On Protocol Sentences*

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In the preceding article of the same title, Otto Neurath has again
raised the question of protocol sentences. This question constitutes
the core problem of the logic of science, that is of the theory of
knowledge, for it comprises the questions dealt with under the terms
"empirical foundation", "testing" and "verification". For
physicalism it is especially urgent to justify protocol sentences and
thereby the experiential foundation of science. This is where most
doubt about physicialism begins, and indeed it is the really critical
point for this view.

   Neurath opposes certain features of the view about protocol
sentences I advocated in my article on the physicalistic language
(*Erkenntnis*, vol. II, p. 432). He wants to contrast it with another
view according to which protocol sentences are in a different form
and are manipulated according to other procedures. My opinion
here is that this is a question, not of two mutually inconsistent views,
but rather of *two different methods for structuring the language of science
both of which are possible and legitimate*. In what follows both procedures
will be described more precisely, and this will show that each of
them has certain advantages. The first language form affords greater

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freedom; I discussed it in my earlier article. The second language form has the advantage of greater unity of system. It appears that Neurath is the first to have recognized the possibility of this second procedure, which will be of crucial significance for the further development of the philosophy of science. The difference can briefly be characterized in the following way. In the first procedure protocol sentences lie outside the system language; here the form of the protocol sentences is arbitrary. Special rules will be constructed for translating protocol sentences into system sentences. In the second procedure (Neurath) protocol sentences are found inside the language of our system; here the form of protocol sentences is not arbitrary, but rather bound to the syntax of our system language. There are no special translation rules here. In order not only to present the abstract characteristics of the two procedures (as one might do in a formal comparison), but also to make them intelligible, we will start each discussion with a practical situation, from which each procedure will develop clearly.

The questions of whether the protocol sentences occur outside or inside the system language and of their exact characterization are, it seems to me, not answered by assertions but rather by postulations. Although earlier (*Erkenntnis*, II, p. 438) I left this question open and indicated only a few possible answers, I now think that the different answers do not contradict each other. They are to be understood as suggestions for postulates; the task consists in investigating the consequences of these various possible postulations and in testing their practical utility.

1. THE FIRST LANGUAGE FORM: PROTOCOL SENTENCES OUTSIDE THE SYSTEM

Assume we find a machine which reacts in certain situations by displaying signal-disks. The disks might bear the numerals '1', '2', etc; instead of this they could also be arbitrary meaningless characters. We can determine the following by observation without knowing the internal mechanism of the machine. The two signals '1' and '4' are only jointly visible if it is currently raining lightly outside; '1' and '5' when it is raining hard; '2' and '4' if it is snowing lightly; '2' and '5' when it is snowing hard; '3' and '4' if it is hailing lightly; the combination '3' and '5' has not yet been observed. On the basis of this we can construct the following dictionary:

1   it is raining
2   it is snowing
3   it is hailing
4   lightly
5   hard

With the help of this dictionary we can translate certain signal com-
binations into sentences of our language, e.g., '1,5', into "It is
raining hard". It is important, moreover, that we can translate com-
binations, for example '3,5' into "It is hailing hard", which have
not been previously observed.

   Whether it concerns a machine which is so built as to give signals,
or any other object exhibiting regular observable reactions under
specified conditions, makes no fundamental difference. The object
can also be an organism, e.g., a tree which perhaps by the shape
and placement of its branches reacts to certain properties of the
soil and air. Even here we can use the reaction as a signal and
construct a system of rules for the translation of the signals into
sentences of our language.

   Basically the same situation is present when we find a human
who reacts in certain circumstances with specific verbalizations.
Assume that we meet a man whose speech sounds do not belong
to any known language and that we establish the following by obser-
vation (in doing which we confine ourselves for the sake of brevity
to examples of the simplest reactions). The man says: "re bim"
if it is raining lightly; "re bum" if it is raining hard; "sche bim"
or "sche bum" if it is snowing lightly or hard respectively; "he
bim" if it is hailing lightly.

   On the basis of this we construct the following dictionary:

re	it is raining
sche	it is snowing
he	it is hailing
bim	lightly
bum	hard

With the help of this dictionary we can translate certain sound se-
quences of the man—we call them then statements—into sentences
of our language; and certainly under certain circumstances also those
which we have not yet heard in this combination, e.g., "he bum"
into "it is hailing hard" .

   The signals of the machine and the statements of the man are
treated like sentences of a language in that translation rules are con-
structed for them. We call them therefore "protocol sentences" of
the "protocol language" of the machine or of the foreign man and
distinguish this language from the language of our system. Generally
every observable process (of a machine, of a man or of whatever),
for which a translation rule has been constructed, is valid as a pro-
tocol sentence. If different rule systems hold for the various machines
or men, then we say they have different protocol languages. One
such language can then be called "intersubjective"if its sentences

for at least two bodies appear as reactions to each other; otherwise they are "subjective" or "monological". (Naturally one can also proceed so that the signals themselves are not translated, but only the sentences about the appearance of signals are used, e.g., "the machine is now showing '1'," "the man is now saying 're' ". We can proceed in this way within the second language form. That is certainly legitimate, as is the described procedure of the first language form also.)

Sometimes the translation of an presented signal or of a statement yields a sentence which we can observe to be incorrect. For example, the man saying: "re", while we determine that it is not raining but that rainlike sounds are heard or rainlike processes are seen. It appears then that the frequency of such a disagreement differs for the various sentences of the foreign protocol language. For example, when the translation of a specific protocol sentence into the system sentence "this is black" leads less often to a false sentence than in the previous example. We can thereby assign to the different sentence forms of the protocol language a higher or lower degree of reliability respectively, according to whether we ascertain disagreement more or less often in them. (If desired, we can call the more reliable sentences "more primitive" ones.) However even with protocol sentences of the kind in the last example (translation: "this is black") the translation occasionally yields a false sentence (namely in the cases one usually characterizes as dream-statements, hallucinatory statements, lies or the like; in our account, however, we are not yet in possession of these concepts). In the examples discussed so far translation rules lead from protocol sentences to sentences which refer to things in the environment of the man in question; here we will speak of "T-rules" and "T-sentences". Observation teaches that with the use of T-rules the acquired T-sentences are not very reliable. This determination can induce us to construct other kinds of translation rules which we call "B-rules". These yield "B-sentences", namely sentences which refer to the momentary state of the body B of the person in question. For example, the protocol sentence "re" is translated into the B-sentence: "The body B is rain-observing". Thus the physical state "rain-observing" can perhaps be characterized as being found in certain conditions (namely when it is raining) or if rainlike audible or visible processes are present, and the eyes or ears of B are in the appropriate relative position to these processes) and as stimulating such and such observable bodily reactions (e.g., on the appropriate stimulus, perhaps questions, under appropriate circumstances the statement "re"). From the B-sentence we can infer with proba-

bility but not with certainty the corresponding T-sentence (in the example: "It is raining"); the probability increases if it is known to us that the environment of B is in a "normal" state. The inference from the B-sentence to the T-sentence is nothing but the usual inference from the effect to a probable cause. (cf. here also the example in *Erkenntnis*, vol. II, p. 460; p corresponds to the protocol sentence, P_1 to the T-sentence, P_2 to the B-sentence.)

As the protocol of B we take the series of his protocol statements as they are presented without making a selection. Each protocol sentence can be translated into our system language in accordance with the B-rules as well as with the T-rules. The T-translation is the ordinary one and for practical life the more suitable, since customarily what matters for us is to learn something about the environment of B. The B-translation is the more reliable; it is preferred when we are concerned mainly with certainty, for example, with critical testing. In both cases we use the statement of our neighbor's B to enrich our knowledge about the processes (physical, intersubjectively comprehensible processes) just as we evaluate the statements of the signal machine for the same purpose.

Now what if the machine or a person Kalon makes two mutually contradictory statements (Neurath p. 209)? Since the signals of the machine and the statements of B are to be understood at the outset as processes and not as sentences in the language, then there is for them literally no contradiction. There can be a contradiction only between the two sentences into which we translate the two signals or the two statements. (Example: 1. The machine shows the signals, 1,4,5; translation: "It is raining lightly", "It is raining hard". 2. At the same time B makes the statements "re bum" and "re bim"—or also "non-re" in which "non" is a noise which is associated by the translation rules with the word "not".) If such a case occurs then we conclude that we have erred in the interpretation of the signals. That will induce us to adjust the rules of translation. [In the examples: 1. Either the combination 1,4 occurs also with hard rain under special conditions which would be determined by closer examination, or the combination 1,5 also occurs with light rain under special conditions: if the "special conditions" are ascertained, then perhaps in the first case the translation for 1,4 will be adjusted as follows: "It is raining lightly, or it is raining hard and such and such conditions are present". 2. The B-rule will be changed so that the B-sentence for "re" reads: "Either (probably) B is rain-observing; or (less frequently) such and such special conditions are present (e.g., B is lying or B's hand has been forced by somebody else to write "re")".]

Assume that a sentence which we have obtained by translating a protocol sentence turns out to be incompatible with our background knowledge, e.g., with other already admitted sentences. Depending on more immediate conditions we will either modify the admitted sentences—especially if it is a question not of translation but of hypothetically established sentences—or else modify our translation rules for the machine or for B. Since (in the present first procedure) the protocol sentences lie outside the system language, then it is always possible, either through the modification of the remaining sentences (to which also belongs the sentence that B formed with his speech organs, the sound "re") or by modification of the translation rules to make present protocol sentences consistent at any given time. The protocol sentences remain unchanged with the described procedure. It is a question of postulation whether one wants to choose this procedure in place of the other, whereby in the case of incompatibility the protocol sentences in question can be explained under certain circumstances as "false" and eliminated.

In the sense of the first view presented we can also understand one's own protocol statements as signals and translate them according to postulated translation rules into the physicalist language. So perhaps the T-translation for my protocol statement "Here is a dog" will read: "Here is an example of the species canis familiaris or an example resembling this species but of such and such (similar) species"; the B-translation is still more complex. The difference between the protocol sentences and the system sentences will be especially clear if a word is used which belongs only to colloquial speech (which serves for the protocol language) and does not at the same time belong to the language of science (which serves as the language of the system). Let us take as an example the statement "It is musty here". The problem of " physicalizing" (cf. *Erkenntnis*, vol. II, pp. 444 ff.) consists in establishing through a systematic series of observations under what outside conditions "it appears musty to me", i.e., under what conditions I am disposed toward the statement "It is musty here". If these conditions are established, then we construct the sentence that designates it as the T-translation for that protocol sentence.

Accordingly, work in the system of science has the following form. Inside the system language there are universal sentences, the so-called "laws of nature", and concrete sentences; outside the system language there are signals which are understood as "protocol sentences" of a "protocol language" of the machine or man in question. T- or B-rules will be set up for translating from the protocol language into the system language. Concrete system sentences can be acquired from the given protocol sentences at any time with the

help of these rules. By relying on these concrete sentences further concrete and universal system sentences will be constructed, and indeed as hypotheses, i.e., without strict derivation and thereby without the possibility of complete verification. From these sentences (the translated concrete, the hypothetical concrete, and the hypothetical universal) further concrete sentences are acquired by derivation. These derived sentences—and indirectly thereby also the hypothetically established sentences—can be empirically tested under certain conditions; the testing consists in a comparison with concrete sentences which are produced by translation from protocol sentences. Thereby, thus, either a corroboration or a refutation of the system sentence to be tested can be achieved. Corroboration (confirmation, verification) of a system sentence means therefore agreement with protocol sentences; corroboration of protocol sentences cannot be required (although this is the case for the aforementioned system sentences which asserted that the signal process in question did in fact take place.) If we encounter a contradiction in the system, then we make a change either in the hypothetically established sentences or in the translation rules.

Neurath (pp. 211 f.) and Zilsel (pp. 144 f.) oppose the use of such expressions as "I", "one's own protocol sentences", "others' protocol sentences" (in the material mode of speech: "autopsychological", "heteropsychological"). Certainly in philosophy much nonsense has been generated by the "I". In our antimetaphysical discussions however these expressions are nothing but abbreviations. These abbreviations are convenient and belong to ordinary linguistic usage, so that everybody knows their translation. Hence, it seems to me that their rejection is unnecessary; it is enough to demand that everyone who uses such expressions be able to give their translation in every case. ("The processing of one's own or others' protocols happens such and such" means: "If S_1 processes the protocol of S_1 or S_2 respectively. . ."; further examples of translation are given by Zilsel with whom I am in complete agreement.)

2. THE SECOND FORM OF LANGUAGE: PROTOCOL SENTENCES INSIDE THE SYSTEM LANGUAGE

We begin as before with consideration of the signal machine. In case we are in a position not only to observe the signal-disks, but to alter them, then it may seem useful to us in place of the discovered signals to write such words or signals of our system on the signal-disks as we have associated with those figures on the basis of the series of observations; for example, on the first disk instead of "1": "it is raining" etc. The machine itself makes, if occasion arises,

the statement "it is snowing—hard", which already has the form
of a system sentence. With a machine thus altered we no longer
deal with signals that lie outside the system language; we save
ourselves the task of translating.

Fundamentally the same thing holds for the sounds of the man
B. In case we succeed not only in observing his noises, but in chang-
ing his noise dispositions, then it will be useful to proceed in the
following way. We prompt B to replace the reaction "re" by the
reaction "it is raining" and correspondingly for the remaining
sounds. That is an operation (habituation, retraining, "discondi-
tioning" and "conditioning", so to speak "transconditioning")
which, as is well known, succeeds with many animals and human
beings in many cases and in others not. We shall now assume that
this operation is successful within the circle in which intersubjective
science can be constructed and applied. Then there is within this
circle only the unified system language, and no longer the private
languages as with the first procedure ("re", etc.).

Neurath was the first to draw attention to the possibility of the
second procedure just described; it is in my opinion however only
one of many equally legitimate ones. In particular Neurath seems
to have a language form in mind which is not in complete agree-
ment with the second language form described here. In the "con-
glomerations" of his "trivial language" he appears to allow the
possibility of free language forms and perhaps also the appearance
of arbitrary expressions in the protocol sentences; that however would
go more in the direction of the first language form. Another dif-
ference will be discussed later.

While in the first language form the forms of certain spontan-
eously occurring reactions are interpreted as protocol sentences, in
the second language form certain concrete sentences of the language
system are taken as protocol sentences, i.e., as a testing basis, as
sentences beyond which one does not reach in the testing of system
sentences (as much for universal sentences as for the remaining con-
crete sentences). The question now reads: which concrete sentences
are protocol sentences?

As already stated, the question of the form of protocol sentences
is to be answered not by an assertion, but by a postulation. That
also holds for the same question within the second language form;
thus for the question of which concrete sentences of the physicalistic
language are to be taken as protocol sentences. Essentially the choice
here is between the following two options: A) with restriction: it
will be postulated that concrete sentences of such and such com-
pletely specified form shall serve as protocol sentences; B) without
restriction: it will be specified that any concrete sentence may be

taken under certain circumstances as a protocol sentence. Neurath chooses option A. Within A there are still various possibilities for conditions of the protocol sentence form. The condition selected by Neurath, that in any protocol sentence the name of the protocaller and an expression like "perceives", "sees" or the like should occur, would be practical with the choice of option A. On the other hand it seems doubtful whether the suggested protocol sentence form especially proposed by him with its three nested components is practical; it has the defect, from the point of view of syntax, that a sentence which refers to another contains the other as a clause. It is important that it is not a question of the correctness of assertions but rather of the practicality of certain postulates. We do not wish to delve deeper into the question of whether A or B is the more suitable option; nor into the elaboration of the various possibilities for the postulation of protocol sentences forms in case A.

In what follows option B shall be adopted. Karl Popper developed the possibility of this procedure for me in conversation. It is very much to be hoped that his instructive investigations about "Deductivism and Inductivism", the results of which he communicated to me, will soon find an opportunity for publication. They form an important contribution to the clarification of currently pressing questions in the logic of science: the character of natural laws as hypotheses and methods of empirical testing. Proceeding from a point of view different from Neurath's, Popper has developed option B as a component of his system. Both interpretations still seem basically similar to me in spite of their existing differences. In my opinion the second language form can be realized with special ease using Popper's suggestion of option B.

Every concrete sentence of the physicalistic system language can serve under certain circumstances as a protocol sentence. Let L be a law (i.e., a universal sentence of the system language). For testing purposes sentences are to be derived from L which are above all concrete and related to specific space-time positions (through the insertion of concrete values for the space-time coordinates x,y,z,t which appear in L as free variable). From these concrete sentences with the help of other laws and logico-mathematical inference rules further concrete sentences are derivable, until one arrives at sentences one wants to admit in the case immediately at hand. Thereby it is a matter of decision which sentences one wants to use at various times as such endpoints of reduction and thus as protocol sentences. As soon as one wants—should doubt appear or if one wishes to lay a more secure foundation for scientific theses—one can take the sentences previously interpreted as endpoints and reduce them in turn to other sentences which are interpreted as endpoints by decree.

In no case, however, is one forced to stop at any specified place. From any sentence one can reduce still further; there are no absolute initial sentences for the structure of science.

EXAMPLE. Testing of the law L: "At an arbitrary place at an arbitrary time: if T is the period of an irregular pendulum of length 1 in gravity field g, then $T = 2\pi \sqrt{1/g}$." "Now perhaps my test protocol reads: "(P_1:) Here (in a laboratory on the surface of the earth) is a pendulum of such and such a kind; (P_2:) the length of the pendulum is 245.3 cm. (P_3:) I push lightly, the pendulum begins to swing a little. I let the pendulum swing freely without further contact. (P_4:) I observe 20 swings; at the beginning the clock reads: 5 hr. 37 min. 4 sec.; after 20 swings: 5 hr. 38 min. 7 sec." From L with the help of the sentence "On the surface of the earth, $g = 981$ cm. sec^{-2}" we can derive: "At an arbitrary point on the earth's surface $T = 2\pi \sqrt{1/981}$". From this with the help of protocol sentences P_1 and P_2 we can derive: "The period T_a of this pendulum comes to $2\pi \sqrt{245.3/981}$; from this according to mathematical theorems (which belong to the rules of logical inference): "$T_a = 2\pi \sqrt{1/4} = \pi = 3.14$". Let T_b be the observed period; from P_4 will be derived: "$20T_b = 63$", and from this "$T_b = 3.15$". The difference between the period calculated according to law L and the observed period comes to 0.01 sec.; this is small (in relation to the observational exactitude of the small experimental set up). We shall therefore regard the protocol as a corroborating case for L.

We want now to clarify the relativity of protocol sentences. As soon as one of the sentences of a protocol is simply no longer recognized, but rather should be tested further, we reduce it to other sentences. The time statement in P_4 can for example be reduced to the following sentences; (Q_1:) "this instrument is (according to the instruction of the firm . . .) a precisely running clock"; (Q_2:) "At the beginning of the experiment the first pointer stood at 5, the second at 37, the third on 4". If desired we can reduce Q_1 further to the sentence which expresses the observation of a witness from an observatory, or a sentence, which describes a calibration proposed by ourselves. We can reduce Q_2 to the following sentences; (R_1:) "I have perceived such and such a meter reading", (R_2:) "Here is an occurrence in a physiological laboratory according to which my reading of the second hand as a rule shows no greater error than . . . ."—If need be, in order to arrive at more accurately based results, we can arrange the experimental set-up in different ways from the beginning and thereby obtain another more comprehensive protocol. For example we can get the help of a second observer of the pendulum and clock and make use of his protocol sentences;

or a physiologist who is with me before, during, and after the experiment is observed, and whose protocol corroborates that I had no fever, that I am not under the influence of a narcotic, that I quietly observed and immediately after the observation wrote the time report P_4, and so on. On the basis of further longer observations of my behavior, statements about my conscientiousness during the formation of scientific protocols will be made. From this a statement about my trustworthiness will be derived. With the help of this statement and the sentences of the physiologist, my protocol sentences P_4 (with such and such degree of certainty) will be confirmed.

The example makes it clear that with this procedure no sentence is an absolute endpoint for reduction. Sentences of all kinds can if necessary be reduced to others. Reduction proceeds at any given time until one arrives at sentences that one acknowledges by decision. Thereby everything takes place in the intersubjective, physicalistic language. Even the observation sentences of the protocoling subject S are nothing but equally important links in the chain. In practical procedure S will frequently be completely satisfied with his own. However, that has no fundamental significance, rather it occurs only because the intersubjective testing of sentences about perceptions (brain processes) is relatively intricate and difficult and in many cases with trained scientific observers does not seem so necessary as the testing of sentences still unreduced to observation sentences. Usually in the practical procedure of science one goes back only in critical cases to sentences about perception, while most of the time—as in the protocol of the abovementioned example— one is satisfied with sentences about observed things, i.e., taking these sentences as protocol sentences. With the procedure described here [second language form, option B (Popper), in contrast to option A (Neurath)] the protocols can thus be valid as protocols in the strong sense in the form that they are actually written down by physicists, biologists, geographers, sociologists, etc. (provided that especially sociologists at least keep their metaphysics out of their factual reports, if not out of their theories). Thereby the protocols may contain concrete sentences of an arbitrary kind: sentences about perceptions or feelings, sentences about observed processes or about unobserved processes inferred from observed processes, sentences about processes reported by others, etc. If a tentative protocol sentence is not consistent with the remaining sentences of the protocol or with other concrete sentences which are already admitted, then we have the choice either of modifying this protocol sentence or the group of other concrete sentences in question, or to modify the group of laws which helped derive these sentences. With the

latter choice all of the—already completed or initiated—testing of these sentences as well as of protocol sentences will be evaluated, insofar as it is practically feasible and leads to relatively certain results.

This article is intended primarily for those who basically accept physicalism but still search for clarification in specific isolated questions. For those who doubt the thesis of physicalism only a few short remarks should be made in order to answer two repeatedly advanced objections. The first of these is the objection: "All testing still consists in reduction to the content of experiences; of this however there is absolutely no discussion; the physicalist may clearly recognize colors: should the observation sentences refer to the observer's body or to his experiences?" The question is put in a material mode of speech and in this form it is not correctly answerable. In the formal mode of speech one can say: The name "B" of the body of the person in question appears in the observation sentences; such an observation sentence can also be formulated so that the words "observe", "see", "hear" or the like occur. The confusions and contradictions that one easily falls into when dealing with that question in the material mode have been discussed elsewhere (*Erkenntinis*, vol. II, pp. 453-457).

The second objection is: "My perception of red, my hunger, my anger are presented only to me but not to my neighbors. However, in physicalism all sentences are intersubjective. Where do we locate the fact about the immutable separation of subjects from each other?" This fact should not be denied; but it must be carefully formulated. "S is hungry" is synonymous with "The nervous system of S in in a hunger state"; "S sees red" is synonymous with "The nervous system of S is in a red-seeing state". "Only S is immediately aware of his hunger" means: "Only S is able to make the statement 'S is hungry' directly on the basis of hunger, i.e., with no physical causal connection with processes outside of S's body". This sentence is correct, but it is nothing more than a special case of the universal sentence: "If A is an arbitrary physical system, and V_1 is an arbitrary process of A, then only a process V_2 of A, and never a process V_3 outside A, can ever be connected with V_1 by a "direct" causal chain, i.e., by one that never leaves A". But this is trivial. Only the speech organs of S, and not those of anyone else, can be influenced by the stomach and brain states of S without detour through a process outside S.

This is connected with the following—physicalistically considered, and likewise obvious—fact. If S_1 (speaking, writing, or thinking) advances and tests a specific sentence, then that happens immediately only on the basis of his own experience. Even if S_1 evaluates statements of S_2 this always happens through the mediation of S_1's

own perceptions, perhaps his hearing of S_2's statements. (By the expressions "thoughts", "perceptions", "hearing" obviously the physical processes in the nervous system of S_1 are meant.) More precisely: the causal chain from the perception of S_2 to the testing thought or discourse of S_1 occurs by way of the speech act of S_2, the process on the sense organs of S_1 and the perception process on the brain of S_1. This fact, that testing rests on the perceptions of the tester, forms the legitimate kernel of truth in "methodological solipsism"; I concede however that one can have misgivings about the retention of this terminology because of its idealistic connotations.

3. COMPARISON OF THE TWO LANGUAGE FORMS

We have investigated two different language forms, and seen that each of them can be carried through consistently, and is therefore legitimate. The first language form, in which the protocol sentences lie outside the system language, has the advantage that it places no demands regarding the form of protocolling: here the utterances of a Negro in an unknown language, the utterances of a child, of an animal, or of a machine can be evaluated in the same way after appropriate translation rules have been constructed on the basis of satisfying observations. The second language form (Neurath, Popper), in which the protocol sentences belong to the language of the system, has the advantage that one deals only with a unified language, so that no rules of translation are necessary.

In all theories of knowledge up until now there has remained a certain absolutism: in the realistic ones an absolutism of the object, in the idealistic ones (including phenomenology) an absolutism of the "given", of "experience", of the "immediate phenomena". There is also a residue of this idealistic absolutism in positivism; in the logical positivism of our circle—in the writings on the logic of science (theory of knowledge) of Wittgenstein, Schlick, Carnap published up to now—it takes the refined form of an absolutism of the ur-sentence ("elementary sentence", "atomic sentence"). Neurath has been the first to turn decisively against this absolutism, in that he rejected the unrevisability of protocol sentences. From other starting points Popper succeeded a step further: in his testing procedure there is no last sentence; his system describes therefore the most radical elimination of absolutism. It seems to me that absolutism can be eliminated, not only with the second, but also with the first of the two language forms dealt with here. However, it might be correct that with the use of the second language forms, and especially of Popper's option B, that the danger is still less that "younger men" in the search for protocol sentences "will fall into metaphysical dead ends" (Neurath p. 207). In weighing the various points mentioned, the second language form with option B as de-

scribed here, appears to me to be the most suitable among the forms of the language of science which are currently discussed in the philosophy of science. (They are usually formulated not as suggestions for a language form, but as a "theory of the structure of experience".)

These investigations in the logic of science do not end with the elimination of absolutism, for we have shown only that it must be purified in one definite but decisive point. The elimination of impurities is important, even indispensable, but it only forms the negative side of the task. Now that we are working in a more positive and unified way, the philosophy of science will be developed even further.