Meaning and Synonymy in Natural Languages

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1. Meaning Analysis in Pragmatics and Semantics

The analysis of meanings of expressions occurs in two fundamentally different forms. The first belongs to *pragmatics*, that is, the empirical investigation of historically given *natural languages*. This kind of analysis has long carried out by linguists and philosophers, especially analytic philosophers. The second form was developed only recently in the field of symbolic logic; this form belongs to *semantics* (here understood in the sense of pure semantics, while descriptive semantics may be regarded as of pragmatics), that is, the study of constructed *language systems* given by their rules.

The theory of the relations between a language—either a natural language a language system—and what language is about may be divided into two parts which I call the theory of extension and the theory of intension, respectively.[1] The first deals with concepts like denoting, naming, extension, and related ones. (For example, the word 'blau' in German, and likewise the predicate '*B*' in a symbolic language system if a rule assigns to it the same meaning, denote any object that is blue; its extension is the class of all blue objects; 'der Mond' is a name of the moon; the sentence 'der Mond ist blau' is true if and only if the moon is blue.) The theory of intension deals with concepts like intension, synonymy, analyticity, and

related ones; for our present discussion let us call them "*intension concepts*." (I use 'intension' as a technical term for the meaning of an expression or, more specifically, for its designative meaning component; see below. For example, the intension of 'blau' in German is the property of being blue; two predicates are synonymous if and only if they have the same intension; a sentence is analytic if it is true by virtue of the intensions of the expressions occurring in it.)

From a systematic point of view, the description of a language may well begin with the theory of intension and then build the theory of extension on its basis. By learning the theory of intension of language, say German, we learn the intensions of the words and phrases and finally of the sentences. Thus the theory of intension of a given language *L* enables us to *understand* the sentences of *L*. On the other hand, we can apply the concepts of the theory of extension of *L* only if we have, in addition to the knowledge of the theory of intension of *L*, also sufficient empirical knowledge of the relevant facts. For example, in order to ascertain whether a German word denotes a given object, one must first understand the word, that is, know what is its intension, in other words, know the general condition which an object must fulfill in order to be denoted by this word; and secondly he must investigate the object in question in order to see whether it fulfills the condition or not. On the other hand, if a linguist makes an empirical investigation of a language not previously described, he finds out first that certain objects are denoted by a given word, and later he determines the intension of the word.

Nobody doubts that the pragmatical investigation of natural languages is of greatest importance for an understanding both of the behavior of individuals and of the character and development of whole cultures. On the other hand, I believe with the majority of logicians today that for the special purpose of the development of logic the construction and semantical investigation of language systems is more important. But also for the logician a study of pragmatics may be useful. If he wishes to find out an efficient form for a language system to be used, say, in a branch of empirical science, he might find fruitful suggestions by a study of the natural development of the language of scientists and even of the every. day language. Many of the concepts used today in pure semantics were indeed suggested by corresponding pragmatical concepts which had been used for natural languages by philosophers or linguists, though usually without exact definitions. Those semantical concepts were, in a sense, intended as explicata for the corresponding pragmatical concepts.

In the case of the semantical intension concepts there is an additional motivation for studying the corresponding pragmatical concepts. The reason is that some of the objections raised against these semantical concepts

concern, not so much any particular proposed explication, but the question of the very existence of the alleged explicanda. Especially *Quine's* criticism does not concern the formal correctness of the definitions in pure semantics; rather, he doubts whether there are any clear and fruitful corresponding pragmatical concepts which could serve as explicanda. That is the reason why he demands that these pragmatical concepts be shown to be scientifically legitimate by stating empirical, behavioristic criteria for them. If I understand him correctly, he believes that, without this pragmatical substructure, the semantical intension concepts, even if formally correct, are arbitrary and without purpose. I do not think that a semantical concept, in order to be fruitful, must necessarily possess a prior pragmatical counterpart. It is theoretically possible to demonstrate its fruitfulness through its application in the further development of language systems. But this is a slow process. If for a given semantical concept there is already a familiar; though somewhat vague, corresponding pragmatical concept and if we are able to clarify the latter by describing an operational procedure for its application, then this may indeed be a simpler way for refuting the objections and furnish a practical justification at once for both concepts.

The purpose of this paper is to clarify the nature of the pragmatical concept of intension in natural languages and to outline a behavioristic, operational procedure for it. This will give a practical vindication for the semantical intension concepts; ways for defining them, especially analyticity, I have shown in a previous paper.[2] By way of introduction I shall first (in §2) discuss briefly the pragmatical concepts of denotation and extension; it seems to be generally agreed that they are scientifically legitimate.

2. The Determination of Extensions

We take as example the German language. We imagine that a linguist who does not know anything about this language sets out to study it by observing the linguistic behavior of German-speaking people. More specifically, he studies the German language as used by a given person Karl at a given time. For simplicity, we restrict the discussion in this paper mainly to predicates applicable to observable things, like 'blau' and 'Hund.' It is generally agreed that, on the basis of spontaneous or elicited utterances of a person, the linguist can ascertain whether or not the person is willing to apply a given predicate to a given thing, in other words, whether the predicate denotes the given thing for the person. By collecting results of this kind, the linguist can determine first, the extension of the predicate "Hund" within a given region for Karl, that is, the class of the things to which Karl is willing to apply the predicate, second, the extension of the

contradictory, that is, the class of those things for which Karl denies the application of 'Hund,' and, third, the intermediate class of those things for which Karl is not willing either to affirm or to deny the predicate. The size of the third class indicates the degree of vagueness of the predicate 'Hund,' if we disregard for simplicity the effect of Karl's ignorance about relevant facts. For certain predicates, e.g., 'Mensch,' this third class is relatively very small; the degree of their extensional vagueness is low. On the basis of the determination of the three classes for the predicate 'Hund' within the investigated region, the linguist may make a hypothesis concerning the responses of Karl to things outside of that region, and maybe even a hypothesis concerning the total extension in the universe. The latter hypothesis cannot, of course, be completely verified, but every single instance of it can in principle be tested. On the other hand, it is also generally agreed that this determination of extension involves uncertainty and possible error. But since this holds for all concepts of empirical science, nobody regards this fact as a sufficient reason for rejecting the concepts of the theory of extension. The sources of uncertainty are chiefly the following: first, the linguist's acceptance of the result that a given thing is denoted by 'Hund' for Karl may be erroneous, e.g., due to a misunderstanding or a factual error of Karl's; and, second, the generalization to things which he has not tested suffers, of course, from the uncertainty of all inductive inference.

3. The Determination of Intensions

The purpose of this paper is to defend the thesis that the analysis of intension for a natural language is a scientific procedure, methodologically just as sound as the analysis of extension. To many linguists and philosophers this thesis will appear as a truism. However, some contemporary philosophers, especially Quine[3] and White[4] believe that the pragmatical intention concepts are foggy, mysterious, and not really understandable, and that so far no explications for them have been given. They believe further that, if an explication for one of these concepts is found, it will at best be in the form of a concept of degree. They acknowledge the good scientific status of the pragmatical concepts of the theory of extension. They emphasize that their objection against the intension concepts is based on a point of principle and not on the generally recognized facts of the technical difficulty of linguistic investigations, the inductive uncertainty, and the vagueness of the words of ordinary language. I shall therefore leave aside in my discussion these difficulties, especially the two mentioned at the end of the last section. Thus the question is this: *granted that the linguist can determine the extension of a given predicate, how can he go beyond this and determine also its intension?*

The technical term 'intension,' which I use here instead of the ambiguous word 'meaning,' is meant to apply only to the cognitive or designative meaning component. I shall not try to define this component. It was mentioned earlier that determination of truth presupposes knowledge of meaning (in addition to knowledge of facts) ; now, cognitive meaning may be roughly characterized as that meaning component which is relevant for the determination of truth. The noncognitive meaning components, although irrelevant for questions of truth and logic, may still be very important for the psychological effect of a sentence on a listener, e.g., by emphasis, emotional associations, motivational effects.

It must certainly be admitted that the pragmatical determination of intensions involves a new step and therefore a new methodological problem. Let us assume that two linguists, investigating the language of Karl, have reached complete agreement in the determination of the extension of a given predicate in a given region. This means that they agree for every thing in this region, whether or not the predicate in question denotes it for Karl or not. As long as only these results are given, no matter how large the region is—you may take it, fictitiously, as the whole world, if you like—it is still possible for the linguists to ascribe to the predicate different intensions. For there are more than one and possibly infinitely many properties whose extension within the given region is just the extension determined for the predicate.

Here we come to the core of the controversy. It concerns the nature of a linguist's assignment of one of these properties to the predicate as its intension. This assignment may be made explicit by an entry in the German-English dictionary, conjoining the German predicate with an English phrase. The linguist declares hereby the German predicate to be synonymous with the English phrase. The *intensionalist thesis* in pragmatics, which I am defending, says that the assignment of an intension is an empirical hypothesis which, like any other hypothesis in linguistics, can be tested by observations of language behavior. On the other hand, *the extensionalist thesis* asserts that the assignment of an intension, on the basis of the previously determined extension is not a question of fact but merely a matter of choice. The thesis holds that the linguist is free to choose any of those properties which fit to the given extension; he may be guided in his choice by a consideration of simplicity, but there is no question of right or wrong. Quine seems to maintain this thesis; he says: "The finished lexicon is a case evidently of *ex pede Herculem*. But there is a difference. In projecting Hercules from the foot we risk error but we may derive comfort from the fact that there is something to be wrong about. In the case of the lexicon, pending some definition of synonymy,

we have no stating of the problem; we have nothing for the lexicographer to be right or wrong about."(*Op. cit.*, p. 63)

I shall now plead for the intensionalist thesis. Suppose, for example, that one linguist, after an investigation of Karl's speaking behavior, writes into his dictionary the following:

(1) *Pferd*, horse,

while another linguist writes:

(2) *Pferd*, horse or unicorn.

Since there are no unicorns, the two intensions ascribed to the word 'Pferd' by the two linguists, although different, have the same extension. If the extensionalist thesis were right, there would be no way for empirically deciding between (1) and (2). Since the extension is the same, no response by Karl, affirmative or negative, with respect to any actual thing can make a difference between (1) and (2). But what else is there to investigate for the linguist beyond Karl's responses concerning the application of the predicate to all the cases that can be found? The answer is, he must take into account not only the actual cases, but also possible cases.[5] The most direct way of doing this would be for the linguist to use, in the German questions directed to Karl, modal expressions corresponding to "possible case" or the like. To be sure, these expressions are usually rather ambiguous; but this difficulty can be overcome by giving suitable explanations and examples. I do not think that there is any objection of principle against the use of modal terms. On the other hand, I think that their use is not necessary. The linguist could simply describe for Karl cases, which he knows to be possible, and leave it open whether there is anything satisfying those descriptions or not. He may, for example, describe a unicorn (in German) by something corresponding to the English formulation: "a thing similar to a horse, but having only one horn in the middle of the forehead." Or he may point toward a thing and then describe the intended modification in words, *e.g.*: "a thing like this one but having one horn in the middle of the forehead." Or, finally, he might just point to a picture representing a unicorn. Then he asks Karl whether he is willing to apply the word "Pferd" to a thing of this kind. An affirmative or a negative answer will constitute a confirming instance for (2) or (1) respectively. This shows that (1) and (2) are different empirical hypotheses.

All *logically possible* cases come into consideration for the determination of intensions. This includes also those cases that are causally impossible, *i.e.*, excluded by the laws of nature holding in our universe, and certainly those that are excluded by laws which Karl believes to hold. Thus, if Karl believes that all *P* are *Q* by a law of nature, the linguist will still induce him to consider things that are *P* but not *Q*, and ask him whether or not he would apply to them the predicate under investigation (*e.g.*, 'Pferd').

The inadequacy of the extensionalist thesis is also shown by the following example. Consider, on the one hand, these customary entries in German-English dictionaries:

(3) *Einhorn*, unicorn. *Kobold*, goblin,

and, on the other hand, the following unusual entries:

(4) *Einhorn*, goblin. *Kobold*, unicorn.

Now the two German words (and likewise the two English words) have the same extension, viz., the null class. Therefore, if the extensionalist thesis were correct, there would be no essential, empirically testable difference between (3) and (4). The extensionalist is compelled to say that the fact that (3) is generally accepted and (4) generally rejected is merely due to a tradition created by the lexicographers, and that there are no facts of German language behavior which could be regarded as evidence in favor of (3) as against (4). I wonder whether any linguist would be willing to accept (4). Or, to avoid the possibly misguiding influence of the lexicographers' tradition, let us put the question this way: Would a man on the street, who has learned both languages by practical use without lessons or dictionaries, accept as correct a translation made according to (4) ?

In general terms, the determination of the intension of a predicate may start from some instances denoted by the predicate. The essential task is then to find out what variations of a given specimen in various respects (e.g., size, shape, color) are admitted within the range of the predicate. The intension of a predicate may be defined as its range, which comprehends those possible kinds of objects for which the predicate holds. In this investigation of intension, the linguist fords a new kind of vagueness, which may be called *intensional vagueness*. As mentioned above, the extensional vagueness of the word "Mensch" is very small, at least in the accessible region. First, the intermediate zone among animals now living on earth is practically empty. Second, if the ancestors of man are considered, it is probably found that Karl cannot easily draw a line; thus there is an intermediate zone, but it is relatively small. However, when the linguist proceeds to the determination of the *intension* of the word "Mensch," the situation is quite different. He has to test Karl's responses to descriptions of strange kinds of animals, say intermediate between man and dog, man and lion, man and hawk, etc. It may be that the linguist and Karl know that these kinds of animals have never lived on earth; they do not know whether or not these kinds will ever occur on earth or on any other planet in any galaxy. At any rate, this knowledge or ignorance is irrelevant for the determination of intension. But Karl's ignorance has the psychological effect that he has seldom if ever thought of these kinds (unless he happens to be a student of mythology or a science-fiction fan) and therefore never felt an urge to make up his mind to which of them to apply the predicate

"Mensch." Consequently, the linguist finds in Karl's responses a large intermediate zone for this predicate, in other words, a high intensional vagueness. The fact that Karl has not made such decisions means that the intension of the word "Mensch" for him is not quite clear even to himself, that he does not completely understand his own word. This lack of clarity does not bother him much because it holds only for aspects which have very little practical importance for him.

The extensionalist will perhaps reject as impracticable the described procedure for determining intensions because, he might say, the man on the street is unwilling to say anything about nonexistent objects. If Karl happens to be overrealistic in this way, the linguist could still resort to a lie, reporting, say, his alleged observations of unicorns. But this is by no means necessary. The tests concerning intensions are independent of questions of existence. The man on the street is very well able to understand and to answer questions about assumed situations, where it is left open whether anything of the kind described will ever actually occur or not, and even about nonexisting situations. This is shown in ordinary conversations about alternative plans of action, about the truth of reports, about dreams, legends, and fairy tales.

Although I have given here only a rough indication of the empirical procedure for determining intensions, I believe that it is sufficient to make clear that it would be possible to write along the lines indicated a manual for determining intensions or, more exactly, for testing hypotheses concerning intensions. The kinds of rules in such a manual would not be essentially different from those customarily given for procedures in psychology, linguistics, and anthropology. Therefore the rules could be understood and carried out by any scientist (provided he is not infected by philosophical prejudices).[6]

4. Intensions in the Language of Science

The discussions in this paper concern in general a simple, prescientific language, and the predicates considered designate observable properties of material bodies. Let us now briefly take a look at the *language of science*. It is today still mainly a natural language (except for its mathematical part), with only a few explicitly made conventions for some special words or symbols. It is a variant of the prescientific language, caused by special professional needs. The degree of precision is here in general considerably higher (*i.e.*, the degree of vagueness is lower) than in the everyday language, and this degree is continually increasing. It is important to note that this increase holds not only for extensional but also for intensional precision; that is to say that not only the extensional intermediate zones (i.e., those of actual occurrences) but also the intensional ones (i.e., those

of possible occurrences) are shrinking. In consequence of this development, also, the intension concepts become applicable with increasing clarity. In the oldest books on chemistry, for example, there were a great number of statements describing the properties of a given substance, say water or sulphuric acid, including its reactions with other substances. There was no clear indication as to which of these numerous properties were to be taken as essential or definitory for the substance. Therefore, at least on the basis of the book alone, we cannot determine which of the statements made in the book were analytic and which synthetic for its author. The situation was similar with books on zoology, even at a much later time; we find a lot of statements, e.g., on the lion, without a clear separation of the definitory properties. But in chemistry there was an early development from the state described to states of greater and greater intensional precision. On the basis of the theory of chemical elements, slowly with increasing explicitness certain properties were selected as essential. For a compound, the molecular formula (e.g., "H_2O") was taken as definitory, and later the molecular structure diagram. For the elementary substances, first certain experimental properties were more and more clearly selected as definitory, for example the atomic weight, later the position in Mendeleyev's system. Still later, with a differentiation of the various isotopes, the nuclear composition was regarded as definitory, say characterized by the number of protons (atomic number) and the number of neutrons.

We can at the present time observe the advantages already obtained by the explicit conventions which have been made, though only to a very limited extent, in the language of empirical science, and the very great advantages effected by the moderate measure of formalization in the language of mathematics. Let us suppose—as I indeed believe, but that is outside of our present discussion—that this trend toward explicit rules will continue. Then the practical question arises whether rules of extension are sufficient or whether it would be advisable to lay down also rules of intension? In my view, it follows from the previous discussion that rules of intension are required, because otherwise intensional vagueness would remain, and this would prevent clear mutual understanding and effective communication.

5. The General Concept of the Intension of a Predicate

We have seen that there is an empirical procedure for testing, by observations of linguistic behavior, a hypothesis concerning the intension of a predicate, say 'Pferd,' for a speaker, say Karl. Since a procedure of this kind is applicable to any hypothesis of intension, the general concept of the intension of any predicate in any language for any person at any time has a clear, empirically testable sense. This general concept of intension

may be characterized roughly as follows, leaving subtleties aside: the intension of a predicate "*Q*" for a speaker *X* is the general condition which an object *y* must fulfill in order for *X* to be willing to ascribe the predicate "*Q*" to *y*. (We omit, for simplicity, the reference to a time *t*.) Let us try to make this general characterization more explicit. That *X* is able to use a language *L* means that *X* has a certain system of interconnected dispositions for certain linguistic responses. That a predicate "*Q*" in a language *L* has the property *F* as its intension for *X*, means that among the dispositions of *X* constituting the language *L* there is the disposition of ascribing the predicate "*Q*" to any object *y* if and only if *y* has the property *F*. (*F* is here always assumed to be an observable property, *i.e.*, either directly observable or explicitly definable in terms of directly observable properties.) (The given formulation is oversimplified, neglecting vagueness. In order to take vagueness into account, a pair of intensions F_1, F_2 must be stated: *X* has the disposition of ascribing affirmatively the predicate "*Q*" to an object *y* if and only if *y* has F_1; and the disposition of denying "*Q*" for *y* if and only if *y* has F_2. Thus, if *y* has neither F_1 nor F_2, *X* will give neither an affirmative nor a negative response; the property of having neither F_1 nor F_2 constitutes the zone of vagueness, which may possibly be empty.)

The concept of intension has here been characterized only for thing-predicates. The characterization for expressions of other types, including sentences, can be given in an analogous way. The other concepts of the theory of intension can then be defined in the usual way; we shall state only those for "synonymous" and "analytic" in a simple form without claim to exactness.

Two expressions are *synonymous* in the language *L* for *X* at time *t* if they have the same intension in *L* for *X* at *t*.

A sentence is *analytic* in *L* for *X* at *t* if its intension (or range or truth-condition) in *L* for *X* at *t* comprehends all possible cases.

A language *L* was characterized above as a system of certain dispositions for the use of expressions. I shall now make some remarks on the *methodology of dispositional concepts*. This will help to a clearer understanding of the nature of linguistic concepts in general and of the concept of intension in particular. Let *D* be the disposition of *X* to react to a condition *C* by the characteristic response *R*. There are in principle, although not always in practice, two ways for ascertaining whether a given thing or person *X* has the disposition *D* (at a given time *t*). The first method may be called *behavioristic* (in a very wide sense) ; it consists in producing the condition *C* and then determining whether or not the response *R* occurs. The second way may be called the *method of structure analysis*. It consists in investigating the state of *X* (at *t*) in sufficient detail such that it is pos-

sible to derive from the obtained description of the state with the help of relevant general laws (say of physics, physiology, etc.) the responses which *X* would make to any specified circumstances in the environment. Then it will be possible to predict, in particular, whether under the condition *C*, *X* would make the response *R* or not; if so, *X* has the disposition *D*, otherwise not. For example, let *X* be an automobile and *D* be the ability for a specified acceleration on a horizontal road at a speed of 10 miles per hour. The hypothesis that the automobile has this ability *D* may be tested by either of the following two procedures. The behavioristic method consists in driving the car and observing its performance under the specified conditions. The second method consists in studying the internal structure of the cart, especially the motor, and calculating with the help of physical laws the acceleration which would result under the specified conditions. With respect to a psychological disposition and, in particular, a linguistic disposition of a person *X*, there is first the familiar behavioristic method and second, at least theoretically, the method of a microphysiological investigation of the body of *X*, especially the central nervous system. At the present state of physiological knowledge of the human organism and especially the central nervous system, the second method is, of course, not practicable.

6. The Concept of Intension for a Robot

In order to make the method of structure analysis applicable, let us now consider the pragmatical investigation of the language of a robot rather than that of a human being. In this case we may assume that we possess much more detailed knowledge of the internal structure. The logical nature of the pragmatical concepts remains just the same. Suppose that we have a sufficiently detailed blueprint according to which the robot *X* was constructed and that *X* has abilities of observation and of use of language. Let us assume that *X* has three input organs *A*, *B*, and *C*, and an output organ. *A* and *B* are used alternatively, never simultaneously. *A* is an organ of visual observation of objects presented. *B* can receive a general description of a kind of object (a predicate expression) in the language *L* of *X*, which may consist of written marks or of holes punched in a card. *C* receives a predicate. These inputs constitute the question whether the object presented at *A* or any object satisfying the description presented at *B* is denoted in *L* for *X* by the predicate presented at *C*. The output organ may then supply one of three responses of *X*, for affirmation, denial, or abstention; the latter response would be given, e.g., if the observation of the object at *A* or the description at *B* is not sufficient to determine a definite answer. Just as the linguist investigating Karl begins with pointing to objects, but later, after having determined the interpretation of some

words, asks questions formulated by these words, the investigator of *X*'s language *L* begins with presenting objects at *A*, but later, on the basis of tentative results concerning the intensions of some signs of *L*, proceeds to present predicate expressions at *B* which use only those interpreted signs and not the predicate presented at *C*.

Instead of using this behavioristic method, the investigator may here use the method of structure analysis. On the basis of the given blueprint of *X*, he may be able to calculate the responses which *X* would make to various possible inputs. In particular, he may be able to derive from the given blueprint, with the help of those laws of physics which determine the functioning of the organs of *X*, the following result with respect to a given predicate "*Q*" of the language *L* of *X* and specified properties F_1 and F_2, (observable for *X*) : If the predicate "*Q*" is presented at *C*, then *X* gives an affirmative response if and only if an object having the property F_2 is presented at *A* and a negative response if and only if an object with F_1 is presented at *A*. This result indicates that the boundary of the intension of "*Q*" is somewhere between the boundary of F_1 and that of F_2. For some predicates the zone of indeterminateness between F_1 and F_2 may be fairly small and hence this preliminary determination of the intension fairly precise. This might be the case, for example, for color predicates if the investigator has a sufficient number of color specimens.

After this preliminary determination of the intensions of some predicates constituting a restricted vocabulary *V* by calculations concerning input *A*, the investigator will proceed to making calculations concerning descriptions containing the predicates of *V* to be presented at *B*. He may be able to derive from the blueprint the following result: If the predicate "*P*" is presented at *C*, and any description *D* in terms of the vocabulary *V* is presented at *B*, *X* gives an affirmative response if and only if *D* (as interpreted by the preliminary results) logically implies G_1, and a negative response if and only if *D* logically implies G_2. This result indicates that the boundary of the intension of "*P*" is between the boundary of G_1 and that of G_2. In this way more precise determinations for a more comprehensive part of *L* and finally for the whole of *L* may be obtained. (Here again we assume that the predicates of *L* designate observable properties of things.)

It is clear that the method of structure analysis, if applicable, is more powerful than the behavioristic method, because it can supply a general answer and, under favorable circumstances, even a complete answer to the question of the intension of a given predicate.

Note that the procedure described for input *A* can include empty kinds of objects and the procedure for input *B* even causally impossible kinds. Thus, for example, though we cannot present a unicorn at *A*, we can

nevertheless calculate which response *X* would make if a unicorn were presented at *A*. This calculation is obviously in no way affected by any zoological fact concerning the existence or nonexistence of unicorns. The situation is different for a kind of objects excluded by a law of physics, especially, a law needed in the calculations about the robot. Take the law I_1: "Any iron body at 60° F is solid." The investigator needs this law in his calculation of the functioning of *X*, in order to ascertain that some iron cogwheels do not melt. If now he were to take as a premise for his derivation the statement "A liquid iron body having the temperature of 60° *F* is presented at *A*," then, since the law I_1 belongs also to his premises, he would obtain a contradiction; hence every statement concerning *X*'s response would be derivable, and thus the method would break down. But even for this case the method still works with respect to *B*. He may take as premise "The description 'liquid iron body with the temperature of 60° F' (that is, the translation of this into *L*) is presented at *B*." Then no contradiction arises either in the derivation made by the investigator or in that made by *X*. *The derivation carried out by the investigator* contains the premise just mentioned, which does not refer to an iron body but to a description, say a card punched in a certain way; thus there is no contradiction, although the law I_1 occurs also as a premise. On the other hand, in *the derivation made by the robot X,* the card presented at *B* supplies, as it were, a premise of the form "*y* is a liquid iron body at 60° F"; but here the law I_1 does not occur as a premise, and thus no contradiction occurs. *X* makes merely logical deductions from the one premise stated and, if the predicate '*R*' is presented at *C*, tries to come either to the conclusion "*y* is *R*" or "*y* is not *R*. " Suppose the investigator's calculation leads to the result that *X* would derive the conclusion "*y* is *R*" and hence that *X* would give an affirmative response. This result would show that the (causally impossible) kind of liquid iron bodies at 60° F is included in the range of the intension of '*R*' for *X*.

I have tried to show in this paper that in a pragmatical investigation of a natural language there is not only, as generally agreed, an empirical method for ascertaining which objects are denoted by a given predicate and thus for determining the extension of the predicate, but also a method for testing a hypothesis concerning its intension (designative meaning).[7] The intension of a predicate for a speaker *X* is, roughly speaking, the general condition which an object must fulfill for *X* to be willing to apply the predicate to it.[9] For the determination of intension, not only actually given cases must be taken into consideration, but also possible cases, *i.e.*, kinds of objects which can be described without self-contradiction, irrespective of the question whether there are any objects of the kinds described. The

intension of a predicate can be determined for a robot just as well as for a human speaker, and even more completely if the internal structure of the robot is sufficiently known to predict how it will function under various conditions. On the basis of the concept of intension, other pragmatical concepts with respect to natural languages can be defined, synonymy, analyticity, and the like. The existence of scientifically sound pragmatical concepts of this kind provides a practical motivation and justification for the introduction of corresponding concepts in pure semantics with respect to constructed language systems.

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[1] This distinction is closely related to that between radical concepts and L-concepts which I made in *Introduction to Semantics*. The contrast between extension and intension is the basis of the semantical method which I developed in *Meaning and Necessity*. Quine calls the two theories "theory of reference" and "theory of meaning," respectively.

[2] R. Carnap, "Meaning Postulates," *Philosophical Studies,* 3:65-73 (1952).

[3] W. V. Quine, *From a Logical Point of View: Nine Logico-Philosophical Essays* (1953). For his criticism of intension concepts see especially Essays II ("Two Dogmas of Empiricism," first published in 1951), III, and VII.

[4] M. White, "The Analytic and the Synthetic: An Untenable Dualism" in Sidney Hook, ed., *John Dewey: Philosopher of Science and Freedom,* 1950, pp. 316-30.

[5] Some philosophers have indeed defined the intension of a predicate (or a concept closely related to it) as the class of the possible objects falling under it. For example, C. I. Lewis defines: "The comprehension of a term is the classification of all consistently thinkable things to which the term would correctly apply" ("The Modes of Meaning," *Philosophy and Phenomenological Research*, 4:236-50 (1944)). I prefer to apply modalities like possibility not to objects but only to intensions, especially to propositions or to properties (kinds). (Compare *Meaning and Necessity*, pp. 66*f*.) To speak of a possible case means to speak of a kind of objects which is possibly nonempty.

[6] After writing the present paper I have become acquainted with a very interesting new book by Arne Naess, *Interpretation and Preciseness: A Contribution to the Theory of Communication* (Skrifter Norske Vid. Akademi, Oslo, II. Hist.-Filos. Klasse, 1953, No. 1). This book describes in detail various procedures for testing hypotheses concerning the synonymity of expressions with the help of questionnaires, and gives examples of statistical results found with these questionnaires. The practical difficulties and sources of possible errors are carefully investigated. The procedures concern the responses of the test persons, not to observed objects as in the present paper, but to pairs of sentences within specified contexts. Therefore the questions are formulated in the metalanguage, *e.g.*, "Do the two given sentences in the given context express the same assertion to you?" Although there may be different opinions concerning some features of the various procedures, it seems to me that the book marks an important progress in the methodology of empirical meaning analysis for natural languages. Some of the questions used refer also to possible kinds of cases, *e.g.*, "Can you imagine circumstances (conditions, situations) in which you would accept the one sentence and reject the other, or vice versa?" (p. 368). The book, both in its methodological discussions and in its reports on experiences with the questionnaires, seems to me to provide abundant evidence in support of the intensionalist thesis (in the sense explained in §3 above).

[7] Y. Bar-Hillel in a recent paper ("Logical Syntax and Semantics," *Language* 30: 230-37 (1954)) defends the concept of meaning against those contemporary linguists who wish to ban it from linguistics. He explains this tendency by the fact that in the first quarter of this century the concept of meaning was indeed in a bad methodological state; the usual explanations of the concept involved psychologistic connotations, which were correctly criticized by Bloomfield and others. Bar-Hillel points out that the semantical theory of meaning developed recently by logicians is free of these drawbacks. He appeals to the linguists to construct in an analogous way the theory of meaning needed in their empirical investigations. The present paper indicates the possibility of such a construction. The fact that the concept of intension can be applied even to a robot shows that it does not have the psychologistic character of the traditional concept of meaning.