff there is some finite, consistent set O of sentences which, when used in conformity with the linguistic conventions governing them, predicate observational properties of things, such that *O entails the negation of S*.

Attempt 1
A nonanalytic, noncontradictory *sentence* S is empirically meaningful iff *uses of S*, in conformity with the linguistic conventions that govern it, are conclusively verifiable.

Attempt 2
A nonanalytic, noncontradictory *sentence* S is empirically meaningful iff *uses of S*, in conformity with the linguistic conventions that govern it, are conclusively falsifiable.

These two attempts come to grief over the following facts.

Fact 1: *Uses of universal generalizations (and negations of existential generalizations) are not conclusively verifiable.*

(i) All moving bodies not acted upon by external forces continue in a state of uniform motion in a straight line.

(ii) All solid bodies expand when heated.

These examples are of the form (iii).

(iii) $\forall x\ (Ax \rightarrow Bx)$ All A's are B's

Although these sentences are meaningful, they are not entailed by any finite, consistent set of observation sentences, nor, indeed, by any consistent set of sentences *An, Bn no matter what size*. Since sentences of the forms (iii) and (iv) are equivalent, the same is true of negations of existential generalizations.

(iv) $\sim\exists x\ (Ax\ \&\ \sim Bx)$ It is not the case that something is A but not B.

Fact 2: Uses of universal generalizations (and of negations of existential generalizations) are conclusively falsifiable.

The negation of an example of the form (iii) has the form (v).

(v) $\sim\forall x\ (Ax \rightarrow Bx)$ Not all A's are B's

Sentences of this form are equivalent to those of the form (vi).

(vi) $\exists x\ (Ax\ \&\ \sim Bx)$ At least one A is not a B

If *A* and *B* express observable properties, then (v) and (vi) are entailed by the set of observation sentences (viii).

(vii) An, ~Bn

Thus, uses of the corresponding universal generalizations of the form (iii), and of negations of existential generalizations (of the form (iv)), are conclusively falsifiable.

Fact 3: Uses of existential generalizations (and of the negations of universal generalizations) are not conclusively falsifiable.

A use of a sentence S is conclusively falsifiable iff a corresponding use of the negation of S is conclusively verifiable. Since a use of the negation, (iv), of the existential generalization, (vi), is *not* conclusively verifiable, a corresponding use of the existential generalization (vi) is *not* conclusively falsifiable. Similarly, since uses of the universal generalization (iii) are *not* conclusively verifiable, uses of its negation, (v), are *not* conclusively falsifiable.

Attempts 1, 2 exclude l many meaningful sentences. Attempt 1 wrongly characterizes many meaningful universal generalizations, and many meaningful negations of existential generalizations, as meaningless. Attempt 2 wrongly characterizes many meaningful existential generalizations, and many meaningful negations of universal generalizations, as meaningless. Both attempts also characterize certain sentences as meaningful, while denying their negations are. This result conflicts with two principles that were widely held by logical empiricists.

P1. A sentence is (cognitively) meaningful iff uses of it (in conformity with the conventions that govern it) are true or false.

P2. Uses of the negation of a sentence S are true (false) iff uses of S are false (true).

For all these reasons, Attempts 1 and 2 had to be rejected.

Attempt 3

A nonanalytic, noncontradictory sentence S is empirically meaningful iff uses of S in conformity with the linguistic conventions that govern it are either conclusively verifiable or conclusively falsifiable.

When ‘A’ and ‘B’ stand for observable characteristics, this formulation handles *All A’s are B’s* because uses of it are conclusively falsifiable, and it handles the existential generalization *At least one A is a B* because uses of it are conclusively verifiable. So, both types of generalization are characterized as meaningful by Attempt 3. But three other problems remain.

Mixed quantification—sentences containing both an universal and an existential quantifier.

1. For every substance, there is a solvent. $\forall x (Sx \rightarrow \exists y\, Dxy)$
2. For every man, there is a woman who loves him. $\forall x (Mx \rightarrow \exists y (Wy \,\&\, Lyx))$

Since these are universal generalizations, their uses are not conclusively verifiable. So if the sentences are meaningful, then, according to Attempt 3, their uses must be conclusively falsifiable. In order for a use of (1) to be false, a use of at least one of its instances—given in (1-Ia)—must be false; or, what is saying the same thing, a use of least one of the sentences in (1-Ib) must be true. (A use of $Sa \rightarrow \exists y\, Day$ is false iff the corresponding use of $Sa \,\&\, \sim\exists y\, Day$ is true. $\sim\exists y\, Day$ is equivalent to $\forall y \sim Day$.)

1-Ia. $Sa \rightarrow \exists y\, Day$, $Sb \rightarrow \exists y\, Dby$, $Sc \rightarrow \exists y\, Dcy$, …
1-Ib. $Sa \,\&\, \forall y \sim Day$, $Sb \,\&\, \forall y \sim Dby$, $Sc \,\&\, \forall y \sim Dcy$, …

But since each conjunction in (1-Ib) has a conjunct that is a universal generalization, none of the conjunctions is entailed by any finite, consistent set of observation sentences. Since each conjunction is logically independent of the others, no finite, consistent set of observation sentences entails the disjunction of any pair of conjunctions, the disjunction of any trio, etc. Since a use of at least one of the disjunctions must be true if any use of (1) is to be false, no finite consistent set of observation sentences entails the negation of (1). Thus a

use of (1) isn't conclusively falsifiable. Since (1) isn't conclusively verifiable, Attempt 3 classifies it as meaningless, despite the fact that it is meaningful. The same reasoning applies to (2).

The second problem with Attempt 3 involves quantifications illustrated in (3) and (4).

3. There are more A's in the universe than B's.
4. Most A's are B's.

No finite, consistent set of observation sentences of the sort in (5) entails (3) or (4).

5. Aa, Ab, Ac, … Bn, Bo, Bp, …

For such an entailment to exist, one would have to add to (5) the claim that the A's and B's enumerated in (5) are all there are. But that claim wouldn't be regarded by the logical empiricists as observational. So uses of (3) and (4) wouldn't count as conclusively verifiable—or, by similar reasoning, conclusively falsifiable. Since such sentences are meaningful, Attempt 3 wrongly characterizes meaningful sentences of this type as meaningless.

The third difficulty with Attempt 3 plagued all attempts to formulate a criterion of meaning built on the idea that an empirical sentence is meaningful only if the truth or falsity of uses of it could, in principle, be established by deductive reasoning from consistent sets of observational sentences. This excludes much of natural science, including examples like (6).

6. The surface is being bombarded with electrons.

Scientists developing the atomic theory didn't directly observe electrons. Nor did they logically deduce (6) from their sensory observations. They also couldn't appeal to simple, enumerative induction. In short, they didn't start with observations and then deduce, or induce, (6) from them. Rather, they posited the existence of electrons as a way of explaining, and making predictions about, observable events. The process works roughly as follows: Sentences like (6) are used, together with other sentences of one's scientific theory (often including some used to record true observations), to entail further observational sentences. If uses of all these observational consequences turn out to be true, the theory is, to that extent, confirmed. If some turn out to be false, the theory must be modified. The logical empiricists introduced the term *weak verifiability* to describe the relationship that uses of theoretical sentences like (6) stand to observational events that may confirm or disconfirm them.

How are uses of theoretical sentences assessed for truth or falsity? By itself, (6) doesn't entail any observation sentences. To get such consequences, one must combine (6) with other sentences of one's theory. Logical empiricists like Ayer wanted to say that (6) is empirically meaningful because uses of it, together with other statements, allow us to make empirical predictions we would not be in a position to make without it. They needed a new formulation of the verifiability criterion of meaning to capture this idea.

Meaningfulness as Weak Verifiability

According to the new strategy, what makes empirical sentences meaningful is not that uses of them are, or make, statements that can be proved true, or false, by observations we could make. What makes them meaningful is that such observations are relevant to determining the truth or falsity of those statements. If including a sentence S in a theory allowed one to deduce observation sentences expressing predictions that couldn't otherwise be made, then the truth of the predictions would support (without conclusively establishing) the statement S is used to make, while the falsity of the predictions would disconfirm the statement (without conclusively refuting it). Since logical empiricists viewed scientific hypotheses that are confirmed or disconfirmed in this way as paradigmatic examples of uses

of meaningful empirical sentences, they needed a criterion of meaning that would count those sentences as meaningful.

> Accordingly, we fall back on the weaker sense of verification. We say that the question that must be asked about any putative statement of fact is not, *Would any observations make its truth or falsehood logically certain?* but simply, *Would any observations be relevant to the determination of its truth or falsehood?* And it is only if a negative answer is given to this second question that we conclude that the statement under consideration is nonsensical.
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> Let us call a proposition which records an actual or possible observation an experiential proposition. Then we may say that it is the mark of a genuine factual proposition, not that it should be equivalent to an experiential proposition, or any finite number of experiential propositions, but simply that some experiential propositions can be deduced from it in conjunction with certain other premises without being deducible from those other premises alone. Ayer (1936 [1946]. pp.38-39)

Attempt 4

A nonanalytic, noncontradictory sentence S is meaningful iff S, by itself, or in conjunction with certain further premises P, Q, R, … , entails some observation sentence O not entailed by P, Q, R, … alone.

Ayer thought that a sentence that can be used to help explain or predict observation statements must be meaningful. The reason for the final qualifying clause is that if O were entailed by P, Q, R, … alone, then S would play no such role, and uses of S would not be connected to experience. He thought that uses of metaphysical sentences could never be so connected, and thus that those sentences would be labeled meaningless. But, as he noted in the introduction to the 2nd edition of *Language, Truth, and Logic*, he came to realize that he was wrong.

> I say [in the first edition] of this criterion that it "seems liberal enough," but in fact it is far too liberal, since it allows meaning to any statement whatsoever. For, given any statement "S" and an observation statement "O", "O" follows from "S" and "if S then O" without following from "if S then O" alone. Thus, the statements "the Absolute is lazy" and "if the Absolute is lazy, this is white" jointly entail the observation-statement "this is white," and since "this is white" does not follow from either of these premises, taken by itself, both of them satisfy my criterion of meaning…But a criterion of meaning that allows such latitude as this is evidently unacceptable. (11-12)

As Ayer saw it, the problem arises from not putting restrictions on the supplementary premises P, Q, R, used in testing the meaningfulness of an arbitrary sentence. The *reductio* seemed to arise because the sentence, $(S \rightarrow O)$, chosen to combine with S couldn't *itself* be shown to be meaningful prior to showing that S was. This suggested modifying Attempt 4 by restricting supplementary premises to those that had already been proved meaningful, *prior* to their use in testing the meaningfulness of other sentences. In presenting the new attempt, I will speak of *sentences* as observational, directly verifiable, or indirectly verifiable just in cases *uses of them* in accord with the linguistic conventions governing them are..

Attempt 5

S is *directly verifiable* iff (a) S is an observation sentence; or (b) S by itself, or in conjunction with one or more *observation sentences* P, Q, R …, entails an observation sentence not entailed by P, Q, R, … alone.

S is *indirectly verifiable* iff (a) S, by itself, or in conjunction with other sentences P, Q, R… , entails a *directly verifiable* sentence D that is not entailed by P, Q, R, … alone; and (b) the other sentences P, Q, R…, are all either *analytic, directly verifiable,* or can be shown independently to be *indirectly ver*ifiable.

> A nonanalytic, noncontradictory sentence S is meaningful iff S is either directly or indirectly verifiable. (Analytic and contradictory sentences are, by definition, meaningful too.) p. 13

The definition of *indirect verifiability* works in stages. At the first stage, we select a sentence and test whether it plus some directly verifiable (or analytic) sentences P, Q, R entail a directly verifiable sentence not entailed by P, Q, R, alone. Call any sentence passing this test *stage-1-indirectly verifiable*. At stage 2 we select a new sentence S that is neither directly verifiable nor stage-1-indirectly-verifiable. We test whether S plus some P, Q, R that are either directly verifiable, stage-1-indirectly-verifiable, or analytic will entail some directly verifiable sentence not entailed by P, Q, R, alone. If S passes this test, it is *stage-2-indirectly-verifiable.*The process may be repeated indefinitely many times. Any sentence passing the test at any stage counts as indirectly verifiable, and hence meaningful. But the only way a sentence can be so counted is by drawing out consequences of it in combination with sentences the meaningfulness of which has already been shown to be in accord with the criterion. Because of this, Ayer thought that he had avoided the problem that led to the collapse of Attempt 4.

Let 'O_1a' and 'O_2a' be observation sentences, neither of which entails the other. ('a' is a name, 'O_1x' and 'O_2x' are formulas containing variable 'x'.) (7) and (8) are directly verifiable.

7. $(O_1a \rightarrow O_2a)$ e.g., If I drop this book, it will fall.
8. $\forall x\,(O_1x \rightarrow O_2x)$ If I drop any book, it will fall.

If 'O_3' is an observation sentence the conjunction of which with 'O_1a' doesn't entail 'O_2a', then (9) will also be directly verifiable.

9. $(O_3 \rightarrow \forall x\,(O_1x \rightarrow O_2\,x))$ e.g., If I flip the switch, then every light will go on.

When O is any observation sentence and DV is any directly verifiable sentence, *$(O \rightarrow DV)$* always counts as meaningful.

> *Proof:* $\ulcorner(O \rightarrow DV)\urcorner$ plus O entails DV. If O alone doesn't entail DV, then $\ulcorner(O \rightarrow DV)\urcorner$ is indirectly verifiable. If O does entail DV, then $\ulcorner(O \rightarrow DV)\urcorner$ is a tautology hence analytic. Either way it counts as meaningful.
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> The negation of a directly verifiable sentence always counts as meaningful.
>
> *Proof*: Let DV be any directly verifiable sentence, and let O be any observation sentence the negation of which is an observation sentence not entailed by DV—i.e., both O and $\ulcorner\sim O\urcorner$ are observational and DV doesn't entail $\ulcorner\sim O\urcorner$. For any DV, there will always be such an O. (Directly sentences are noncontradictory, so at least one won't be entailed by DV.) We have just seen that $\ulcorner(O \rightarrow DV)\urcorner$ is always either indirectly verifiable or analytic. $\ulcorner\sim DV\urcorner$ plus $\ulcorner(O \rightarrow DV)\urcorner$ entails $\ulcorner\sim O\urcorner$. Since (by hypothesis) $\ulcorner\sim O\urcorner$ isn't entailed by DV alone, $\ulcorner\sim O\urcorner$ isn't entailed by $\ulcorner(\sim O \vee DV)\urcorner$. (Anything entailed by a disjunction is entailed by both disjuncts.) Since $\ulcorner(\sim O \vee DV)\urcorner$ is equivalent to $\ulcorner(O \rightarrow DV)\urcorner$, this means that $\ulcorner\sim O\urcorner$ isn't entailed by $\ulcorner(O \rightarrow DV)\urcorner$ alone. So, $\ulcorner\sim DV\urcorner$ is indirectly verifiable, and hence meaningful.
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> This is good. We want $\ulcorner\sim S\urcorner$ to be meaningful when S is.

Refutation

Hempel's problem:[1] Let S be any *true*, nonanalytic, meaningful sentence; let N be some

[1] Carl G. Hempel (1935). "On the Logical Positivist's Theory of Truth." *Analysis* 2:49–59.

nonsensical sentence. Attempt 5 counts ⌜(S&N)⌝ as meaningful, since if S is directly or indirectly verifiable, ⌜(S&N)⌝ will also be. For Ayer, uses of meaningful sentences are true or false. So, a use of ⌜(S&N)⌝ is true or false. If it is true, then a use of N must also be true, since N is entailed by ⌜(S&N)⌝. But if N is meaningless, no use of it can be true. Suppose, then, that the use of ⌜(S&N)⌝ is false. Then a use of ⌜~(S&N)⌝ must be true, and our use ⌜~N⌝ must also be true because ⌜~N⌝ is entailed by S and ⌜~(S&N)⌝. So, ⌜~N⌝ must be meaningful. But that is impossible since, by hypothesis, N is meaningless.

This is a *reductio ad absurdum* of the conjunction of Attempt 5 with principles P1 and P2.

P1 A sentence is (cognitively) meaningful iff its uses are either true or false.
P2: A use of ⌜~S⌝ is true (false) iff the corresponding use of S is false (true).

Church's Problem:[2]

S1. Let P, Q, R be observation sentences none of which entail the others.

S2. Let S be any sentence.

S3. Let (a) be the sentence ⌜(~P &Q) ∨ (R & ~S)⌝.

S4. R is entailed by (a) plus P. Since (by hypothesis) R isn't entailed by P alone, (a) is directly verifiable.

S5. Q is entailed by (a) plus S.

S6. If Q is not entailed by (a) alone, then S is indirectly verifiable, and so is meaningful.

S7. If Q is entailed by (a) alone, then Q is entailed by its right disjunct (b): ⌜(R & ~S)⌝.

S8. If (b) does entail Q, then ⌜~S⌝ and R together entail an observation sentence Q that is not entailed by R alone—in which case ⌜~S⌝ is directly verifiable.

S9. So (from S7 and S8), if Q is entailed by (a) alone, then ⌜~S⌝ is directly verifiable.

S10. We have already shown in our discussion of Attempt 5 that the negation of a directly verifiable sentence is always indirectly verifiable, and hence meaningful. So, if ⌜~S⌝ is directly verifiable, then both ⌜~S⌝ and S are meaningful.

S11. So (from S9 and S10), if Q is entailed by (a) alone, then S is meaningful.

S10. So (from S6 and S11), if Q is, or is not, entailed by (a) alone, then S is meaningful.

S11. Since Q is always entailed by (a) alone, or not entailed by (a) alone, S is meaningful (by Ayer's criterion) no matter what S we choose.

The final problem with Attempt 5 is a variant of Church's argument put in a more revealing form. Recall the problem with Attempt 4 that motivated Attempt 5. For any nonanalytic S, there is an observation sentence O such that S plus ⌜(S → O)⌝ entails O, even though ⌜(S → O)⌝ doesn't entail O by itself. This was enough for Attempt 4 to count S as meaningful. *That problem can be recreated in a nearly identical form for Attempt 5.* For any nonanalytic S, there is a pair of observation sentences O and R such that S plus ⌜((S ∨ R) → O)⌝ entails O, and either (i) S counts as meaningful because ⌜((S ∨ R) → O)⌝ doesn't

[2] Alonzo Church (1949). "Review *of Language, Truth, and Logic: 2nd Ed.*" *Journal of Symbolic Logic* 14:52–53.

entail O, or (ii) S counts as meaningful because the entailment of O by ⌜((S ∨ R) → O)⌝ shows ⌜~S⌝ to be directly verifiable. *In short, all the extra complexity of Attempt 5 is rendered useless when one appeals to the premise ⌜((S ∨ R) → O)⌝ rather than ⌜(S → O)⌝.*

S1. Let S be any sentence.

S2. Let R and ⌜~R⌝ be incompatible observation sentences neither of which entails the observation sentence O.

S3. S plus ⌜((S ∨ R) → O)⌝ entails O.

S4. ⌜((S ∨ R) → O)⌝ is directly verifiable, because it plus R entails the observation sentence O, which is not entailed by R itself.

S5. So (from S3, S4), if O isn't entailed by ⌜((S ∨ R) → O)⌝ alone, then S is meaningful.

S6. If O is entailed by ⌜((S ∨ R) → O)⌝ alone, then O is entailed by ⌜~(S ∨ R) ∨ O⌝ (which is equivalent to ⌜((S ∨ R) → O)⌝), in which case O is entailed by ⌜~(S ∨ R)⌝, and hence by ⌜(~S & ~R)⌝. But that means that ⌜~S⌝ is directly verifiable, since it, plus the observation sentence ⌜~R⌝, entails the observation sentence O, which is not entailed by ⌜~R⌝ alone. So, if O is entailed by ⌜((S ∨ R) → O)⌝ alone, ⌜~S⌝ is directly verifiable.

S7. We have already shown that the negation of a directly verifiable statement is always indirectly verifiable, and hence meaningful. Thus, if ⌜~S⌝ is directly verifiable, then both ⌜~S⌝ and S are meaningful.

S8. So (from S6, S7), if O is entailed by ⌜((S ∨ R) → O)⌝ alone, then S is meaningful.

S9. So (from S5. S8), if O is, or isn't, entailed by ⌜((S ∨ R) → O)⌝ alone, S is meaningful.

S10. Thus every sentence is meaningful.

Empirical Meaningfulness as Translatability into an Empiricist Language

The Translatability Criterion of Meaning: Hempel (1950) (Derived From Carnap 1936/37)

A sentence is empirically meaningful iff it can be translated into an empiricist language—i.e., iff it can be translated into a version of Russell's language of *Principia Mathematica* in which the only predicates are those expressing observable properties, plus predicates definable from them together with the truth-functional operators and quantifiers of Russell's language.

This formulation has some advantages. (i) It makes explicit provision for universal and existential quantifications. So sentences containing them aren't excluded on principle from being meaningful, as they were by criteria based on conclusive verifiability and conclusive falsifiability. (ii) Since sentences like 'The absolute is perfect' can't be translated into an empiricist language, the new criterion does not, as Attempts 4 and 5 did, count all sentences as meaningful. (iii) Since 'the absolute is perfect' can't be translated into an empiricist language, no meaningful conjunctions or disjunctions can contain it as a constituent. (iv) It also captures the idea that if S is meaningful, its negation is too.

Hempel notes two problems. The first involves *disposition terms,* which he characterized as "terms which reflect the disposition of one or more objects to react in a determinate way under specified conditions." (p. 119) He cites, *temperature, electrically charged, magnetic, intelligent,* and *electrical resistance* as examples. A clearer example is *fragile,* which

means, roughly, *disposed to break when struck.* But it doesn't seem that his example, *temperature,* means *is disposed to ν,* for some choice of 'ν'. Still, it is clear what he had in mind. Consider *the temperature of x is 90 degrees Fahrenheit.* He doesn't regard this as a simple observation sentence—presumably because ordinary observation, unaided by measuring devices, and unmediated by background theory containing non-observational terms, isn't enough to determine whether uses of it are true. So, he thinks, it is translatable into an empiricist language only if the predicate *the temperature of x = y* can be defined in observational terms.

Possible Definitions

D1. For any object x and number y, the temperature of x = y degrees Fahrenheit iff x is in contact with a thermometer that measures y degrees Fahrenheit on its scale.

D2. For any object x and number y, the temperature of x = y degrees Fahrenheit iff (x is in contact with a thermometer → the thermometer it is in contact with measures y degrees Fahrenheit on its scale).

D1 fails because it wrongly characterizes any object not in contact with a thermometer as not having any temperature. D2 fails because it wrongly characterizes any object not in contact with a thermometer as having every temperature. (The right side of D2 is a material conditional, which is equivalent to the disjunction of its consequent and the negation of its antecedent.) Hempel notes that we might have more success if we allowed the use of counterfactual conditionals, as in D3.

D3. For any object x and number y, the temperature of x = y degrees Fahrenheit iff (if it were the case that x was in contact with a thermometer then the thermometer would measure y degrees Fahrenheit on its scale).

But since counterfactual conditionals are not truth-functional, and so not part of Russell's language, D3 is not available in Hempel's "empiricist language."

Might we liberalize the criterion by allowing empiricist languages to include counterfactual conditionals like D3? Hempel says, "*This suggestion would provide an answer to the problem of defining disposition terms if it were not for the fact that no entirely satisfactory account of the exact meaning of counterfactual conditionals seems to be available at present*." (p. 130) Although this comment was true when written, it is not so today. By the late 1960s and early '70s, several philosophers, including Robert Stalnaker and David Lewis, had adapted the framework of possible worlds semantics developed by Rudolf Carnap, Saul Kripke, Richard Montague, and others to the study of counterfactual constructions. Roughly put, *If it had been the case that A, then it would have been the case that B* is true at a possible state of the world w iff among the world-states at which A is true, some at which B is true are more similar to w than any at which B is false. More informally, *If A had been so, then B would have been so* is true at w iff a world-state differing from w in the minimum amount needed to make A true is one at which B is true. This approach is now widely accepted.

Thus we may now ask whether allowing definitions like D3 into empiricist languages would solve problems posed for the translatability criterion of meaning by notions like *temperature.* There are two reasons to think not. First, the idea of possible states of the world used in the current theories of counterfactual statements might well have been regarded with suspicion by proponents of the empiricist criterion of meaning. Possible states of the world are now standardly taken to encode *metaphysical possibilities* that aren't reducible to, or explainable in terms of, purely linguistic conceptions of possibility. Hence, using possible world-states to characterize an empiricist language might be viewed by logical empiricists as importing metaphysics into a criterion of meaning designed to exclude metaphysics as meaningless.

The second reason for thinking that definitions like D3 don't solve the problems posed by terms like *temperature* for the translatability criterion is more prosaic. If definitions like this are noncircular, then they won't cover all the cases, and so will fail as definitions. To see this, it suffices to note that some things, like the sun are very hot; its temperature is so high that a thermometer put up against it would melt or explode, and not give any reading. Nevertheless, the sun has a temperature. Since D3 does not allow for this, it is not an adequate definition.

One might object by saying that D3 is incorrect only if we take the word *thermometer* to mean the sort of ordinary existing thermometers with which we are familiar. Surely, the objector might say, we can imagine thermometers that wouldn't melt or explode, even on the sun. If we take *thermometer* in D3 to be talking about them, then the counterexample disappears. Not really. Suppose we use *thermometer* in D3 to cover these nonexistent but conceivable devices. What, then, are we taking the word to mean? We are probably taking it to mean *a device (however constructed) for accurately measuring temperature.* If so, then it may be true that if n is the temperature of the sun, and if a thermometer—i.e., an accurate device for measuring any temperature—were placed on the sun, then the device would read n on its scale. But the cost of saving D3 from this counterexample has been to define *thermometer* in terms of the antecedently understood notion of *temperature,* rather than the other way around. When so understood, D3 isn't a definition of *temperature*. So we still haven't succeeded in rendering statements about temperature translatable into an empiricist language.

Another defect with the translatability criterion of meaning involves what Hempel calls *theoretical constructs,* examples of which include the terms *electron, gravitational potential,* and *electric field.* As he defined an empiricist language, the only predicates allowed are observation predicates, and predicates definable in terms of them plus Russell's logical apparatus. Hempel notes that *is an electron* is neither observational, nor definable in strictly observational terms. Since this means that it would be excluded from an empiricist language, the translatability wrongly characterizes sentences about electrons and other theoretical entities as meaningless.

Hempel took this to show that empiricists must shift the focus of their criterion of meaning away from individual sentences, and toward systems of sentences. According to him, what makes sentences about theoretical entities meaningful is that they are embedded in a network of observational and non-observational sentences that can be used to make testable predictions, which are the products of the different parts of the system working together. So, if one is given a set of observational predictions made by using a theory, one cannot match up each prediction with an isolated hypothesis expressed using a single sentence of the theory. For Hempel this is the crucial fact that makes it impossible to define theoretical terms in isolation. If for each statement made using a sentence S involving a theoretical term, we could isolate a set of predictions made by one's use of S alone, and if those predictions exhausted the contribution made by uses of S to the predictions derived using

the theory as a whole, then we could simply identify the meaning of S with those predictions. But the interdependence of S with other sentences in the theory makes this impossible. Thus, what we have to look for is not the empirical content of each individual use of a sentence taken in isolation, but rather the empirical content of the theory as a whole.