The Verifiability Theory of Meaning*

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. . . I WOULD LIKE to give a brief analysis of the verifiability theory of meaning in its present status, underlining those points about which there exists agreement among the various adherents of the theory, and setting apart those points about which there is disagreement.

Meaning rules are conventions

(1) The verifiability theory of meaning lays down rules for the construction of meaningful expressions. These rules are conventions determining the structure of language. Being rules, they are neither true nor false, but volitional decisions. However, it is possible to make cognitive statements about the properties of the language resulting from the acceptance of these rules. These statements have the form of implications: if this convention concerning meaning is accepted, then the language thus resulting has such and such properties. It is possible to study such relations for various definitions of meaning and to compare the various languages. If finally one convention concerning meaning is accepted, it is possible to justify the decision for this set of rules in terms of a certain aim; for instance, the aim of interpreting the language of physics, or the aim of constructing a language that can be used for the purpose of human action.

Claims about language are made on the basis of meaning rules

Conventions are justified by their aims

On this point there is general agreement among the adherents of the verifiability theory of meaning. The problem of meaning falls under the category of what Carnap has called *explication*. A term of conversational language, so far used in a vague sense, is replaced by a precise term. The original term is called *explicandum;* for the term proposed to replace it I will use the name *explicans* (the term "explicatum" used by Carnap is misleading because of its grammatical form, which means "*what is explained*", whereas "explicans" means "what explains"). An explication can never be called true; however, it can be justified. That is, it can be shown that the explicans has properties which make the use of the term compatible with human behavior in connection with it.

Explication, explicandum, explicans

(2) The verifiability theory of meaning concerns *cognitive* meaning. It therefore is not concerned with the meaning of imperatives, in which category value judgments are included, though they often do not have the grammatical form of imperatives. It is possible to correlate to imperatives a cognitive statement; for instance, to the imperative "shut the door" the cognitive statement "the speaker wants the door to be shut". Imperatives may therefore be said to have a cognitive component, which is taken care of in the verifiability theory of meaning. This is not meant to say, however, that the question of the meaning of imperatives is completely settled by the transition to the cognitive component. On this point, too, there is, I think, general agreement among the adherents of the verifiability theory of meaning; the theory concerns only cognitive meaning.

The meaning of imperatives is omitted in VTM

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Meaning of observation sentences

Meaning of other sentences

(3) Cognitive meaning is defined by a step process. First, a basic class *O* of *observational sentences* and terms is introduced which are assumed to have *direct meaning*. We may also speak of *primitive meaning*, i.e., a meaning which is not under investigation during the analysis to be performed. Sentences and terms of the class *O* may also be called *direct sentences*, or *direct terms*, respectively. Second, the meaning of further terms and sentences is constructed by the help of *derivative relationships D*, which connect these new terms with the basis *O*. A step process of this kind is assumed in all forms of the verifiability theory of meaning. The emphasis on this step process and the analysis of the construction of indirect terms is one of the major contributions of the Vienna circle to the theory of meaning.

Questions about meaning= verification

Knowledge of truth does not entail understanding

Knowledge of semantic structure and semantic interpretation is required

(4) The properties of the basic sentences *O* must be stated more explicitly. It is sometimes said that we must know how to verify them, and that this is the same as knowing their meaning; in other words, that for the basic sentences at least, the identity of meaning and method of verification can be assumed. But the statement "we must know how to verify them" is not very precise and open to criticism. Suppose a man is given a list of report sentences (Protokollsätze) which are not his own reports, but which he has good reasons to believe to be true. Can the man, whom I will call the reconstructor, construct the system of knowledge resulting from this list of sentences? Obviously it does not suffice him to know that the sentences are true; he must *understand* the sentences. This qualification can be made clear as follows. Suppose the report sentences are written by the use of the logical symbolism. Now if the two sentences "Peter is tall" and "John is tall" are written down in the list, it would not suffice if they are symbolized by the letters "p" and "q". They must be symbolized as "$f(x_1)$" and "$f(x_2)$", since otherwise the usual inferences, for instance, an inference of induction by enumeration, cannot be drawn. This shows that the structure of the report sentences must be known. That is, the report sentences must be symbolized, not in the calculus of propositions, but in the calculus of functions. A further distinction must be added. Even if the report sentences are given in their full structure, the reconstructor does not know to which of his own experiences the symbols "f", "x_1", etc., refer. In spite of the absence of such knowledge, he is able to follow all the inferences made for the construction of scientific theories, and indirect terms thus acquire for him a structural meaning. But what is still missing

is the relation to his own experiences. For this purpose, a final step is required. The reconstructor must be given the interpretation of the empirical constants "f", "x_1", etc.; then all terms, including the indirect ones, acquire for him an interpreted meaning. For these reasons, the formulation "the person must know how to verify the sentences of the basis O" is better replaced by the formulation "the person must know the meaning of the sentences of the basis O".[1]

What are the best candidates for observation sentences?

For the basis O, the following kinds of sentences have been used:

- (α) reports about the objects of our personal macroscopic environment (concreta) at a certain moment
- (β) reports about the same kind of objects, but including our past observations
- (γ) reports about the same kind of objects given by any human observer at any time
- (δ) reports about sense data at a certain moment (or, as in β or γ, extended to include the past, or different observers)
- (ϵ) reports about atomic physical occurrences, like coincidences of electrons, etc.

As to the choice of these bases, which were discussed in greater detail by Carnap and Neurath, there seems to be general agreement that the basis α has a psychological priority. The objects of the other bases then are regarded as constructed by inferences starting from the basis α. Doubts have been uttered whether the basis α is large enough; in fact, it is difficult to show how on that basis the statement that Caesar was murdered in 44 B.C. can be constructed. It seems we have to include in the basis our recollection of established laws, such as the law that looking into a suitable reference book you find reliable historical data about Caesar; but these recollections are mostly only potentially there. Who would be willing to include the unconscious in the basis α? A clarification of this point is desirable, although I believe that it involves no difficulties of principle.

No logical equivalence between direct and indirect sentences

Direct sentences cannot be logically deduced from indirect ones

(5) I will now turn to the derivative relationships D. There is today, finally, agreement among most of us that these relations cannot be equivalences between indirect and direct sentences. This widening of meaning is necessary in order to admit as meaningful such sentences as "the planets will go on traveling on their orbits after the death of the last human being".[2] Furthermore, it is agreed that the relations D cannot be merely deductive relations from the indirect to the direct sentences. The relations must transfer truth in the opposite direction: the basic sentences must confer a degree of truth-character upon the indirect sentences. This requirement means that the indirect sentences must be so constructed as to be appropriate for the derivation of observable predictions, i.e., of future direct sentences which we have good reason to treat as true before they are directly verified. This cautious formulation will indicate that the derivative relations D involve inductive inferences and that such inferences cannot be proved to lead to true conclusions, or even to a large number of true conclusions.

[1] I think these remarks correspond to views about the verifiability theory of meaning recently presented by P. Marhenke, Presidential Address to the Pacific Division of the American Philosophical Association, Christmas 1949, to be published in *Philosophical Review*.

[2] See the discussion of such sentences in my book "Experience and Prediction", Chicago 1938, pp. 133-135.

Indirect sentences are inductive generalisations of direct ones

Frequency interpretation of probability to be preferred

Now we all know that the interpretation of probability and induction is highly controversial today; in fact, the derivative relations mark the point where the controversy about probability enters into the domain of the verifiability theory of meaning. My own interpretation of probability and induction is so constructed that it satisfies the above requirement; this is admitted, as far as I see, even by my opponents, with the exception of Bertrand Russell, who claims that my inductive posit "is admitted to be not intellectually justified".[3] I would like to know where he found such an admission in my writings. The objections which other writers have raised against my theory of induction and probability maintain that the frequency interpretation of probability is unsuitable for the reason that it does not express what we really mean by a probability referred to a single case, or to a scientific theory. I answer that we are concerned here with an explication, and that for an explication of probability it does not matter what a man means. The explicans given by me has the property of making a man's behavior justifiable whenever he is in a situation which, in correspondence with established usage, he describes by means of the term "probable"; or in other words, it has the property of making the use of the term "probable" compatible with human behavior in connection with the term. This is a sufficient reason to accept my explication.

If others suggest other interpretations, they would have to give a similar proof for the explicans suggested by them. As far as I see, none among the advocates of other interpretations has even tried to give such a proof. Carnap regards his interpretation of probability as justified because, as he says, it is in agreement with the beliefs which a scientist has when he makes inductive inferences.[4] I do not think that this psychological brand of justification is acceptable. Scientists often have strange beliefs, and make fallacious inferences with good results. The logician is not interested in copying the scientist's mistakes. What he wants to give is a rational reconstruction of scientific inference, and for a reconstruction of this kind, correspondence to beliefs is no criterion of adequacy.[5] The only

[3] Bertrand Russell, Logical Positivism, *Revue Internationale de Philosophie*, No. 11, 1950, p. 19.

[4] R. Carnap, On Inductive Logic, *Philosophy of Science*, vol. 12, 1945, p. 95.

[5] I would therefore say that for a fallacious argument, as a whole, there is no rational reconstruction. Such argument can be analyzed as follows: the argument contains a "jump" from one point P_1 to another point P_2. From the premises up to P_1, and from P_2 to the conclusion, we can give a rational reconstruction; but for the transition from P_1 to P_2 there is no rational reconstruction. It seems to me that even the term

way of showing that a reconstruction of scientific inference is rational is to give a proof that the explicans logically validates the inference. It would be too much to ask that the conclusion be true; the cautious formulation above given is meant to explicate the term "validate". I was glad to see that Carnap now admits that a justification of induction must be given, and that he does not share Schlick's views according to which the justification of induction concerned a pseudo problem. But I cannot regard his interpretation of probability as justified unless he gives a proof that it is advisable, in some sense, to use his probability values as a directive for action.[6] From the presentations of his theory which he has published I would infer that such a logical justification can never be given, because he introduces a probability metric *a priori*.[7] But if the scientist should have to put up with an interpretation which makes his inferences unjustifiable in the logical sense, he could as well quit working.

To be verified is to be inductively supported by observation

To be meaninful is to be possibly verified

(6) After defining the basis O and the derivative relations D, the term "verified" can be defined as "being derived from the basis O in terms of the relations D". Now there is general agreement that the condition of meaning is not actual verification, but possible verification. This widening of meaning is necessary in order to admit as meaningful such statements as "it snowed on Manhattan Island in the year 4 A.D.". Therefore the term "possible" must now be defined.

Senses of possible verification

Three kinds of possibility must be investigated: logical, physical, and technical possibility. The first means non-contradictory character; the second, non-contradictory to empirical laws; the third, being within the reach of known practical methods. That a verifiability defined in terms of technical possibility makes the definition of meaning too narrow is now generally admitted. Schlick, and with him most members of the Vienna circle, have used logical possibility. But a definition of meaning in terms of logical possibility of verification makes the definition of meaning too wide, at least, when the interpretation of physics is concerned. For instance, Einstein's principle of equivalence, according to which being in accelerated motion means the same as being in a gravitational field, presupposes a definition of verifiability based on physical possibility. For these reasons I have advocated a definition of meaning in terms of the physical possibility of verification. A suitable definition of this kind of possibility and of physical laws is given in the frame of my theory of nomological statements.[8]

Physical possibility to be preferred over logical one

X is physically possible iff X is not excluded by physical laws

Since meaning is a matter of definition, it must be kept in mind that

"reconstruction" cannot be defined without some criterion of validity, and that fallacious thinking cannot be reconstructed unless the reconstruction is rational at least with respect to parts of the argument.

[6] Carnap's paper, Probability as a Guide in Life, *Journ. of Philos.*, vol. 44, 1947, p. 141, does not contain any proof of this kind.

[7] I refer to the discussion in my book "The Theory of Probability", Berkeley 1949, §71 and §88.

[8] "Elements of Symbolic Logic", New York 1947, chap. VIII.

none of the three definitions resulting from the three kinds of possibility can be called "true"; moreover, none of them seems to supply the only suitable explicans of meaning. It appears that all three of them are actually used. The physicist usually assumes *physical meaning*, for which verification is physically possible. But in his discussions of physical theories which he wants to prove false, he often uses *logical meaning*, for which verification is logically possible. For instance, an absolute time can very well be defined by speaking of the logical possibility of signals faster than light; and when the physicist says that the theory of absolute time is false, he has assumed logical meaning for it. The simultaneous use of the three definitions of meaning is very expedient for the discussion of physical theories and their comparison under the viewpoint of empirical truth. We may say, however, that for the actual system of physics, physical meaning is generally assumed.[9]

The role of logically possible verification in refuting physical theories

(7) The conditions 1–6 together with condition 8, which I shall deal with presently, lay down conditions of meaningfulness and thus specify what I have called the first principle of the verifiability theory of meaning. The second principle, which defines sameness of meaning, must now be added.

The second principle of VTM to be discussed

Although equivalence was not assumed to hold between direct and indirect sentences, there can be equivalences between indirect sentences; and it is indispensable for a theory of meaning to lay down the condition that such equivalences lead to sameness of meaning. The three forms of possibility lead to a corresponding division for this category. If the equivalence is analytic, i.e., follows from the rules of logic, we have logical identity of meaning; if the equivalence is synthetic and follows from the laws of physics, we have physical identity of meaning. Technical identity of meaning is a dispensable concept. The above example of Einstein's principle of equivalence illustrates physical identity of meaning. It is an important part of physical research to discover such identities; this has been very well pointed out by Feigl,[10] who mentions the identity of light waves and electromagnetic waves, of heat and average kinetic energy of the molecules, etc., and discusses in this frame the mind-body problem.

Equivalences between indirect sentences: analytic, physical, technical

As before, it can be useful to employ different definitions of identity of meaning in the same context; for instance, to use Frege's example, we may say that the expressions "the morning star" and "the evening star" have the same physical meaning, but not the same logical meaning. Furthermore, it appears necessary to subdivide the category of logical identity of meaning and to define synonymity by a much narrower requirement, so that, for instance, the terms "five" and "number of regular polyhedrons" are not synonymous, though they can be shown to be tautologically equiva-

Logical and physical possibility contrasted

Synonymity is a stronger requirement than logical identity

[9] It is a pity, therefore, that Carnap in his enlightening book "Meaning and Necessity", Chicago 1947, does not speak at all about physical meaning and physical possibility.

[10] H. Feigl, The Mind-Body Problem, *Revue Internationale de Philosophie*, No. 11, 1950, p. 80, reprinted this volume.

(Roughly, expressions are synonymous if they represent the same proposition, possibly in different notations.)

lent. A definition of synonymity of this kind was recently given in a highly satisfactory form by Carnap.[11]

Reduction of ethical and religious discourse

It is the practical significance of the second principle of the verifiability theory of meaning that it allows for the translation of expressions of emotive languages into an empirical language. Statements about mystical visions, or about "moral truth", can thus be given an empirical content, though such a translation may provoke violent opposition on the side of the advocate of superempirical meanings. Visions then acquire the status of dreams, or hallucinations, of certain persons; and "moral truths", the status of beliefs of certain persons. I refer to another publication.[12]

This discussion of identity of meaning answers the objections raised by Bertrand Russell,[13] which are based on earlier versions of the verifiability theory of meaning. He argues that, for the positivist, speaking about other persons' minds would mean the same as speaking about dreamed objects. I doubt whether this is true even for the earliest form of positivism, where the distinction between dream and waking state was already made. And it certainly is not true for a verifiability theory of meaning which allows for indirect verification, since in such a theory identity of meaning does not hold between indirect sentences and observation sentences.

(8) I now come to the discussion of a set of rules which had been overlooked in the earlier discussion of meaning and which were first introduced in my analysis of the problem of unobservables of quantum mechanics.

Sentences about unobservables are based on inductive inference

Going from the sentences of the basis *O* to indirect sentences is the same as going from observables to unobservables. We are all agreed that this inference is not a matter of belief in a transcendental reality; in fact, if the verifiability theory of meaning is accepted, this would be a belief in something meaningless. So, it must be a form of inductive inference; and thus arises the difficulty of how to make inductions which connect unobservables to observables. Inductions concerning a certain object must start with some properties of this object and then may add further properties to it. But since we have no knowledge of the unobservables, we have nothing to start with. We cannot say: so far the things have existed when we were not looking at them, therefore they will do the same in the future. The premise of this inference is not verified by any observation, and cannot be so verified because of the definition of the term "unobserved object".[14]

Problem: induction should begin with observations

[11] R. Carnap, "Meaning and Necessity", Chicago 1947, §§ 14–15. Incidentally, it seems to me that the outcome of this book can be summarized in the following thesis: the major point is the definition of the terms "having the same extension" and "having the same intension"; interpretations of the terms "extension" and "intension" can then be added more or less arbitrarily.

[12] "Experience and Prediction", Chicago 1938, pp. 66–68.

[13] Bertrand Russell, Human Knowledge, New York 1948, p. 449.

[14] This argument was constructed by W. T. Stace, Refutation of Realism, *Mind* 43, 1934. It is also discussed in my book "Philosophic Foundations of Quantum Mechanics," Berkeley 1944, p. 18. It is shown there that the solution consists, not in a refutation of realism, but in a reformulation of realism.

Solution: postulate similarities between observables and unobservables

This simple analysis shows that statements about unobservables cannot be introduced unless certain conventions are added to our language. In my investigation of quantum mechanics,[15] I have shown that the usual language of science includes the convention that unobservables follow the same physical laws as observables; in particular, that they satisfy the principle of causality, which for observables is an empirical law. Without such a convention, the language of unobservables is incomplete and not accessible to verification. It leads to statements of the same kind as, for instance, the statement that during the night all things, including our bodies, have become ten times larger. Such paradoxes spring from incompleteness of language, and are easily eliminated by making the language complete through suitable rules.

The postulate works in classical physics, but breaks down in quantum mechanics

I will call rules of this kind *extension rules*. They extend the range of laws from observables to unobservables. They are conventions determining the structure of language. Varying the convention, we arrive at a set of *equivalent descriptions*, which are all true to the same extent. Among them, the description for which unobservables follow the same laws as observables is called the *normal system*. Yet the necessity of conventions opens up an empirical investigation: it requires an analysis whether a certain convention can be carried through, i.e., does not lead to contradictory statements about observables. Classical physics can be carried through consistently on the convention that the laws of unobservables are the same as the law of observables. Classical physics, therefore, has a normal system—which is nothing but the usual realistic language. Quantum physics does not admit of a normal system. This is a domain where the mentioned extension rule breaks down and other extension rules have to be used. We have therefore to distinguish between admissible and inadmissible conventions of language. Whether a convention is admissible, is an empirical question. If it is admissible, its use makes the resulting language not "more true" than the use of another admissible convention.

I hope these formulations will clarify a controversy which has arisen about the exposition of realism in my book "Experience and Prediction". I have introduced the term *illata* for objects that can be described only in indirect sentences.[16] This term is as legitimate as the term "indirect sentence". Certainly, illata are not determined unless the extension rules of the language are given; but this fact does not make them "less real". They share this property with all other things, since nothing can be described adequately in an incomplete language. Furthermore, in the discussion of a cubical world [17] in which bird-like shadows are visible, I have argued for a realistic language which speaks about the birds although they are un-

Unobservables are no less real than observables

[15] See p. 19 of my book mentioned in the preceding footnote.

[16] "Experience and Prediction", Chicago 1938, p. 212.

[17] Ibid. §14.

observable and thus are illata. In the terminology of my analysis of quantum mechanics, I would say that in this world the realistic language constitutes the normal system, whereas the positivistic language, which speaks only about the shadows on the walls, is a restrictive interpretation. My argument therefore is that there is no reason to introduce a restrictive interpretation if a normal system exists.[18] The same would apply to quantum mechanics if, for instance, the corpuscle interpretation could be carried through without causal anomalies, even if Heisenberg's indeterminacy were to remain valid and a simultaneous ascertainment of position and momentum were impossible.

Conventions are adopted and rejected on the basis of experience

When I say that we have inductive evidence for the existence of the external world, I mean the fact that the realistic language can be carried through for the macrocosm, that there is a normal system. This is a verifiable and meaningful statement; but of course, it is so only after the language is made complete through extension rules. That the realistic hypothesis is empirical, and not a faith, or perhaps a truism, is shown by the strange results of quantum mechanics, which exclude the realistic hypothesis, in the usual sense, for the microcosm. Here we can speak about physical reality only in an indirect way, using the duality of wave and particle description; instead of the normal system, we use a set of equivalent descriptions, none of which has the directness of the normal system. A realistic language in the sense of the language of the macrocosm is here impossible; if there is any realism left, it is certainly not a "naive realism".

Idealistic interpretations of quantum mechanics are untenable

I should like to add the remark that the reality problem of quantum mechanics has been construed as resulting from the influence of the human observer and thus as confirming idealistic philosophies, according to which the *ego* creates the external world; in another version of such ideas, it has been argued that the line of demarcation between observer and external object cannot be clearly drawn. I do not think such a "metaphysical" interpretation of quantum mechanics is tenable. The observables of quantum mechanics are not human perceptions, but physical occurrences of a certain kind; and the quantum mechanical difficulties begin when the realm of these observables, or phenomena, is to be supplemented by a realm of unobservables, or interphenomena. It is therefore not the step from the human observer to the external object, but the step from macrophysics to microphysics which involves the difficulties. The quantum-mechanical indeterminacy is an entirely physical affair; i.e., it expresses a structural property of the physical world, which has nothing to do with the fact that this world is observed by human beings.[19] That the indeterminacy influences our system of knowledge has other reasons. Our bodies are macroscopic

[18] This answers certain objections by H. Feigl, Existential Hypotheses, *Philos. of Science*, vol. 17, 1950, p. 54, who unfortunately overlooks the exposition of the problem in my book "Philosophic Foundations of Quantum Mechanics" and bases his critique merely on my book "Experience and Prediction".

[19] See my book, "Philosophic Foundations of Quantum Mechanics", p. 15. An imaginary macroscopic analogy of quantum mechanics is described there on pp. 38–39.

organisms, and our direct observations are restricted to macroscopic objects. Our knowledge of the microcosm is acquired by way of the macrocosm, and on this transition the indeterminacy enters our statements about the microcosm.

Quantum logic

In order to construct an adequate realistic language for quantum phenomena I have suggested to use a three-valued logic, which possesses a category of indeterminate sentences between those of true and of false sentences. Since the indeterminate sentences are neither true nor false, the objection has been raised that my interpretation of quantum mechanics contradicts the verifiability criterion of meaning.[20] This is a misunderstanding. The theory of meaning has been emancipated, for a long while, from its first dogmatic version and has assumed a moderate version, which admits of modified forms of verification. In order to include the three-valued logic of quantum mechanics, the conditions of meaningfulness, in particular, the extension rules, have to be widened so as to admit the category of indeterminate statements. Since these statements are connected by well-defined rules with the observational basis of language, they are as legitimate as any other statements exempt from direct verification. To put it briefly: a quantum-mechanical statement is meaningful if it is verifiable (in the moderate sense of probability verification) as true, false, or indeterminate.

[20] E. Nagel, *Journ. of Philosophy*, vol. 42, 1945, pp. 437–444. See also my reply, vol. 43, 1946, p. 244.