6 Psychology in Physical Language

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1. Introduction. Physical Language and Protocol Language

In what follows, we intend to explain and to establish the thesis that *every sentence of psychology may be formulated in physical language.* To express this in the material mode of speech: *all sentences of psychology describe physical occurrences, namely, the physical behavior of humans and other animals.* This is a sub-thesis of the general thesis of *physicalism* to the effect that *physical language is a universal language,* that is, a language into which every sentence may be translated. The general thesis has been discussed in an earlier article,[1] whose position shall here serve as our point of departure. Let us first briefly review some of the conclusions of the earlier study.

In meta-linguistic discussion we distinguish the customary *material mode of speech* (e.g., "The sentences of this language speak of this and that object.") from the more correct *formal mode of speech* (e.g., "The sentences of this language contain this and that word and are constructed in this and that manner."). In using the material mode of speech we run the risk of introducing confusions and pseudo-problems. If, because of its being more easily understood, we occasionally do use it in what follows, we do so only as a paraphrase of the formal mode of speech.

Of first importance for epistemological analyses are the *protocol language,* in which the primitive protocol sentences (in the material mode of speech: the sentences about the immediately given) of a particular person are formulated, and the *system language,* in which the sentences of the system of science are formulated. A person S *tests* (verifies) a system-sentence by deducing from it sentences of his own protocol language, and comparing these sentences with those of his actual protocol. The possibility of such a deduction of protocol sentences constitutes the *content* of a sentence. If a sentence permits no such deductions, it has no content, and is meaningless. If the same sentences may be deduced from two sentences, the latter two sentences have the same content. They say the same thing, and may be translated into one another.

To every sentence of the system language there corresponds some sentence of the physical language such that the two sentences are inter-translatable. It is the purpose of this article to show that this is the case for the sentences of psychology. Moreover, every sentence of the protocol language of some specific person is inter-translatable with some sentence of physical language, namely, with a sentence about the physical state of the person in question. The various protocol languages thus become sub-languages of the physical language. The *physical language is universal and inter-subjective.* This is the thesis of physicalism.

If the physical language, on the grounds of its universality, were adopted as the system language of science, all science would become physics. Metaphysics would be discarded as meaningless. The various domains of science would become parts of unified science. In the material mode of speech: there would, basically, be only one kind of object—physical occurrences, in whose realm law would be all-encompassing.

Physicalism ought not to be understood as requiring psychology to concern itself only with physically describable situations. The thesis, rather, is that psychology may deal with whatever it pleases, it may formulate its sentences as it pleases—these sentences will, in every case, be translatable into physical language.

We say of a sentence P that it is *translatable* (more precisely, that it is reciprocally translatable) into a sentence Q if there are rules, independent of space and time, in accordance with which Q may be deduced from P and P from Q; to use the material mode of speech, P and Q describe the same state of affairs; epistemologically speaking, every protocol sentence which confirms P also confirms Q and *vice versa.* The definition of an expression "a" by means of ex-

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pressions "b," "c" . . . , represents a translation-rule with the help of which any sentence in which "a" occurs may be translated into a sentence in which "a" does not occur, but "b," "c," . . . do, and *vice versa.* The translatability of all the sentences of language L_1 into a (completely or partially) different language L_2 is assured if, for every expression of L_1, a definition is presented which directly or indirectly (i.e., with the help of other definitions) derives that expression from expressions of L_2. Our thesis thus states that a definition may be constructed for every psychological concept (i.e., expression) which directly or indirectly derives that concept from physical concepts. We are not demanding that psychology formulate each of its sentences in physical terminology. For its own purposes psychology may, as heretofore, utilize its own terminology. All that we are demanding is the production of the definitions through which psychological language is linked with physical language. We maintain that these definitions can be produced, since, implicitly, they already underlie psychological practice.

If our thesis is correct, the generalized sentences of psychology, the *laws* of psychology, are also translatable into the physical language. They are thus physical laws. Whether or not these physical laws are deducible from those holding in inorganic physics, remains, however, an open question. This question of the deducibility of the laws is completely independent of the question of the definability of concepts. We have already considered this matter in our discussion of biology.[2] As soon as one realizes that the sentences of psychology belong to the physical language, and also overcomes the emotional obstacles to the acceptance of this provable thesis, one will, indeed, incline to the conjecture, which cannot as yet be proved, that the laws of psychology are special cases of physical laws holding in inorganic physics as well. But we are not concerned with this conjecture here.

Let us permit ourselves a brief remark—apart from our principal point—concerning the emotional resistance to the thesis of physicalism. Such resistance is always exerted against any thesis when an Idol is being dethroned by it, when we are asked to discard an idea with which dignity and grandeur are associated. As a result of Copernicus' work, man lost the distinction of a central position in the universe; as a result of Darwin's, he was deprived of the dignity of a special supra-animal existence; as a result of Marx's, the factors by means of which history can be causally explained were degraded from the realm of ideas to that of material events; as a result of Nietzsche's, the origins of morals were stripped of their halo; as a result of Freud's, the factors by means of which the ideas and actions of men can be causally explained were located in the darkest depths, in man's nether regions. The extent to which the sober, objective examination of these theories was obstructed by emotional opposition is well known. Now it is proposed that psychology, which has hitherto been robed in majesty as the theory of spiritual events, be degraded to the status of a part of physics. Doubtless, many will consider this an offensive presumption. Perhaps we may therefore express the request that the reader make a special effort in this case to retain the objectivity and openness of mind always requisite to the testing of a scientific thesis.

2. The Forms of Psychological Sentences

The distinction between singular and general sentences is as important in psychology as in other sciences. A *singular psychological sentence,* e.g., "Mr. A was angry at noon yesterday" (an analogue of the physical sentence, "Yesterday at noon the temperature of the air in Vienna was 28 degrees centigrade"), is concerned with a particular person at a particular time. *General psychological sentences* have various forms, of which the following two are perhaps the most important. A sentence may describe a specific quality of a specific kind of event, e.g., "An experience of surprise always (or: always for Mr. A, or: always for people of such and such a society) has such and such a structure." A physical analogy would be: "Chalk (or: chalk of such and such a sort) always is white." The second important form is that of universal-conditional statements concerning sequences of events, that is, of causal laws. For instance, "When, under such and such circumstances, images of such and such a sort occur to a person (or: to Mr. A, or: to anyone of such and such a society), an emotion of such and such a sort always (or: frequently, or: sometimes) is aroused." A physical analogy would be: "When a solid body is heated, it usually expands."

Research is primarily directed to the discovery of general sentences. These cannot, however, be established except by means of the so-called method of induction from the available

singular sentences, i.e., by means of the construction of hypotheses.

Phenomenology claims to be able to establish universal synthetic sentences which have not been obtained through induction. These sentences about psychological qualities are, allegedly, known either a priori or on the basis of some single illustrative case. In our view, knowledge cannot be gained by such means. We need not, however, enter upon a discussion of this issue here, since even on the view of phenomenology itself, these sentences do not belong to the domain of psychology.

In physics it sometimes seems to be the case that a general law is established on the basis of some single event. For instance, if a physicist can determine a certain physical constant, say, the heat-conductivity of a sample of some pure metal, in a single experiment, he will be convinced that, on other occasions, not only the sample examined but any similar sample of the same substance will, very probably, be characterizable by the same constant. But here too induction is applied. As a result of many previous observations the physicist is in possession of a universal sentence of a higher order which enables him in this case to follow an abbreviated method. This higher-order sentence reads roughly: "All (or: the following) physical constants of metals vary only slightly in time and from sample to sample."

The situation is analogous for certain conclusions drawn in psychology. If a psychologist has, as a result of some single experiment, determined that the simultaneous sounding of two specific notes is experienced as a dissonance by some specific person A, he infers (under favorable circumstances) the truth of the general sentence which states that the same experiment with A will, at other times, have the same result. Indeed, he will even venture—and rightly—to extend this result, with some probability, to pairs of tones with the same acoustic interval if the pitch is not too different from that of the first experiment. Here too the inference from a singular sentence to a general one is only apparent. Actually, a sentence inductively obtained from many observations is brought into service here, a sentence which, roughly, reads: "The reaction of any specific person as to the consonance or dissonance of a chord varies only very slightly with time, and only slightly on a not too large transposition of the chord." It thus remains the case that every general sentence is inductively established on the basis of a number of singular ones.

Finally, we must consider sentences about psycho-physical interrelations, such as for instance, the connection between physical stimulus and perception. These are likewise arrived at through induction, in this case through induction in part from physical and in part from psychological singular sentences. The most important sentences of gestalt psychology belong also to this kind.

General sentences have the character of hypotheses in relation to concrete sentences, that is, the testing of a general sentence consists in testing the concrete sentences which are deducible from it. A general sentence has content insofar and only insofar as the concrete sentences deducible from it have content. Logical analysis must therefore primarily be directed towards the examination of the latter sort of sentences.

If A utters a singular psychological sentence such as "Yesterday morning B was happy," the epistemological situation differs according as A and B are or are not the same person. Consequently, we distinguish between sentences about *other minds* and sentences about *one's own mind.* As we shall presently see, this distinction cannot be made among the sentences of inter-subjective science. For the epistemological analysis of subjective, singular sentences it is, however, indispensable.

3. Sentences about Other Minds

The epistemological character of a singular sentence about other minds will now be clarified by means of an analogy with a sentence about a physical property, defined as a disposition to behave (or respond) in a specific manner under specific circumstances (or stimuli). To take an example: a substance is called "plastic" if, under the influence of deforming stresses of a specific sort and a specific magnitude, it undergoes a permanent change of shape, but remains intact.

We shall try to carry out this analogy by juxtaposing two examples. We shall be concerned with the epistemological situation of the example taken from psychology; the parallel example about the physical property is intended only to facilitate our understanding of the psychological sentence, and not to serve as a specimen of an argument from analogy. (For the sake of convenience, where the text would have been the same in both columns, it is written only once.)

A Sentence about a property of a physical substance.	*A Sentence about a condition of some other mind.*
Example: I assert the sentence P_1: "This wooden support is very firm."	Example: I assert the sentence P_1: "Mr. A is now excited."

There are two different ways in which sentence P_1 may be derived. We shall designate them as the "rational" and the "intuitive" methods. The *rational* method consists of inferring P_1 from some protocol sentence p_1 (or from several like it), more specifically, from a perception-sentence

about the shape and color of the wooden support.	about the behavior of A, e.g., about his facial expressions, his gestures, etc., or about physical effects of A's behavior, e.g., about characteristics of his handwriting.

In order to justify the conclusion, a major premise O is still required, namely the general sentence which asserts that

when I perceive a wooden support to be of this color and form, it (usually) turns out to be firm. (A sentence about the perceptual signs of firmness.)	when I perceive a person to have this facial expression and handwriting he (usually) turns out to be excited. (A sentence about the expressional or graphological signs of excitement.)

The content of P_1 does not coincide with that of p_1, but goes beyond it. This is evident from the fact that to infer P_1 from p_1 O is required. The cited relationship between P_1 and p_1 may also be seen in the fact that under certain circumstances, the inference from p_1 to P_1 may go astray. It may happen that, though p_1 occurs in a protocol, I am obliged, on the grounds of further protocols, to retract the established system sentence P_1. I would then say something like, "I made a mistake. The test has shown

that the support was not firm, even though it had such and such a form and color."	that A was not excited, even though his face had such and such an expression."

In practical matters the *intuitive* method is applied more frequently than this rational one, which presupposes theoretical knowledge and requires reflection. In accordance with the intuitive method, P_1 is obtained without the mediation of any other sentence from the identically sounding protocol sentence p_2.

"The support is firm."	"A is excited."

Consequently, one speaks in this case of *immediate perceptions*

of properties of substances, e.g., of the firmness of supports.	of other minds, e.g., of the excitement of A.

But in this case too the protocol sentence p_2 and the system sentence P_1 have different contents. The difference is generally not noted because, on the ordinary formulation, both sentences sound alike. Here too we can best clarify the difference by considering the possibility of error. It may happen that, though p_2 occurs in my protocol, I am obliged, on the basis of further protocols, to retract the established system sentence P_1. I would then say "I made a mistake. Further tests have shown

that the support was not firm, although I had the intuitive impression that it was."	that A was not excited, although I had the intuitive impression that he was."

[The difference between p_2 and P_1 is the same as that between the identically sounding sentences p and P_1: "A red marble is lying on this table," of

an earlier example.[3] The argument of that article shows that the inference of P_1 from p_2, if it is to be rigorous, also requires a major premise of general form, and that it is not in the least simple. Insofar as ordinary usage, for convenience's sake, assigns to both sentences the same sequence of words, the inference is, in practice, simplified to the point of triviality.]

Our problem now is: *what does sentence P_1 mean*? Such a question can only be answered by the presentation of a sentence (or of several sentences) which has (or which conjointly have) the same content as P_1. The viewpoint which will here be defended is that P_1 has the same content as a sentence P_2 which asserts the existence of a physical structure characterized by the disposition to react in a specific manner to specific physical stimuli. In our example, P_2 asserts the existence of that physical structure (micro-structure)

of the wooden support that is characterized by the fact that, under a slight load, the support undergoes no noticeable distortion, and, under heavier loads, is bent in such and such a manner, but does not break.

of Mr. A's body (especially of his central nervous system) that is characterized by a high pulse and rate of breathing, which, on the application of certain stimuli, may even be made higher, by vehement and factually unsatisfactory answers to questions, by the occurrence of agitated movements on the application of certain stimuli, etc.

On my view, there is here again a thoroughgoing analogy between the examples from physics and from psychology. If, however, we were to question the experts concerning the examples from their respective fields, the majority of them nowadays would give us thoroughly non-analogous answers. The identity of the content of P_2

and of the content of the physical sentence P_2 would be agreed to as a matter of course by all physicists.

and of the content of the psychological sentence P_1 would be denied by almost all psychologists (the exceptions being the radical behaviorists).

The contrary view which is most frequently advocated by psychologists is that, "A sentence of the form of P_1 asserts the existence of a state of affairs not identical with the corresponding physical structure, but rather, only accompanied by it, or expressed by it. In our example:

P_1 states that the support not only has the physical structure described by P_2, but that, besides, there exists in it a certain force, namely its *firmness.*

P_1 states that Mr. A not only has a body whose physical structure (at the time in question) is described by P_2, but that—since he is a *psychophysical being*—he has, besides, a consciousness, a certain power or entity, in which that excitement is to be found.

This firmness is not identical with the physical structure, but stands in some parallel relation to it in such a manner that the firmness exists when and only when a physical structure of the characterized sort exists.

This excitement cannot, consequently, be identical with the cited structure of the body, but stands in some parallel relation (or in some relation of interaction) to it in such a manner that the excitement exists when and only when (or at least, frequently when) a physical, bodily structure of the characterized sort exists.

Because of this parallelism one may consider the described reaction to certain stimuli—which is causally dependent

Because of this parallelism one may consider the described reaction to certain stimuli to be an *expression* of excitement.

upon that structure—to be an *expression* of firmness.

Firmness is thus an occult property, an obscure power which stands behind physical structure, appears in it, but itself remains unknowable."

Excitement, or the consciousness of which it is an attribute, is thus an occult property, an obscure power which stands behind physical structure, appears in it, but itself remains unknowable."

This view falls into the error of a hypostatization as a result of which a remarkable duplication occurs: besides or behind a state of affairs whose existence is empirically determinable, another, *parallel* entity is assumed, whose existence is not determinable. (Note that we are here concerned with a sentence about other minds.) But—one may now object—is there not really at least one possibility of testing this claim, namely, by means of the protocol sentence p_2 about the intuitive impression of

the firmness of the support?

the excitement of A?

The objector will point out that this sentence, after all, occurs in the protocol along with the perception sentence p_1. May not then a system sentence whose content goes beyond that of P_2 be founded on p_2? This may be answered as follows. A sentence says no more than what is testable about it. If, now, the testing of P_1 consisted in the deduction of the protocol sentence p_2, these two sentences would have the same content. But we have already seen that this is impossible.

There is no other possibility of testing P_1 except by means of protocol sentences like p_1 or like p_2. If, now, the content of P_1 goes beyond that of P_2, the component not shared by the two sentences is not testable, and is therefore meaningless. If one rejects the interpretation of P_1 in terms of P_2, P_1 becomes a metaphysical pseudo-sentence.

The various sciences today have reached very different stages in the process of their decontamination from metaphysics. Chiefly because of the efforts of Mach, Poincaré, and Einstein, physics is, by and large, practically free of metaphysics. In psychology, on the other hand, the work of arriving at a science which is to be free of metaphysics has hardly begun. The difference between the two sciences is most clearly seen in the different attitudes taken by experts in the two fields towards the position which we rejected as metaphysical and meaningless. In the case of the example from physics, most physicists would reject the position as anthropomorphic, or mythological, or metaphysical. They thereby reveal their anti-metaphysical orientation, which corresponds to our own. On the other hand, in the case of the example from psychology (though, perhaps, not when it is so crudely formulated), most psychologists would today consider the view we have been criticizing to be self-evident on intuitive grounds. In this one can see the metaphysical orientation of psychologists, to which ours is opposed.

NOTES

1. Carnap, "Die Physikalische Sprache als Universalsprache der Wissenschaft," *Erkenntnis* II, 1931, pp. 432–65. [The English translation of this article by Max Black was published as a monograph under the title *The Unity of Science* (London: Kegan Paul, 1934).]
2. Ibid., p. 449 ff. (*The Unity of Science,* p. 68 ff.).
3. See Ibid., p. 460 (*The Unity of Science*, p. 92).