

## RECENT THEORIES OF THEORETICAL MEANING<sup>1</sup>

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Over the past fifteen years there have appeared a number of accounts of the meaning of theoretical terms that were intended as and were understood as rivals for the 'received' or logical empiricist view of meaning. These are the 'historicist' theories of Hanson, Kuhn, Feyerabend, Toulmin and others. These authors share the view that the meanings of theoretical (and observational) terms are determined by the theoretical context in which they occur and not by relations to the terms or statements in a fixed and universal 'observation language', as held by the logical empiricists. On the other hand, it is well known that the logical empiricist conception of meaning has evolved from the reductionistic view that theoretical terms must be explicitly definable in observational terms to the more liberal view that theoretical meanings may derive from indirect theoretical connections with observation statements or the vocabulary of an observation language. Finally a number of philosophers (e.g. Shapere, Scheffler, Achinstein, Nagel) have attacked the historicist theory of meaning on the grounds that it leads to methodological relativism and to the logical isolation of scientific theories. Also they claim that the historicist theory is vague in that it does not spell out exactly what it is that determines meaning or meaning change and that the consequences of meaning change are unclear.

However these critics have neglected a striking similarity between the historicist and the recent logical empiricist accounts of theoretical meaning. Both claim that the theoretical meaning of a term is determined by the theoretical context in which that term appears. This similarity suggests that the logical empiricist account may be subject to some or all of the difficulties found in the historicist theories of meaning.

In this essay I shall give a brief exposition of the historicist and

recent logical empiricist views of meaning for theoretical terms. I shall then spell out what I take to be the main difficulties of the historicist theory and consider whether and how the recent logical empiricist proposals might escape these difficulties. I shall contend that the critics of the historicist theories raise difficulties that are equally serious for the logical empiricist. Finally, I shall argue that a promising way of resolving these difficulties lies in the historicist and not in the logical empiricist programme for the philosophy of science. I shall argue that these difficulties can be avoided by viewing the 'context' that determines meaning as including 'pragmatic' considerations regarding the beliefs of persons and communities holding or discussing various scientific theories. The latter part of this paper will be devoted to detailing and illustrating these pragmatic considerations.

### *1. Two versions of the contextual theory of meaning.*

To begin with a brief comparative exposition of the historicist and logical empiricist versions of the contextual theory, the historicist Hanson borrows a metaphor used by Wittgenstein and popular among some recent linguistic philosophers :

Cause-words resemble game-jargon.... 'Revoke', 'trump', 'finesse' belong to the parlance system of bridge. The entire conceptual pattern of the game is implicit in each term : you cannot grasp one of these ideas properly while remaining in the dark about the rest.

Likewise with 'pressure', 'temperature', 'volume', ... 'wave-length',... in physics; 'ingestion', 'digestion', ... 'respiration' in biology;... To understand one of these ideas throughly is to understand the concept pattern of the discipline in which it figures ([11] p. 61f).

For Feyerabend 'theory' plays the role of Hanson's 'conceptual patterns' in determining meanings :

...the meaning of every term we use depends upon the theoretical context in which it occurs. Words do not "mean" something in isolation : they obtain their meanings by being part of a theoretical system. Hence, if we consider two contexts with basic principles that either contradict each other or lead to inconsistent consequences in certain domains, it is to be expected that some terms of the first context will not occur in the second with exactly the same meaning. ([9], p. 180).

Curiously the logical empiricist say much the same thing as the historicists. For example, in 1956 Carnap tells us

The specification, not only of the [correspondence] rules C, but also of the postulates T, is essential for the problem of meaningfulness. The definition of meaningfulness must be relative to a theory T, because the same term may be meaningful with respect to one theory but meaningless with respect to another. ([5], p. 48)

In short, Carnap believes that a theory T determines whether and how certain 'theoretical' sentences can be shown to be empirically true or false. T contains the inferential linkage connecting theoretical statements to statements in a language whose descriptive power is limited to possible observations, the 'observation language'  $L_o$ .

Similarly, Nagel expresses his agreement with 'some recent commentators on the logic of science [sic. the historicist philosophers]' in these words :

...the sense and use of predicates employed in the sciences, including those employed to report allegedly observed matters, is determined by the general laws and rules into which these predicates enter. ([20], pp. 19f).

Bunge ([3]) also states as the foundation of his theory of sense that ... the purport and the import of a construct [the sense, or one dimension of the meaning of a concept] depend upon the body of knowledge in which it occurs. ([3], v.1, p. 143).

Thus the historicist philosophers and a number of the proponents of the 'received' logical empiricist view of scientific theories share the belief that certain key scientific concepts are 'implicitly' defined by their occurrence in 'theoretical contexts'. However, these views diverge upon the question as to which concepts are defined in this manner : The logical empiricists single out an 'observation language' containing terms whose meaning is unproblematic and unaffected by association with any theory. Only 'theoretical' terms are thus contextually defined. The historicist philosophers typically deny that an observation language can be specified for all science and thus contend that 'observational' as well as 'theoretical' terms' meanings are determined by the theoretical context in which they occur. The two philosophical programmes also divide on the question as to what counts as a theoretical context. According to the received view the context giving meaning to certain terms ideally consists of an axiomatized set of statements drawing its non-logical vocabulary from a specified set of expressions with a specified domain of discourse. To the historicist this context is far broader. It may include discarded theories or discarded early versions of the finished products that the logical empiricists try to cast into axiomatic form (Lakatos, [19]). It may also include a variety of analogous theories,

pragmatic considerations concerning the 'use' of theories or laws (Hanson, [11]) and explicit or implicit methodological values such as what counts as an adequate scientific explanation, and, according to some historicist philosophers, ineffable heuristic guidelines that can be conveyed only by examples or 'paradigm' solutions to a problem (Kuhn, [18]).

The historicist views have been attacked on a number of grounds, some of which may also bear upon the logical empiricist's version of the contextual theory. Among the difficulties associated with the historicist's account of meaning are: (1) the contextual theory claims that all components of a global theory, paradigm or disciplinary matrix or research programme take part equally in determining meaning. This view has the consequence that not only different global theories, etc., but also different specific theories within a paradigm or research programme are radically isolated or incommensurable. (Scheffler, [25], Chap. 3) For example, under this broad interpretation of 'context', Newton's treatment of a planetary system as a two-body gravitating system with one fixed mass-point (the Sun) and one moving mass-point (Mars) would be radically incommensurable with his treatment of the system as a pair of gravitating mass points moving with respect to their common centre of mass. (2) There are so many and such diverse criteria for meaning (meaning change) that it is doubtful that any one concept of meaning is at issue and that any progress can be made by introducing meaning into metascientific discourse. If all propositions in a theory containing a term are equally relevant to its meaning, little seems to be gained by specifying meaning as opposed to listing the propositions of a theory. (Shapere, [27]) (3) The historicist's account of meaning seemingly entails a vicious circle. How can the claim that the meaning of a term is determined by the propositions in which it appears be informative when it is also said that the meaning of a proposition is a function of the terms it contains? It would appear that one could not break this circle and understand a proposition by understanding the terms therein without initially understanding the proposition as a whole, and conversely one cannot understand the proposition as a whole without initially understanding its component terms. (4) Finally it has been objected that calling all the components of a theory implicit definitions of the theory's terms renders those components analytic and *a priori* and hence inaccessible to empirical test. (Achinstein, [1], 3.5, p. 97).

To consider how the logical empiricist's contextual theory fares on these counts, regarding (1), it appears that different theories are semantically incommensurable<sup>2</sup> — i.e. incapable of bearing the

logical relations of contrariness, consequence, etc. — for the logical empiricist as well as the historicist. However, semantic commensurability can be established by reference to the shared and universal observation language in the logical empiricist account. Theories entailing contradictory observation statements are contraries, and if the observational consequences of  $T_1$  include those of  $T_2$  then  $T_1$  reduces  $T_2$  (Kemeny-Oppenheim, [15]). Nevertheless, apart from observational consequences, different theories have no mutual logical relations, and might thus be called theoretically incommensurable but observationally commensurable.

Whatever case might be made for direct theory comparison accordingly will count equally against both versions of the contextual theory. There are numerous examples from the sciences which I believe render unavoidable the conclusion that theories can be compared independently of their observational consequences. Galileo's assumption that bodies in free fall have constant acceleration is contradicted by Newton's theory of gravity applied to terrestrial bodies, as Feyerabend [8] has pointed out. To take another of Feyerabend's examples, we needn't work out what the improbable decrease of entropy would look like experimentally before we can recognize that statistical thermodynamics is incompatible with classical macro-thermodynamics in that the former permits but the latter forbids an entropy decreasing process in an isolated system. In this case, the incompatibility of the two theories can be stated in metatheoretical terms. The classical macro-theory excludes perpetual motion of the second kind under all circumstances, but the statistical theory permits such motion. The incompatibility between deterministic exclusion and stochastic permission is a logical relation between metatheoretical descriptions.

(2) The Popper-Reichenbach (Popper, [21]: Reichenbach [23]) distinction between 'Contexts' of justification and discovery excludes, e.g., heuristic models and analogies, 'psychological' features of perception or creative innovation, or ineffable or 'tacit' heuristic devices from the logical analysis of scientific theories. This distinction might be thought useful in limiting the proliferation of meaning criteria by excluding pragmatic and psychologistic notions such as 'use' and 'intent' as well as psychological connotation or suggestiveness. One might thus limit the determiners of meaning to certain features or components of axiomatic formulations of scientific theories.

Bunge, for example, draws a sharp distinction between the subject matter of the philosophical or non-empirical semantics of factual and formal science and that of psycholinguistic semantics. The latter

subject concerns psychological and social mechanisms of linguistic communication, problems concerning language learning, processes of assigning significance to signs, as well as psychological concepts of personal truth, strength of belief and credibility. Rather, his concern is with the 'semantic' concepts of sense, reference and truth for 'factual constructs', propositions and theories. ([3], pp. 2 ff).

In the next section I shall contend at length that certain socio- or psycho-linguistic concepts, e.g. intended meanings, interpersonal knowledge and the propagation of interpersonal knowledge, are needed for properly understanding changes in meanings and the consequences of such changes in scientific terminology. Accordingly, Bunge's restrictions, and those implicit in other recent logical empiricist theories of meaning, render semantical theory insufficient for illuminating certain philosophically significant issues regarding communication, interpretation, reference and inference as they occur in a discipline whose proponents hold beliefs that evolve in time.

In addition to justifying the exclusion of psychological, sociological and other pragmatic considerations from determiners of meaning in canonical formulations of scientific theories, it was also hoped that determiners of meaning could be further narrowed to identifiable 'meaning postulates' appearing in these formulations (Carnap [4]). However, in a well-known essay [22] Quine appears to have dashed these hopes. Quine contends that the traditional logical tests for analyticity, e.g. that the denial is self-contradictory, conversion to logical truth by substitution of synonyms, substitutions, *salva veritate*, either fail to give the desired distinction, beg the question or rely upon concepts as obscure as analyticity, e.g. synonymy. In short, there are no satisfactory general methodological, syntactic or semantic grounds for distinguishing meaning postulates from synthetic or descriptive propositions in a theory. Since the logical empiricist excludes pragmatic considerations from his analysis of scientific theories, there appear to be no proper philosophical grounds — i.e. general methodological, syntactic or semantic — for distinguishing changes in belief from changes in meaning. Thus there is no reason to mention meaning change in the logical empiricist account of the growth of scientific knowledge. Accordingly, objection (2) to the historicist version of the contextual theory also applies to the logical empiricist version.

(3) The apparent vicious circularity of the historicist's version of the contextual theory presumably presents no problem for the logical empiricist, for he simply takes for granted the clarity of terms and statements in the observation language. That clarity is then imparted to the theoretical terms by specific logical or nomological

relations as are specified in any acceptable axiomatization of a theory. However, the assurance of avoiding circularity provided by this account evaporates as soon as it is recognized that we cannot always assume that two theories share one observation language.

But even were such an observation language available, logical empiricists and most others now acknowledge that distinct theories are compatible with and can have as consequences the same known or anticipated observational statements. Thus whatever meanings theoretical statements might have are undetermined by observational statements subsumed under them. Even with a single formalism the meanings of the theoretical terms appearing therein are undetermined. As F. Suppe points out, by a theorem pertaining to definition due to the mathematicians Padoa and Beth, the reference of a theoretical term is uniquely determined by that of an observational term if and only if the theoretical term is explicitly defined by some propositional function in the observation language. Since few logical empiricists insist upon such explicit observational definition for all theoretical terms, many theoretical terms are left referentially indeterminate.

More precisely, the assumed truth of a theory  $T$  with correspondence rules  $C$  and a semantic interpretation assigning determinate references to the terms of an observation language  $L_O$  determines a class of models  $M$  (conceptual structures or possible worlds satisfying  $T$ ,  $C$  and the observation statements). However, unless all non-logical terms in the theoretical vocabulary  $V_T$  are explicitly defined or given non-observational semantic interpretations,  $M$  cannot be further restricted to a subset  $M'$  of models constituting the same referential meanings for the terms in  $V_T$ . Thus, the class of models satisfying electron theory with only an observational interpretation cannot be restricted to a class assigning unique references to the terms 'electron' or 'electron emission'. Without restrictions beyond the assumption that observationally interpreted statements in  $L_O$  are consequences of  $TC$ ,  $TC$  can be given interpretations assigning blatantly unintended referents to those theoretical terms. The terms might also be construed as not referring at all, thus rendering  $TC$  at best an uninterpreted calculating device. Accordingly, without further semantical interpretation of the non-logical terms of  $V_T$ , the propositions of  $T$  can hardly constitute a context for determining their meanings without begging the question regarding those very meanings. (Suppe, [29], pp. 81, 95; [28], pp. 61-65; also see Hesse, [13]).

Suppe doesn't fully specify the conditions of theoretical reference, but some such conditions might be as follows: A semantic

interpretation may be provided for the terms in  $V_T$  by propositions in a scientific meta-language. These propositions may assign unique meanings to the terms by associating them with expressions in some other language, e.g. scientific English, where the latter expressions already have suitable meanings. Alternatively, there may be such semantic interpretations for some terms in  $V_T$  but not others, but the other terms are explicitly defined in  $T$  in terms of those interpreted terms. The Beth-Padoa theorem guarantees unique references to those defined terms.

Bunge is unique among logical empiricists in that he fully embraces non-observational semantic interpretations of theoretical terms. His version of the contextualist theory has two features that may allow him to avoid the charge of circularity: (i) He is careful to include in his axiomatic reconstructions mention of background or presupposed theories. These theories may be logical, mathematical or factual and they provide concepts that can be introduced into other theories by semantical postulates for expressions occurring in those other theories. For example, the special theory of relativity presupposes formal theories such as the predicate calculus with identity, analysis, manifold geometry, etc. governing the use of quantifiers, differentials and mention of abstract spaces as they occur in the special theory. The special theory also presupposes physical theories such as physical geometry and chronometry, from which it borrows concepts such as spatiotemporal coincidence and distance, and classical electrodynamics from which it borrows the concept of electromagnetic radiation or light signals ([2], pp. 160, 182 f). (ii) Bunge also acknowledges the introduction into theories by semantic postulate certain 'extrasystemic constructs' that are not theory-dependent. ([3], Vol. I, p. 172)

Feature (i) has as a consequence that generally only *some* concepts are determined by their appearance in the context of a given theory, the remaining concepts in the theory being borrowed from other theories or a common background and introduced by semantical postulates. The second feature (ii) suggests that the borrowed concepts need not themselves be determined by theoretical context. However, Bunge notes that the sense of the pre-theoretical concepts is often uncertain, subject to variation, or insufficiently clear or sophisticated to be introduced, at least without modification, into axiomatic scientific theories ([3], Vol. I, p. 172; Vol. II, p. 36).

However Bunge's theory and the other contextual theories permitting non-observational semantical interpretation are faced with this dilemma: One horn is that if the terms introduced by semantical

postulate are contextually defined in other theories, the problem of indeterminacy is simply pushed back to one of the presupposed theories and must be confronted there. On the other horn, if the concepts introduced by semantical postulate are pre-systematic, they may not be suitable for the intricacies of technical scientific inquiry and discourse. Some theory of concept-formation or concept-revision other than the contextual theory would be needed to account for the formation of technically adequate terminology with determinate meanings. Bunge and the other logical empiricists offer no such theory. Accordingly both have failed to provide a logically adequate — i.e., a non-question begging — account of determinate theoretical meanings.

(4) Calling the components of a theory implicit definitions need not render them inaccessible to empirical scrutiny provided we are willing to acknowledge that the meanings of the implicitly defined terms can be changed and the change can be justified on empirical grounds. This point supports the historicist position on meaning change and suggests that the historicist is correct in criticizing the logical empiricists for overlooking the possibility of meaning change. However, granting such changes of meaning does lead to the difficulties mentioned under (1) above, viz. difficulties in logically comparing theories that diverge in meaning.

## 2. *A pragmatic account of meaning and meaning change.*

One of the criticisms of the contextualist theory of meaning mentioned above is that it does not provide any reason for talking about meaning over and above mentioning various propositions or theories. That is, the thesis that meanings of theoretical terms change as a scientific discipline develops in time seems to collapse into the platitude that theories are replaced or modified as science develops. On the other hand, if we can find some grounds for distinguishing components of theories that determine meaning, e.g., a core of a theory that might be thought constitutive of a scientific tradition or research programme (Lakatos, [19]; Kuhn, [18]), these grounds may also support the claim that talk about meanings is philosophically or historiographically useful.

Quine's argument that there are no semantical or syntactical grounds for distinguishing meaning postulates from synthetic *a posteriori* propositions in a theory does not entail that people do not in fact make such a distinction in practice. Nor does it entail that there are not in certain contexts good reasons for making such distinctions. Propositions can be introduced by stipulation or

defended on empirical grounds. But also propositions introduced by stipulation can shift to being empirically defeasible and conversely. For example, the law of constant proportions in chemistry has become a criterion for what counts as a chemical compound as opposed to a solution or mixture, i.e., it has acquired the status of an analytic statement. Conversely, the stipulation that, e.g., the diurnal period of a fixed star constitutes a sequence of equal time intervals can be defeated when one takes into consideration various perturbations of the earth's rotation.

Accordingly, we might distinguish different formulations or versions of a theory by certain *choices* or *intentions* on the part of its proponents regarding which of the theory's components are to be taken as analytic or meaning-relevant. To borrow Achinstein's terminology, in one version of a theory a property P might be chosen or intended as in and of itself a necessary, sufficient, or good (in varying degrees) reason for applying a term Q. In a second version P may be viewed as grounds for applying Q by virtue of a defeasible nomological connection between P and Q, not in and of itself. This intent or choice is neither arbitrary nor permanent. It may be backed by good reasons, e.g., the lawlike relation between P and Q is so highly confirmed or corroborated that it is simply taken for granted in a community of speakers. Alternatively, a community C to which a speaker S addresses himself may take the relation for granted whether or not for good reasons. This matter of what a community in fact believes provides a good reason for the choice if S's intent is to communicate with members of that community. The choice can be thus justified if there are no reasons against taking the relation for granted, but there are also circumstances justifying the choice even if there are good reasons for not taking the relation for granted. I shall expand and defend this point shortly.

H. P. Grice has attempted to incorporate the communication of such intentions into a theory of meaning [10]. In this section I shall state a version of Grice's theory that is adapted to apply to theoretical meanings in scientific discourse. I have found certain amendments and extensions of the theory made by S. Schiffer [26] useful in this adaptation, and shall refer to Schiffer's version of Grice's theory as the Grice-Schiffer theory.

According to the Grice-Schiffer account, an expression x means a proposition p if and only if people in a group G do, would, could or are highly likely to mean p by uttering x. If they so mean p by x, then x is a conventional or standard way of expressing p in G. A person knows what x means (in G) if and only if he knows what a person (in G) would or would be likely to mean by uttering x.

(Schiffer, [26] p. 6, 14).

The burden of the analysis of meaning now rests upon analyzing what it means for a speaker S to mean p in uttering x. Grice claims that S means p by x if and only if S intends the utterance of x to produce an effect r in an audience A by means of A's recognizing or inferring S's intention to produce r by uttering x. Generally the intended effect r will be a propositional or affective attitude, e.g., to think or entertain or to believe P, or to make it true that p. r must be intended by S in order to exclude certain actions (e.g., putting on a tail coat 'means' one is going to a dance) or 'natural' signs (e.g., spots 'mean' he has measles) from the concept of speaker-meaning. Also r is produced in A by A's recognition of S's intention to produce r. In adding this stipulation Grice wants to exclude from S-meaning cases in which S induces r in A leaving A unaware of S's intent, e.g., S's efforts to induce in Mr. X the belief that Mrs. X is unfaithful by leaving around photos of Mrs. X with Mr. Y but concealing S's purpose for leaving around the photos. In such a case S is not strictly telling Mr. X about his wife's infidelities, for Mr. X responds with r to the photograph, not to his recognition of S's intentions. (Grice, [10], pp. 380 ff) S does not mean by the photograph that Mrs. X is unfaithful, nor does the photograph mean that Mrs. X is unfaithful in the sense relevant to linguistic communication — what Grice calls non-natural meaning.

What illumination do these considerations promise for scientific discourse? Suppose S utters or writes by the token x in circumstances C some principle, e.g., '...there must in every case be a struggle for existence, either one individual with another of the same species, or with the individuals of distinct species, or with the physical conditions of life' (Darwin, [6]). As historians or scientists our concern in studying the statement is with Darwin's intent in writing the sentence. Since Darwin published the statement, Darwin intended some response r on the part of an audience A. It is likely he intended them to believe the principle, or at least consider, further elaborate and test it or its implications. As his principle is expressed explicitly in verbal form, and not hinted at by clues selected to direct A's attention to reproduction or competition within and among species, we should say that his (S's) words are intended to produce r in his audience (A) by means of A's appreciation of S's intent. This kind of communication is quite distinct from, e.g., inferring Darwin's intellectual interests and beliefs by observing his research activities alone. Communication by means of a language uses certain expressions that are conventionally associated with specific intentions and an audience's cognitive responses are based on

recognizing the intentions of speakers by virtue of the conventional association. Such communication would appear to be more economical in time, verbiage, ink and paper and far more reliable than inferring another's beliefs from the above-mentioned natural clues. Thus it would appear that the efficient communication essential to science as we know it does make use of expressions having non-natural meanings and that Grice's analysis should help in illuminating certain features of scientific discourse.

However, we need to consider in more detail the nature of the intended response  $r$  and the role it should play in an adequate Gricean analysis of scientific discourse. Grice apparently considers the only appropriate response  $r$  in audience  $A$  to be belief or acceptance of the principle. In requiring that reasons for  $r$  be recognition of  $S$ 's intent in uttering  $x$ , he notes that there are certain beliefs for which the fact that someone believes them is adequate evidence for them. ([10], pp. 383 f) But beliefs of this kind — e.g., beliefs about one's own introspectible psychological state or beliefs held by an honest witness — are far from exhausting the kinds of belief conveyed in scientific communication. Many scientific beliefs require experimental evidence, or the fact that they are believed should be supplemented with experimental evidence, if they are to be supported by and thus believed for good reasons. Thus Darwin's statement might be entertained for further investigation on the grounds that Darwin intended the statement by a given sentence. However, Darwin's authority, considerable though it might be (might have been), is generally regarded as insufficient for belief in the principle. Indeed, with the passage of time and the development of modern versions of the theory of evolution, Darwin's authority may now be insufficient for entertaining the proposition. In such cases, the appropriate response  $r$  on the part of  $A$  may diverge from Darwin's intent. For example, one may appropriately respond with the belief that Darwin intends  $A$  to believe or entertain  $p$  rather than by actually believing or entertaining the proposition.

That  $A$ 's actual response to recognizing  $S$ 's intent can vary depending upon a variety of circumstances, including  $A$ 's trust in  $S$ , whether or not  $A$  views  $S$ 's work as obsolete, etc. does not damage the Grice-Schiffer thesis or reduce its relevance to scientific discourse. In fact this feature is a positive advantage of their analysis of meaning. By contrast to the contextualist theory of meaning, a sentence or expression  $x$  is meaningful to an audience  $A$  independently of whether  $A$  is willing to entertain or accept  $S$ 's theories on the proposition  $S$  offers by uttering  $x$ .  $A$  need only appreciate  $S$ 's intention in uttering or writing  $x$ , i.e., he need only

know what the proposition is that S intends him to hold or consider.

But a right-minded scientist would not seriously intend that an audience A respond with belief or consideration *r* to his utterance *x* simply on the basis of A's recognizing S's intention in uttering *x*. He would not intend an audience to hold a belief, even of his favorite theory, simply on his authority. However, S may in intending A to respond by *r* think that A has certain collateral beliefs *e* which would, in S's estimation of A's views and on occasion of A's hearing or reading *x*, support *p* sufficiently to move A to choose *r*. (Schiffer, [26], pp. 21, 158) *e* might include various beliefs more or less remote from experiment or observation but having, at least in what S takes to be A's view, evidential relations to the intended proposition *p*.

Thus Darwin might expect his audience to have certain beliefs regarding, e.g., the fecundity of all organisms, limitations of space they occupy and the food they consume. (I shall refer to these beliefs as 'the malthusian principle' below.) Of course he might have prepared his audience before with statements and arguments defending the malthusian principle or he might have expected to gain their assent to *p* by offering that principle in arguments to come on later in his text. But the malthusian principle might also have been taken for granted by Darwin's audience — say members of a group or scientific community *G*. If the speakers *S* of *G*, or even an outsider such as a critic, know the status of the malthusian principle in the minds of other members constituting an audience *A* in *G*, then *S* would expect *A* to respond to Darwin's expression alone by belief or consideration, and *S* would not expect to have to offer arguments mentioning the malthusian principle. Note that *S* need not believe *s*, but could find it more expedient to intentionally induce *r* in *A* by means of what he (*S*) takes to be *A*'s background knowledge without trying to modify that knowledge to conform to his own background knowledge. That is, if *S* is rational and is sincere in his intent to induce *r* in *A*, he will choose his expressions in accordance with what he takes to be *A*'s beliefs about the way his (*S*'s) intentions are expressed and the fund of propositions that *A* takes as requiring no argument. *S*'s own beliefs about the way his intentions ought to be expressed or about what can be taken for granted in a discipline need not be employed in *S*'s efforts to induce *r* in *A*. His own beliefs could be a hinderance in realizing his intent say if *A* required, in *S*'s view, extensive background re-education or if *A* proved to be unreceptive to efforts at such re-education.

Since *S* intends *A* to believe *p* by virtue of *A*'s recognizing *S*'s intent in uttering *x*, and *S* can only reasonably so intend if he believes that *A* believes that *e* supports *p*, *A* cannot appreciate *S*'s

intent without appreciating the beliefs relevant to S's intent. Thus S expects A to believe that S believes that A believes e. Also for A to appreciate S's intent, A will have to believe that S believes that A believes e. However, from this latter belief of A's, it does not follow that A believes e, nor need he actually believe e to appreciate S's intent. Accordingly, as was suggested above, if e becomes less believable to A with the passage of time, it may be entirely appropriate for A to respond to S's utterance x with beliefs about S's intentions but without accepting or considering p.

To return to our example, we might with accumulating evidence regarding symbiotic and altruistic behavior among and within certain species of organisms begin to doubt Darwin's claims about a universal struggle for existence. Alternatively, on the basis of knowledge of population control mechanisms in the behaviour of certain species, we may question the assumption that the malthusian principle is true for all species. However, such doubts do not alter our ability to appreciate Darwin's intent in writing the sentence.

In Sum, for S to mean p by uttering x, S must intend

- (i) by uttering x to induce r (belief of consideration of p) in A
- (ii) to convey his intention (i) to A

In implementing his intent, S must justifiably believe (believe on the best evidence he can be expected to have in the circumstances) :

- (iii) That A knows that S normally utters x when intending to induce r in A.
- (iv) that A possesses correlative information e which together with his belief that S intends to induce r, is sufficient for A to choose to be in cognitive state r, and
- (v) that A knows that S knows that A knows items (iii) and (iv).

On the other hand, for A to grasp what S means by uttering x, he need only appreciate S's intent (i) and (ii), with the corollary that he knows that S thinks that he (A) believes e.

Briefly, S's meaning p entails that S have certain justified beliefs — beliefs that may still be false — about what A knows or takes for granted. Conversely, A's appreciating what S means entails A's knowing certain things S believes or takes for granted, including primarily what S takes to be A's knowledge. S's beliefs about A may be summed up as follows :

- S<sub>1</sub> : BsKaDxsp (S believes — perhaps falsely — that A knows that S's utterance of X designates that he intends A to consider or believe p. Dxsp = S intends by x to induce p in some A.)
- S<sub>2</sub> : BsKaKsKaDxsp (S believes that A knows that S knows that A knows that S's utterance of x expresses S's intention that A believe or consider p.)

$S_3$  : BsKae (S believes that A knows e.)

$S_4$  : BsKaKsKae (S believes that A knows that S knows that A knows e.)

A's knowledge of S may be summarized as follows :

$A_1$  : KaDxsp (A knows that S intends by x for A to believe, etc. p).

$A_2$  : KaBsKaDxsp (A knows that S believes that A knows that S intends by x for A to believe, etc. p.)

$A_3$  : KaBsKae (A knows that S believes that A knows e.)

Note that in general  $S_4$  does not follow from  $S_3$ , and  $A_2$  does not follow from  $A_1$ . In short,  $KsKap$  or  $BsKap$  do not entail  $KsKaKsKap$  or  $BsKaKsKap$ . I may know or believe that another person knows a proposition  $p$  without knowing or believing that that other person knows that I know that he knows  $p$ . My knowledge of his knowledge of  $p$  is easily concealed from him. Yet there are conditions under which both pairs,  $KsKap$  and  $BsKap$ , and  $KsKaKsKap$  and  $BsKaKsKap$ , are commonplace truths. Schiffer suggests that such knowledge is possible if there is a property  $H$  (an epistemic property) that can be possessed by an individual  $a$  such that an individual  $b$  can know that  $a$  possesses  $H$  and that possession of  $H$  by  $a$  is sufficient for  $a$ 's knowing some proposition  $p$  and for knowing that  $a$  knows  $p$ . For example,  $b$  may know that  $a$  has normal vision and is looking at some object that  $b$  also sees. Under these circumstances  $a$ 's possession of  $H$ , viz. that  $a$  has normal vision and is looking right at some object, is known to  $b$  and is sufficient for  $b$ 's knowing that  $a$  knows the presence of that object.  $a$  can also observe  $b$  observing him ( $a$ ) observing the object and thus know that  $b$  knows that he ( $a$ ) knows the object. (Schiffer, [26], pp. 31 f)

There are probably a large number of different epistemic properties  $H$ , and seemingly one such property that will be useful in establishing the conditions  $S_1$ – $S_4$  and  $A_1$ – $A_3$  for communication would be membership in a scientific profession or community where such membership presupposes an education of known content (Cf. Kuhn, [18], Secs. 2,3). Thus S might believe that A knows correlative information  $e$  because he knows that A is a physicist with a university degree and  $e$  is a truism or  $x$  is a standard way of expressing certain intentions for all such physicists and anyone with a degree in physics will know what is known by those with degrees in physics. S knows that being a physicist with a university degree is sufficient for knowing  $e$  and what is meant by  $x$  and his education in physics has taught him this relation of sufficiency. But S may also have encountered A so that A, knowing S has university credentials, also has knowledge of S's knowledge of A's credentials — surely a

commonplace occurrence in any discipline. Under these circumstances, not only does S know that A believes e or that A knows that x means p (KsKae, KsKaDxsp) but also S knows that A knows that S knows these (KsKaKsKae, KsKaKsKaDxsp). Similar points can be made about A's knowledge of S'.<sup>3</sup>

Note that his kind of encounter does not assure agreement between S and A. In S's encounter with A S may learn that A belongs to a school that uses x' rather than x to mean p. It does not follow that S will find it expedient to adopt x' in general when he wishes to express p, although in addressing A that choice is likely to be the best for realizing his intentions. Similarly, as I have pointed out, S need not believe e in order that he use his knowledge of A's belief of e to induce A's acceptance of p. Conversely, A's knowledge of S's intended meanings for x or S's beliefs about A's collateral beliefs e, but not A's belief in e or A's decision to use x to express his intended p, is necessary for A's grasping S's intentions.

Lacking such agreement, we should say that x has more than one meaning, different people mean different things by x, or that x means p for one individual or community but not for another. Accordingly, in addressing A', S may use x' to express his intentions but in addressing some other audience A he will use x for the same purpose. In this case S might believe that A' takes x' as the standard way of expressing p, but believes that A' takes x as the standard expression for p. Such a procedure would be appropriate if S believed that A and A' spoke different languages, e.g., English and Russian, or used different mathematical or logical notations. Alternatively, a community A may take x to express p but A' takes x to express p'. Thus A might take 'This is an amoeba' to identify a single-celled animal, where A belongs to a community of cytologists, i.e., specialists in the study of cells, cell-structure, cell organelles, etc. On the other hand A' would take the same sentence to identify a non-celled animal, e.g., an ecologist might view the amoeba as an organism having more complex structures and varied capabilities than cells. As independent individuals, amoebas occupy a position in the food chain of some ecosystems but they lack cellular tissue of specialized reproductive organs found in some other animals. Yet certain organelles do function equivalently to the organs of multi-celled animals, thus differentiating free-living single-celled animals from the more specialized cells in multi-celled animals or tissue. (Hanson, [11], p. 4) In the first example x lacks meaning for a part A' of the scientific community; in the second x has different meanings in different subdisciplines of biology.

However, the second case involves more than just a difference in

the notation associated with one or more intended meanings. Group A consists of persons for whom we can assume that the possession of university credentials is sufficient for their knowing that amoebas possess a certain kind of cell membrane that has certain metabolic functions, a nucleus, lysosomes, etc., i.e., the main features of the 'generalized cell'. In group A' university credentials are sufficient for knowing that amoeba are heterotrophic (they rely upon other organisms for food), that they live in symbiosis with certain other organisms, they are fed upon by certain other organisms, etc. This is not to say that there is no considerable overlap in the knowledge of A and A' of the general features of the amoeba, just that A and A' may differ considerably in the details of the features that they take for granted.

As was suggested in the previous section, the intentional analysis of meaning can provide speakers with good reasons for avoiding idiosyncratic choices or arbitrary changes in the choices of sentences or expressions to designate what they mean. If a rational speaker S intends to bring about a certain response r in an audience A, he will choose the expression he takes to be the most likely to induce r in A. His choice thus should be based upon his knowledge of A's knowledge of his (S's) usual means — or the usual means within some group of which S and S's anticipated audience are members — for expressing his intent. If S chooses expressions that he has used in the past for expressing an intended proposition p, there is a greater likelihood that A will recognize his intent than were S to choose an expression without such precedented use. (Schiffer, [26], pp. 120-126) There thus appear to be good reasons for establishing and maintaining standard or conventional means of expressing meanings in communities within which discourse is frequent or unusual.

Regarding well-established collateral knowledge, there are also good reasons for incorporating well-established propositions into a fund of knowledge taken for granted within a community. A proposition may be so well confirmed or corroborated and so universally accepted within a community that there is rarely an occasion for asserting it. It may also play a role in inferences that are essential to some domain of research, as, e.g., assuming Newton's laws of motion in using satellites to detect variations in the earth's magnetic field, or using characteristic spectral lines to infer the presence of certain chemical elements in stars or elsewhere. In such cases mention of perturbations or of certain characteristic spectral lines can eventually mean the presence of variations in a gravitational field or of a certain chemical element. Thus the confirmation or corroboration of the principle in question, the utility of the principle

as an instrument for research and the convenience of concise expression in combination constitute good reasons for taking the principle for granted and incorporating it into the meanings of everyday scientific expressions.

Often this incorporation is not one of conscious rational choice, but a matter of an unconscious 'drift' in the meanings of expressions that are frequently used in verbal exchanges between members of a community. In such exchanges speakers and audiences gain the kind of mutual knowledge expressed in  $S_1-S_4$  and  $A_1-A_3$  above. As some of A's or S's substantive beliefs may be continually changing, the content of this mutual knowledge will undergo change, and with it the meanings of the expressions commonly used by S and A. This drift in what S and A take for granted may well escape the consciousness of these persons and come to the attention only of some third person who is able to compare their discourse with that characteristic, e.g., of some other period in the development of the discipline.

Yet there may occur good reasons for consciously changing meanings. Correlative knowledge taken for granted may be defeated or thrown into doubt by contrary evidence. In the Darwin example, the discovery of mechanisms to insure population stability in certain species casts some doubt on the malthusian principle. Accordingly, mention of a 'struggle for existence' among organisms does not and is not expected to command assent among biologists today. To be acceptable, an account of competition between organisms of the same or of different species must be accompanied with empirically based descriptions of intraspecific breeding and other social relations, some of which can be altruistic rather than competitive. Similar empirically based descriptions or relations between species are also required, and some of these relations may involve cooperation, i.e., symbiosis.

In fact, most biologists would regard the very terminology 'struggle for existence' as grossly inadequate for expressing the variety of relations between various species of organism in the various biological communities. Accordingly, there are good reasons for departing from that original Darwinian terminology and introducing terminology capable of expressing differences between inter- and intra-specific competition and cooperation, various forms of altruism and symbiosis, as well as competition for food, water, sunlight, living or breeding space, and actual breeding.

### 3. *Conclusion.*

In conclusion I shall sum up briefly how the intentional theory is able to meet the objections cited against the various versions of the contextual theory of meaning.

(1) According to the version of the intentional theory presented in this essay, one might restrict the meaning-determining beliefs in a community to those for which there are ready epistemic properties  $H$  (e.g., the possession of a university degree in a field) which are (a) sufficient to determine whether a given possessor knows a proposition  $p$  and (b) sufficient for knowing that that possessor knows  $p$ . Such a property might be the possession of a university degree in a given discipline or some similar qualification for research in a discipline or sub-discipline. Of course  $H$  cannot provide infallible knowledge of  $p$  or infallible knowledge that a person  $A$  knows  $p$ , but such infallible knowledge is not required for meaning, as was contended above. However, choosing professional credentials as the epistemic property  $H$  restricts the requisite mutual background knowledge to propositions that are taken for granted in a community and for which there is knowledge in the community that they are taken for granted. Such knowledge would include using atomic number or characteristic atomic spectra for identifying elements, accelerations to identify anomalies in gravitational fields, etc. But it would also exclude propositions for which there is widespread disagreement or uncertainty, for then possession of professional qualifications need not entail knowledge of or knowledge that one knows a given proposition. Such propositions include, for example, debatable claims such as the evolutionary basis of various elements of human culture and behavior (Ruse, [24]). Those with university credentials in evolution theory may believe or may be quite sceptical of such propositions.  $H$  in this case is insufficient for knowing or knowing that one knows these propositions.

(2) One of the central points of the intentional theory is the distinction between believing a theory and meaning a proposition  $p$  by  $x$  or appreciating that a speaker means  $p$  by  $x$ . In both cases the beliefs are about the beliefs of others and not beliefs in theories. Accordingly, there is good reason for talking of the meaning of an expression  $x$  apart from belief, acceptance or advocacy of the theories in which  $x$  is embeded. An audience  $A$  may change the global theories it believes or advocates without changing its appreciation of the claims of a speaker  $S$ , where the latter appreciation depends upon  $A$ 's beliefs about  $S$ 's beliefs and not  $A$ 's beliefs themselves. Conversely, what  $S$  means by  $x$  directed to  $A$  depends on

S's assessment of A's beliefs, not upon the theories held by S.

As communication thus depends upon knowledge of other's beliefs and not directly upon theoretical or other knowledge of some scientific subject-matter, S's and A's differences in the latter beliefs or knowledge do not necessarily bring about semantic incommensurability, i.e., mutual incomprehension resulting from using expressions with different meanings. Semantic incommensurability need not occur where only meanings differ. Different meanings suffice for such incommensurability only under rather unusual or problematic historical circumstances where these meanings are also inaccessible to both parties of discourse. Accordingly, the intentional theory neatly avoids one of the most commonly raised objections to the historicist's version of the contextual theory.

(3) Finally, the intentional theory does appear to avoid the circularity and the indeterminacy of the historicist and logical empiricist version of the contextualist theory. An expression's meaning  $p$  in a language  $L$  is a matter of speakers  $S$  of  $L$  making a practice of intending propositions or commands  $p$  by  $x$  so that an audience  $A$  knows of these intentions. The units  $x$  are, according to the Grice-Schiffer account, 'whole utterance types', i.e., utterances or inscriptions that mean propositions or commands. Such utterances, etc. may be composite — i.e., an utterance may have a proper part  $y$  that means something and the meaning of  $x$  is determined in part by the meaning of  $y$  — or they may be non-composite — i.e., without any such proper part. (Schiffer, [26], pp. 4-7) The circularity problem clearly does not arise for non-composite utterances, for which Schiffer develops the main body of his theory of meaning.

However, one can know the meaning of a non-composite utterance  $x$  only if he knows what is meant by uttering  $x$ . In the case of composite utterances one can know the meaning of a novel utterance  $x$  on the basis of his knowledge of the meaning of — i.e., conventions or precedents pertaining to — components of  $x$ . Composite utterances would constitute the majority of utterances in scientific discourse, and thus in applying the Grice-Schiffer theory to scientific discourse we need an account of the meaning of utterance components — part-utterance types in Schiffer's terminology — that also is not subject to the circularity charge.

At the end of his work Schiffer develops an account of meaning for languages containing composite utterances or sentences, the simplest of which consists of a vocabulary  $N$  of names,  $V$  or predicates, sets of conventions  $M$  associating the names with objects,  $M'$  associating predicates with properties, and a condition  $C$

specifying an utterance  $s$  such that

(a<sub>1</sub>)  $s$  consists of a  $V$  followed by an  $N$

(a<sub>2</sub>)  $\langle N, y \rangle$  is a member of  $M$

(a<sub>3</sub>)  $\langle V, P \rangle$  is a member of  $M'$

(a<sub>4</sub>)  $y$  has  $P$

etc. for truth functions of  $s$ . A sentence  $s$  of  $L$   $C$ -determines a proposition  $p$  iff

(1)  $s$  satisfies  $C$  iff  $p$

(2) if any rational person believes that  $s$  meets  $C$ , he believes that  $p$ , where  $p$  is a proposition other than that  $s$  meets  $C$ .

Schiffer then suggests that to know the meaning of a word, i.e., a member of  $N$  or  $V$  in  $L$ , is to know its contribution to the  $C$ -determination of the sentences in which it occurs. In short, word-meaning is dependent on sentence-meaning in a manner specified by the structure of a language  $L$ . Thus the composite sentences 'a is Red' ( $p$ ) and 'b is Green' ( $p'$ ) have meaning in  $G$ , i.e.,  $C$ -determine  $p$  and  $p'$  in  $G$ , only if, among other things, it is mutually known in  $G$  that 'a' and 'b' refer to specific objects and 'Red' and 'Green' designate definite colour-concepts. But also the  $C$ -condition ensures that 'b is Red' and 'a is Green' determine different propositions  $p''$  and  $p'''$  in  $G$ . (Schiffer, [26], pp. 162-166)

Accordingly circularity is avoided by making word-meaning dependent upon sentence-meaning, the latter of which is explicated in terms other than word-meaning, viz. in terms of mutually known conventions for expressing intentions by whole utterances within a community  $G$ .

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## NOTES

<sup>1</sup> I am indebted to my colleague, John Richards of the University of Georgia, for his helpful comments on an earlier version of this paper.

<sup>2</sup> A distinction should be drawn between *semantic commensurability* and *methodological commensurability*. Two theories are methodologically commensurable when they share common methodological standards against which they may be evaluated relatively to one another. Thus, if two theories are formulated against methodological backgrounds that contain different standards of scientific explanation, they may be methodologically incommensurable. Accordingly, post-newtonian action-at-a-distance force theories are

acceptable under standards in which action across empty space is acceptable as requiring no further explanation. Anyone operating within a neo-cartesian framework in which action-at-a-distance is incomprehensible would not regard the post-newtonian theories as fundamental accounts of natural forces. Neo-cartesian and post-newtonian theories are thus methodologically incommensurable in that they are formulated against divergent background standards of scientific explanation, and unless standards for preferring such standards can be formulated, neither type theory can be assessed *vis-a-vis* the other. (Kuhn, [18] See Bunge [3], Vol. 1 pp. 77-78 for a somewhat different distinction).

<sup>3</sup>Such encounters causally propagate this kind of mutual information through a community. This propagation I take to be the appropriate causal relation for casting Kripke's causal theory of reference into an intelligible and useful form for the philosophy or historiography of science. (Kripke, [17]; Kleiner, [16]).

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