

# The Logical Analysis of Psychology

Carl G. Hempel

**Author's prefatory note, 1977.** The original French version of this article was published in 1935. By the time it appeared in English, I had abandoned the narrow translationist form of physicalism here set forth for a more liberal reductionist one, referred to in note 1, which presents psychological properties and states as partially characterized, but not defined, by bundles of behavioral dispositions. Since then, I have come to think that this conception requires still further broadening, and that the introduction and application of psychological terms and hypotheses is logically and methodologically analogous to the introduction and application of the terms and hypotheses of a physical theory.\* The considerations that prompt-

ed those changes also led me long ago to abandon as untenable the verificationist construal of the "empirical meaning" of a sentence—a construal which plays such a central role in the arguments set forth in this article.

Since the article is so far from representing my present views, I was disinclined to consent to yet another republication, but I yielded to Dr. Block's plea that it offers a concise account of an early version of logical behaviorism and would thus be a useful contribution to this anthology.

In an effort to enhance the closeness of translation and the simplicity of formulation, I have made a number of small

An earlier version of this paper appeared in Ausonio Marras, ed., *Intentionality, Mind, and Language* (Urbana: University of Illinois Press, 1972), pp. 115-131, and in Herbert Feigl and Wilfrid Sellars, eds., *Readings in Philosophical Analysis* (New York: Appleton-Century-Crofts, 1949), pp. 373-384, translated from the French by W. Sellars. Reprinted, with revisions by the author, by permission of the author, Herbert Feigl, Wilfrid Sellars, and the editors of *Revue de Synthèse*.

\*My reasons are suggested in some of my more recent articles, among them "Logical Positivism and the Social Sciences," in P. Achinstein and S. F. Barker, eds., *The Legacy of Legal Posi-*

*tivism* (Baltimore: Johns Hopkins University Press, 1969); "Reduction: Ontological and Linguistic Facets," in S. Morgenbesser, P. Suppes, and M. White, eds., *Philosophy, Science, and Method. Essays in Honor of Ernest Nagel* (New York: St. Martin's Press, 1969); "Dispositional Explanation and the Covering-Law Model: Response to Laird Addis," in A. C. Michalos and R. S. Cohen, eds., *PSA 1974: Proceedings of the 1974 Biennial Meeting of the Philosophy of Science Association* (Dordrecht: Reidel, 1976), pp. 369-376.

changes in the text of the original English version; none of these affects the substance of the article.

## I

One of the most important and most discussed problems of contemporary philosophy is that of determining how psychology should be characterized in the theory of science. This problem, which reaches beyond the limits of epistemological analysis and has engendered heated controversy in metaphysics itself, is brought to a focus by the familiar alternative, "Is psychology a natural science, or is it one of the sciences of mind and culture (*Geisteswissenschaften*)?"

The present article attempts to sketch the general lines of a new analysis of psychology, one which makes use of rigorous logical tools, and which has made possible decisive advances toward the solution of the above problem.<sup>1</sup> This analysis was carried out by the "Vienna Circle" (*Weiner Kreis*), the members of which (M. Schlick, R. Carnap, P. Frank, O. Neurath, F. Waismann, H. Feigl, etc.) have, during the past ten years, developed an extremely fruitful method for the epistemological examination and critique of the various sciences, based in part on the work of L. Wittgenstein.<sup>2</sup> We shall limit ourselves essentially to the examination of psychology as carried out by Carnap and Neurath.

The method characteristic of the studies of the Vienna Circle can be briefly defined as a *logical analysis of the language of science*. This method became possible only with the development of a subtle logical apparatus which makes use, in particular, of all the formal procedures of modern symbolic logic.<sup>3</sup> However, in the following account, which does not pretend to give more than a broad orientation, we shall limit ourselves to setting out the general principles of this new method, without making use of strictly formal procedures.

## II

Perhaps the best way to characterize the position of the Vienna Circle as it relates to psychology, is to say that it is the exact antithesis of the current epistemological thesis that there is a fundamental difference between experimental psychology, a natural science, and introspective psychology; and in general, between the natural sciences on the one hand, and the sciences of mind and culture on the other.<sup>4</sup> The common content of the widely different formulations used to express this contention, which we reject, can be set down as follows. Apart from certain aspects clearly related to physiology, psychology is radically different, both in subject matter and in method, from physics in the broad sense of the term. In particular, it is impossible to deal adequately with the subject matter of psychology by means of physical methods. The subject matter of physics includes such concepts as mass, wave length, temperature, field intensity, etc. In dealing with these, physics employs its distinctive method which makes a combined use of description and causal explanation. Psychology, on the other hand, has for its subject matter notions which are, in a broad sense, mental. They are *toto genere* different from the concepts of physics, and the appropriate method for dealing with them scientifically is that of empathetic insight, called "introspection," a method which is peculiar to psychology.

One of the principal differences between the two kinds of subject matter is generally believed to consist in the fact that the objects investigated by psychology—in contradistinction to those of physics—are specifically endowed with meaning. Indeed, several proponents of this idea state that the distinctive method of psychology consists in "understanding the sense of meaningful structures" (*sinnvolle Gebilde verstehend zu erfassen*). Take, for example, the case of a man who

speaks. Within the framework of physics, this process is considered to be completely explained once the movements which make up the utterance have been traced to their causes, that is to say, to certain physiological processes in the organism, and, in particular, in the central nervous system. But, it is said, this does not even broach the psychological problem. The latter begins with understanding the sense of what was said, and proceeds to integrate it into a wider context of meaning.

It is usually this latter idea which serves as a principle for the fundamental dichotomy that is introduced into the classification of the sciences. There is taken to be an *absolutely impassable gulf* between the *natural sciences* which have a subject matter devoid of meaning and the *sciences of mind and culture*, which have an intrinsically meaningful subject matter, the appropriate methodological instrument for the scientific study of which is "comprehension of meaning."

### III

The position in the theory of science which we have just sketched has been attacked from several different points of view.<sup>5</sup> As far as psychology is concerned, one of the principal countertheses is that formulated by behaviorism, a theory born in America shortly before the war. (In Russia, Pavlov has developed similar ideas.) Its principal methodological postulate is that a scientific psychology should limit itself to the study of the bodily behavior with which man and the animals respond to changes in their physical environment, and should proscribe as nonscientific any descriptive or explanatory step which makes use of terms from introspective or "understanding" psychology, such as 'feeling', 'lived experience', 'idea', 'will', 'intention', 'goal', 'disposition', 'repression'.<sup>6</sup> We find in behaviorism, consequently, an attempt to construct a scientific psychology which would show by its success that even in psychology we have

to do with purely physical processes, and that therefore there can be no impassable barrier between psychology and physics. However, this manner of undertaking the critique of a scientific thesis is not completely satisfactory. It seems, indeed, that the soundness of the behavioristic thesis expounded above depends on the possibility of fulfilling the program of behavioristic psychology. But one cannot expect the question as to the scientific status of psychology to be settled by empirical research in psychology itself. To achieve this is rather an undertaking in epistemology. We turn, therefore, to the considerations advanced by members of the Vienna Circle concerning this problem.

### IV

Before addressing the question whether the subject matters of physics and psychology are essentially the same or different in nature, it is necessary first to clarify the very concept of the subject matter of a science. The theoretical content of a science is to be found in statements. It is necessary, therefore, to determine whether there is a fundamental difference between the statements of psychology and those of physics. Let us therefore ask what it is that determines the content—one can equally well say the "meaning"—of a statement. When, for example, do we know the meaning of the following statement: "To-day at one o'clock, the temperature of such and such a place in the physics laboratory was 23.4° centigrade"? Clearly when, and only when, we know under what conditions we would call the statement true, and under what circumstances we would call it false. (Needless to say, it is not necessary to know whether or not the statement is true.) Thus, we understand the meaning of the above statement since we know that it is true when a tube of a certain kind filled with mercury (in short, a thermometer with a centigrade scale), placed at the indicated time at the location in question, exhibits a coinci-

dence between the level of the mercury and the mark of the scale numbered 23.4. It is also true if in the same circumstances one can observe certain coincidences on another instrument called an "alcohol thermometer"; and, again, if a galvanometer connected with a thermopile shows a certain deviation when the thermopile is placed there at the indicated time. Further, there is a long series of other possibilities which make the statement true, each of which is described by a "physical test sentence," as we will call it. The statement itself clearly affirms nothing other than this: all these physical test sentences obtain. (However, one verifies only some of these physical test sentences, and then "concludes by induction" that the others obtain as well.) The statement, therefore, is nothing but an abbreviated formulation of all those test sentences.

Before continuing the discussion, let us sum up this result as follows:

1. A statement that specifies the temperature at a selected point in space-time can be "retranslated" without change of meaning into another statement—doubtless longer—in which the word "temperature" no longer appears. That term functions solely as an abbreviation, making possible the concise and complete description of a state of affairs the expression of which would otherwise be very complicated.

2. The example equally shows that *two statements which differ in formulation can nevertheless have the same meaning*. A trivial example of a statement having the same meaning as the above would be: "Today at one o'clock, at such and such a location in the laboratory, the temperature was 19.44° Réaumur."

As a matter of fact, the preceding considerations show—and let us set it down as another result—that *the meaning of a statement is established by the conditions of its verification*. In particular, two differently formulated statements have the same meaning or the same effective

content when, and only when, they are both true or both false in the same conditions. Furthermore, a statement for which one can indicate absolutely no conditions which would verify it, which is in principle incapable of confrontation with test conditions, is wholly devoid of content and without meaning. In such a case we have to do, not with a statement properly speaking, but with a "pseudo-statement," that is to say, a sequence of words correctly constructed from the point of view of grammar, but without content.<sup>7</sup>

In view of these considerations, our problem reduces to one concerning the difference between the circumstances which verify psychological statements and those which verify the statements of physics. Let us therefore examine a statement which involves a psychological concept, for example: "Paul has a toothache." What is the specific content of this statement, that is to say, what are the circumstances in which it would be verified? It will be sufficient to indicate some test sentences which describe these circumstances.

- a. Paul weeps and makes gestures of such and such kinds.
- b. At the question "What is the matter?," Paul utters the words "I have a toothache."
- c. Closer examination reveals a decayed tooth with exposed pulp.
- d. Paul's blood pressure, digestive processes, the speed of his reactions, show such and such changes.
- e. Such and such processes occur in Paul's central nervous system.

This list could be expanded considerably, but it is already sufficient to bring out the fundamental and essential point, namely, that all the circumstances which verify this psychological statement are expressed by physical test sentences. [This is true even of test condition *b*, which merely expresses the fact that in specified physical circumstances (the propagation of vibra-

tions produced in the air by the enunciation of the words, "What is the matter?") there occurs in the body of the subject a certain physical process (speech behavior of such and such a kind).]

The statement in question, which is about someone's "pain," is therefore, just like that concerning the temperature, simply an abbreviated expression of the fact that all its test sentences are verified.<sup>8</sup> (Here, too, one verifies only some of the test sentences and then infers by way of induction that the others obtain as well.) It can be retranslated without loss of content into a statement which no longer contains the term "pain," but only physical concepts. Our analysis has consequently established that a certain statement belonging to psychology has the same content as a statement belonging to physics; a result which is in direct contradiction to the thesis that there is an impassable gulf between the statements of psychology and those of physics.

The above reasoning can be applied to *any psychological statement*, even to those which concern, as is said, "deeper psychological strata" than that of our example. Thus, the assertion that Mr. Jones suffers from intense inferiority feelings of such and such kinds can be confirmed or falsified only by observing Mr. Jones' behavior in various circumstances. To this behavior belong all the bodily processes of Mr. Jones, and, in particular, his gestures, the flushing and paling of his skin, his utterances, his blood pressure, the events that occur in his central nervous system, etc. In practice, when one wishes to test statements concerning what are called the deeper layers of the psyche, one limits oneself to the observation of external bodily behavior, and, particularly, to speech movements evoked by certain physical stimuli (the asking of questions). But it is well known that experimental psychology has also developed techniques for making use of the subtler bodily states referred to above in order to confirm the

psychological discoveries made by cruder methods. The statement concerning the inferiority feelings of Mr. Jones—whether true or false—means only this: such and such happenings take place in Mr. Jones' body in such and such circumstances.

We shall call a statement which can be translated without change of meaning into the language of physics, a "physicalistic statement," whereas we shall reserve the expression "statement of physics" to those which are already formulated in the terminology of physical science. (Since every statement is in respect of content equivalent to itself, every statement of physics is also a physicalistic statement.) The result of the preceding considerations can now be summed up as follows: *All psychological statements which are meaningful, that is to say, which are in principle verifiable, are translatable into statements which do not involve psychological concepts, but only the concepts of physics. The statements of psychology are consequently physicalistic statements. Psychology is an integral part of physics.* If a distinction is drawn between psychology and the other areas of physics, it is only from the point of view of the practical aspects of research and the direction of interest, rather than a matter of principle. This logical analysis, the result of which shows a certain affinity with the fundamental ideas of behaviorism, constitutes the physicalistic conception of psychology.

## V

It is customary to raise the following fundamental objection against the above conception. The physical test sentences of which you speak are absolutely incapable of formulating the intrinsic nature of a mental process; they merely describe the physical *symptoms* from which one infers, by purely psychological methods—notably that of understanding—the presence of a certain mental process.

But it is not difficult to see that the

use of the method of understanding or of other psychological procedures is bound up with the existence of certain observable physical data concerning the subject undergoing examination. There is no psychological understanding that is not tied up physically in one way or another with the person to be understood. Let us add that, for example, in the case of the statement about the inferiority complex, even the "introspective" psychologist, the psychologist who "understands," can confirm his conjecture only if the body of Mr. Jones, when placed in certain circumstances (most frequently, subjected to questioning), reacts in a specified manner (usually, by giving certain answers). Consequently, even if the statement in question had to be arrived at, *discovered*, by "empathetic understanding," the only *information* it gives us is nothing more nor less than the following: under certain circumstances, certain specific events take place in the body of Mr. Jones. It is this which constitutes the meaning of the psychological statement.

The further objection will perhaps be raised that men can feign. Thus, though a criminal at the bar may show physical symptoms of mental disorder, one would nevertheless be justified in wondering whether his mental confusion was "real" or only simulated. One must note that in the case of the simulator, only some of the conditions are fulfilled which verify the statement "This man is mentally unbalanced," those, namely, which are most accessible to direct observation. A more penetrating examination—which should in principle take into account events occurring in the central nervous system—would give a decisive answer; and this answer would in turn clearly rest on a physicalistic basis. If, at this point, one wished to push the objection to the point of admitting that a man could show *all the "symptoms"* of a mental disease without being "really" ill, we reply that it would be absurd to characterize such a man as

"really normal"; for it is obvious that by the very nature of the hypothesis we should possess no criterion in terms of which to distinguish this man from another who, while exhibiting the same bodily behavior down to the last detail, would "in addition" be "really ill." (To put the point more precisely, one can say that this hypothesis contains a *logical contradiction*, since it amounts to saying, "It is possible that a statement should be false even when the necessary and sufficient conditions of its truth are fulfilled.")

Once again we see clearly that the meaning of a psychological statement consists solely in the function of abbreviating the description of certain modes of physical response characteristic of the bodies of men or animals. An analogy suggested by O. Neurath may be of further assistance in clarifying the logical function of psychological statements.<sup>9</sup> The complicated statements that would describe the movements of the hands of a watch in relation to one another, and relatively to the stars, are ordinarily summed up in an assertion of the following form: "This watch runs well (runs badly, etc.)." The term "runs" is introduced here as an auxiliary defined expression which makes it possible to formulate briefly a relatively complicated system of statements. It would thus be absurd to say, for example, that the movement of the hands is only a "physical symptom" which reveals the presence of a running which is intrinsically incapable of being grasped by physical means, or to ask, if the watch should stop, what has become of the running of the watch.

It is in exactly the same way that abbreviating symbols are introduced into the language of physics, the concept of temperature discussed above being an example. The system of physical test sentences *exhausts* the meaning of the statement concerning the temperature at a place, and one should not say that these sentences merely have to do with "symp-

toms" of the existence of a certain temperature.

Our argument has shown that it is necessary to attribute to the characteristic concepts of psychology the same logical function as that performed by the concepts of "running" and of "temperature." They do nothing more than make possible the succinct formulation of propositions concerning the states or processes of animal or human bodies.

The introduction of new psychological concepts can contribute greatly to the progress of scientific knowledge. But it is accompanied by a danger, that, namely, of making an excessive and, consequently, improper use of new concepts, which may result in questions and answers devoid of sense. This is frequently the case in metaphysics, notably with respect to the notions which we formulated in section II. Terms which are abbreviating symbols are imagined to designate a special class of "psychological objects," and thus one is led to ask questions about the "essence" of these objects, and how they differ from "physical objects." The time-worn problem concerning the relation between mental and physical events is also based on this confusion concerning the logical function of psychological concepts. Our argument, therefore, enables us to see that *the psycho-physical problem is a pseudo-problem*, the formulation of which is based on an inadmissible use of scientific concepts; it is of the same logical nature as the question, suggested by the example above, concerning the relation of the running of the watch to the movement of the hands.<sup>10</sup>

## VI

In order to bring out the exact status of the fundamental idea of the physicalistic conception of psychology (or logical behaviorism), we shall contrast it with certain theses of psychological behaviorism and of classical materialism, which

give the appearance of being closely related to it.<sup>11</sup>

1. Logical behaviorism claims neither that minds, feelings, inferiority complexes, voluntary actions, etc., do not exist, nor that their existence is in the least doubtful. It insists that the very question as to whether these psychological constructs really exist is already a pseudo-problem, since these notions in their "legitimate use" appear only as abbreviations in physicalistic statements. Above all, one should not interpret the position sketched in this paper as amounting to the view that we can know only the "physical side" of psychological processes, and that the question whether there are mental phenomena behind the physical processes falls beyond the scope of science and must be left either to faith or to the conviction of each individual. On the contrary, the logical analyses originating in the Vienna Circle, one of whose consequences is the physicalistic conception of psychology, teach us that every meaningful question is, in principle, capable of a scientific answer. Furthermore, these analyses show that what, in the case of the mind-body problem, is considered as an object of belief, is absolutely incapable of being expressed by a factual proposition. In other words, there can be no question here of an "article of faith." Nothing can be an object of faith which cannot, in principle, be an object of knowledge.

2. The thesis here developed, though related in certain ways to the fundamental idea of behaviorism, does not demand, as does the latter, that psychological research restrict itself methodologically to the study of the responses organisms make to certain stimuli. It by no means offers a theory belonging to the domain of psychology, but rather a logical theory about the statements of scientific psychology. Its position is that the latter are without exception physicalistic statements, by whatever means they may have been obtained.

Consequently, it seeks to show that if in psychology only physicalistic statements are made, this is not a limitation because it is logically *impossible* to do otherwise.

3. In order for logical behaviorism to be valid, it is not necessary that we be able to describe the physical state of a human body which is referred to by a certain psychological statement—for example, one dealing with someone's feeling of pain—down to the most minute details of the phenomena of the central nervous system. No more does it presuppose a knowledge of all the physical laws governing human or animal bodily processes; nor *a fortiori* is the existence of rigorously deterministic laws relating to these processes a necessary condition of the truth of the behavioristic thesis. At no point does the above argument rest on such a concrete presupposition.

## VII

In concluding, I should like to indicate briefly the clarification brought to the problem of the division of the sciences into totally different areas, by the method of the logical analysis of scientific statements, applied above to the special case of the place of psychology among the sciences. The considerations we have advanced can be extended to the domain of sociology, taken in the broad sense as the science of historical, cultural, and economic processes. In this way one arrives at the result that every sociological assertion which is meaningful, that is to say, in principle verifiable, "has as its subject matter nothing else than the states, processes and behavior of groups or of individuals (human or animal), and their responses to one another and to their environment,"<sup>12</sup> and consequently that every sociological statement is a physicalistic statement. This view is characterized by Neurath as the thesis of "social behaviorism," which he adds to that of "individual behaviorism" which we have expounded

above. Furthermore, it can be shown<sup>13</sup> that every statement of what are called the "sciences of mind and culture" is a sociological statement in the above sense, provided it has genuine content. Thus one arrives at the "thesis of the unity of science":

The division of science into different areas rests exclusively on differences in research procedures and direction of interest; *one must not regard it as a matter of principle. On the contrary, all the branches of science are in principle of one and the same nature; they are branches of the unitary science, physics.*

## VIII

The method of logical analysis which we have attempted to explicate by clarifying, as an example, the statements of psychology, leads, as we have been able to show only too briefly for the sciences of mind and culture, to a "physicalism" based on logic (Neurath): *Every statement of the above-mentioned disciplines, and, in general, of empirical science as a whole, which is not merely a meaningless sequence of words, is translatable, without change of content, into a statement containing only physicalistic terms, and consequently is a physicalistic statement.*

This thesis frequently encounters strong opposition arising from the idea that such analyses violently and considerably reduce the richness of the life of mind or spirit, as though the aim of the discussion were purely and simply to eliminate vast and important areas of experience. Such a conception comes from a false interpretation of physicalism, the main elements of which we have already examined in section VII above. As a matter of fact, nothing can be more remote from a philosophy which has the methodological attitude we have characterized than the making of decisions, on its own authority, concerning the truth or falsity of particular scientific statements, or the desire to

eliminate any matters of fact whatsoever. *The subject matter of this philosophy is limited to the form of scientific statements, and the deductive relationships obtaining between them.* It is led by its analyses to the thesis of physicalism, and establishes on purely logical grounds that a certain class of venerable philosophical "problems" consists of pseudo-problems. It is certainly to the advantage of the progress of scientific knowledge that these imitation jewels in the coffer of scientific problems be known for what they are, and that the intellectual powers which have till now been devoted to a class of meaningless questions which are by their very nature insoluble, become available for the formulation and study of new and fruitful problems. That the method of logical analysis stimulates research along these lines is shown by the numerous publications of the Vienna Circle and those who sympathize with its general point of view (H. Reichenbach, W. Dubislav, and others).

In the attitude of those who are so bitterly opposed to physicalism, an essential role is played by certain psychological factors relating to individuals and groups. Thus the contrast between the constructs (*Gebilde*) developed by the psychologist, and those developed by the physicist, or, again, the question as to the nature of the specific subject matter of psychology and the cultural sciences (which present the appearance of a search for the essence and unique laws of "objective spirit") is usually accompanied by a strong emotional coloring which has come into being during the long historical development of a "philosophical conception of the world," which was considerably less scientific than normative and intuitive. These emotional factors are still deeply rooted in the picture by which our epoch represents the world to itself. They are protected by certain affective dispositions which surround them like a rampart, and for all these reasons appear to us to have genuine content

—something which a more penetrating analysis shows to be impossible.

A psychological and sociological study of the causes for the appearance of these "concomitant factors" of the metaphysical type would take us beyond the limits of this study,<sup>14</sup> but without tracing it back to its origins, it is possible to say that if the logical analyses sketched above are correct, the fact that they necessitate at least a partial break with traditional philosophical ideas which are deeply dyed with emotion can certainly not justify an opposition to physicalism—at least if one acknowledges that philosophy is to be something more than the expression of an individual vision of the world, that it aims at being a science.

### Notes

1. I now consider the type of physicalism outlined in this paper as too restrictive; the thesis that all statements of empirical science are *translatable*, without loss of theoretical content, into the language of physics, should be replaced by the weaker assertion that all statements of empirical science are *reducible* to sentences in the language of physics, in the sense that for every empirical hypothesis, including, of course, those of psychology, it is possible to formulate certain test conditions in terms of physical concepts which refer to more or less directly observable physical attributes. But those test conditions are not asserted to exhaust the theoretical content of the given hypothesis in all cases. For a more detailed development of this thesis, cf. R. Carnap, "Logical Foundations of the Unity of Science," reprinted in A. Marras, ed., *Intentionality, Mind, and Language* (Urbana: Univ. of Illinois Press, 1972).

2. *Tractatus Logico-Philosophicus* (London, 1922).

3. A recent presentation of symbolic logic, based on the fundamental work of Whitehead and Russell, *Principia Mathematica*, is to be found in R. Carnap, *Abriss der Logistik* (Vienna: Springer, 1929; vol. 2 of the series *Schriften zur Wissenschaftlichen Welt-auffassung*). It includes an extensive bibliography, as well as references to other logistic systems.

4. The following are some of the principal publications of the Vienna Circle on the nature of psychology as a science: R. Carnap, *Scheinprobleme in der Philosophie. Das Fremdpsychische und des Realismusstreit* (Leipzig: Meiner, 1928); *Der Logische Aufbau der Welt* (Leipzig: Meiner, 1928) [English trans.: *Logical Structure of the World* (Berkeley: Univ. of California Press, 1967)]; "Die Physikalische Sprache als Universalsprache der Wissenschaft," *Erkenntnis*, 2 (1931-32), 432-465 [English trans.: *The Unity of Science* (London: Kegan Paul, 1934)]; "Psychologie in physikalischer Sprache," *Erkenntnis*, 3 (1932-33), 107-142 [English trans.: "Psychology in Physical Language," in A. J. Ayer, ed., *Logical Positivism* (New York: Free Press, 1959)]; "Ueber Protokollsätze," *Erkenntnis*, 3 (1932-33), 215-228; O. Neurath, "Protokollsätze," *Erkenntnis*, 3 (1932-33), 204-214 [English trans.: "Protocol Sentences," in *Logical Positivism*]; *Einheitswissenschaft und Psychologie* (Vienna: Springer, 1933; vol. 1 of the series *Einheitswissenschaft*). See also the publications mentioned in the notes below.

5. P. Oppenheim, for example, in his book *Die Naturliche Ordnung der Wissenschaften* (Jena: Fischer, 1926), opposes the view that there are fundamental differences between any of the different areas of science. On the analysis of "understanding," cf. M. Schlick, "Erleben, Erkennen, Metaphysik," *Kantstudien*, 31 (1926), 146.

6. For further details see the statement of one of the founders of behaviorism: J. B. Watson, *Behaviorism* (New York: Norton, 1930); also A. A. Roback, *Behaviorism and Psychology* (Cambridge, Mass.: Univ. Bookstore, 1923); and A. P. Weiss, *A Theoretical Basis of Human Behavior*, 2nd ed. rev. (Columbus, Ohio: Adams, 1929); see also the work by Koehler cited in note 11 below.

7. Space is lacking for further discussion of the logical form of test sentences (recently called "protocol sentences" by Neurath and Carnap). On this question see Wittgenstein, *Tractatus Logico-Philosophicus*, as well as the articles by Neurath and Carnap which have appeared in *Erkenntnis* (above, note 4).

8. Two critical comments, 1977: (a) This reference to verification involves a conceptual confusion. The thesis which the preceding considerations were intended to establish was clearly that the statement "Paul has a tooth-

ache" is, in effect, an abbreviated expression of all its test sentences; not that it expresses the claim (let alone the "fact") that all those test sentences have actually been tested and verified. (b) Strictly speaking, none of the test sentences just mentioned is implied by the statement "Paul has a toothache": the latter may be true and yet any or all of those test sentences may be false. Hence, the preceding considerations fail to show that the given psychological statement can be "translated" into sentences which, in purely physical terms, describe macro-behavioral manifestations of pain. This failure of the arguments outlined in the text does not preclude the possibility, however, that sentences ascribing pain or other psychological characteristics to an individual might be "translatable," in a suitable sense, into physical sentences ascribing associated physical micro-states or micro-events to the nervous system or to the entire body of the individual in question.

9. "Soziologie im Physikalismus," *Erkenntnis*, 2 (1931-32), 393-431, particularly p. 411 [English trans.: "Sociology and Physicalism," in A. J. Ayer, ed., *Logical Positivism*].

10. Carnap, *Der Logische Aufbau der Welt*, pp. 231-236; id. *Scheinprobleme in der Philosophie*. See also note 4 above.

11. A careful discussion of the ideas of so-called "internal" behaviorism is to be found in *Psychologische Probleme* by W. Koehler (Berlin: Springer, 1933). See particularly the first two chapters.

12. R. Carnap, "Die Physikalische Sprache als Universalsprache," p. 451. See also: O. Neurath, *Empirische Soziologie* (Vienna: Springer, 1931; the fourth monograph in the series *Schriften zur wissenschaftlichen Weltanschauung*).

13. See R. Carnap, *Der Logische Aufbau der Welt*, pp. 22-34 and 185-211, as well as the works cited in the preceding note.

14. O. Neurath has made interesting contributions along these lines in *Empirische Soziologie* and in "Soziologie im Physikalismus" (see above, note 9), as has R. Carnap in his article "Ueberwindung der Metaphysik durch logische Analyse der Sprache," *Erkenntnis*, 2 (1931-32), 219-241 [English trans.: "The Elimination of Metaphysics through Logical Analysis of Language," in A. J. Ayer, ed., *Logical Positivism*].