What Model-Theoretic Semantics Cannot Do

It has frequently been argued that Structural Semantic theories (e.g., Katz [13, 14, 16, 18],

Jackendoff [12], and some versions of Generative Semantics [1, 21, 27, 28]) are deficient in an

essential way. Cresswell [3], Lewis [24], Partee [32], and Vermazen [39] (among others) all

argue that Structural Semantic theories (hereafter, SS) do not articulate relations between

expressions and the world, that they do not provide an account of the conditions under which

sentences are true, and therefore, these theories are not really semantics. In their place, many

philosophers and linguists endorse model-theoretic semantics (hereafter, MTS).[1] They do so

because they believe that MTS compensates for what is deficient in SS. My aim in this

discussion is to reconstruct the case against SS by demonstrating that the concept of truth is

central to semantics and that a theory which issues in truth-conditions for sentences of a

language L must be the heart of a semantic theory for L. But I will also argue that MTS theories

by themselves, somewhat surprisingly, are inadequate in exactly the same way as SS theories. If

I am correct, then the widespread view that MTS can provide either a theory of meaning or a

theory of truth conditions for the sentences of a natural language is mistaken.

SS theorists countenance properties and relations like synonymy, antinomy,

meaningfulness, meaninglessness or semantic anomaly, redundancy, and ambiguity as a good

initial conception of the range of semantics. They do so because, for them, a semantic theory for

a language L is a theory of meaning for L and they believe that properties and relations like

these are central to our concept of meaning. Therefore, any theory which did not bear on all, or

at least many, of these phenomena should be suspect as a semantic theory [8, 14].

Theories in the SS vein proceed by translating or mapping natural language expressions

into (sequences or sets of) expressions of another language. There is no uniformity among SS

theorists about the nature of this other language or about how these translations or mappings are

to be effected.[2] For our purposes we beg no questions by restricting attention to Katz's

suggestion, where the language translated or mapped into is "Semantic Markerese" [13, 14, 16, 18]. The culmination of the various translation rules and other apparatus within Katz's theory result in theorems like (A):

(A)   "Barbara sekoilee" in Finnish translates into the language of Semantic Markerese as S.

Translations of this kind are constrained, and this is the reason for bringing them in along with the semantic markers in the first place, such that synonymous expressions of some language L translate into the same (sequence or set of) expressions of Semantic Markerese, ambiguous expressions of L translate into different expressions of Semantic Markerese, anomalous expressions of L translate into no expressions of Semantic Markerese at all, and so on. Facts about synonymy, ambiguity, anomaly, and other semantic properties and relations are accounted for through these representations, translations and semantic constraints (or definitions).

Some critics of Katz's theory charge that the phenomena he concerns himself with represent only a sample of the full range of facts semantics must ultimately deal with, and they argue that SS cannot in principle accommodate this full range. In particular, some argue that it is the construction of truth-conditions which should count as the central concern of semantics, not these other properties and relations, and that SS theories cannot provide truth-conditions.[3] This raises two questions: why can't SS theories provide truth-conditions and why should they? This second question is especially significant inasmuch as SS theorists have expressed bewilderment in the face of the criticism that their theories do not specify truth-conditions.

Katz, for one, agrees that his semantic theory leaves out the notion of truth, and therefore, does not specify truth-conditions, but, he goes on to say, "the subject matter to which `truth' is central is not one that my semantic theory is or was ever intended to be about" [14:182]. If "semantics" is construed as having to do with meaning, then truth "is not central to semantics and so there can be no claim that my theory has left out something central" [14:182].

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As Katz sees it, the criticism that his theory does not specify truth-conditions trades off an ambiguity of the term "semantics." For SS theorists the goal of a semantic theory is to construct a theory of meaning, whereas for their critics, the goal of a semantic theory is "to study relations between objects of one sort or another and the expressions of a language that speak about them" [14:183], relations which ultimately get spelled out through truth-conditions for sentences of this language. Therefore, if the criticism that SS theories do not specify truth-conditions is to carry any force with Katz, we must show that a semantic theory for a natural language which has as its goal the construction of a theory of meaning for this language must, in order to achieve this goal, specify truth-conditions for sentences of this language. This would have the effect of collapsing Katz's two senses of "semantics" into one. We take a step in this direction by asking, what should we expect from a semantic theory as a theory of meaning?

Traditional wisdom about meaning is that it is in virtue of knowing what a sentence means that we (in part) understand it. For example, it is in virtue of knowing what "Barbara sekoilee" means alone that I am warranted in believing that an assertive utterance of these words is an assertion that Barbara is confused. If I further know that these words are true on the occasion of utterance, then knowing their meaning warrants (in part) my believing that Barbara is confused as well.[4]

This illustration brings out nicely the two-sidedness of the concept of meaning. On the one hand, meaning is connected with a host of extensional concepts: satisfaction, denotation, truth and so on. This is reflected in the principle implicit in our example: if a sentence S is true, and if S means that p, then p. On the other hand, meaning is connected with a host of intensional concepts: indirect quotation, assertibility, and so on. This is reflected in the connection we just saw between meaning and indirect quotation: if someone assertively utters a sentence S, and S means that p, then this person says that p. Given the meaning of a sentence, this duality permits us to move in either of two directions. We can exploit the relationship between meaning and truth to infer something about the world beyond the speaker, or we can exploit the relationship

between meaning and certain intensional notions to infer something about the speaker himself, what he asserted, queried, commanded, etc. With this wisdom in mind, we expect a semantic theory as a theory of understanding (or, as a theory of semantic competence) for a language *L* to at least specify the meanings of sentences of *L*.[5] SS theorists agree about this, but they have erred in assuming that any semantic theory which accounts for semantic properties and relations like ambiguity and synonymy in the manner suggested above will as a matter of course also specify meanings for sentences in an appropriate way.

Any SS theory which issues in (A) certainly entails (B):

(B) "Barbara sekoilee" means the same as *S*.

Therefore, any SS theory which issues in (A) can be said to specify the meaning of "Barbara sekoilee" but not in an appropriate way since (B) alone will not warrant its knower in believing that an assertive utterance of the sentence named on the left is an assertion that Barbara is confused. Nor would its knower be warranted in believing that Barbara is confused if he further knew that this sentence is true. Why not?

In the overall picture of SS there are three languages: the natural language, the language of Semantic Markers, and the translating language (which may be Semantic Markerese, the natural language, or some other language). Translation proceeds by correlating the first two of these using the third. But it is possible to understand (A) or (B) knowing only the translating language (in this case English) and not the other two. Put somewhat differently, we can know that a sentence translates, or means the same as, another without knowing what either means. We can know that (A) or (B), perhaps, on the basis of what Katz tells us, without knowing what either "Barbara sekoilee" or the Semantic Markerese sentence *S* means.

Of course, if someone understands Semantic Markerese, then he can no doubt use (B) to interpret the Finnish sentence; but this is because he brings to bear two things he knows that (B)

does not state: that Semantic Markerese is a language he understands, and his particular knowledge how to interpret S. This latter knowledge is doing most of the work here - not the SS theory. And it is this knowledge we want an adequate semantic theory of meaning to characterize.

Nothing we have said so far, however, establishes either that a semantic theory as a theory of meaning should be concerned with truth-conditions, nor, for that matter, that SS theories cannot be used to assign truth-conditions. In fact, there is some prima facie evidence to think that SS theories can be used to assign truth-conditions to sentences. For, surely, if (A) holds, then it follows that (C):

(C)   "Barbara sekoilee" is true in Finnish if and only if S is true in Semantic Markerese.

Since S's being true in semantic Markerese is one condition under which "Barbara sekoilee" is true in Finnish, shouldn't (C) count as providing truth-conditions for the Finnish sentence? It would seem that if there is a deficiency in SS theories with respect to truth-conditions, then something must be wrong with the kind of specification of truth-conditions (C) provides. To see that this is so, we must ask why a semantic theory as a theory of meaning should be concerned with truth-conditions in the first place.

We said before that someone who knows the meaning of "Barbara sekoilee" would, presumably, be warranted in believing that Barbara is confused if he further knew these words were true. But this is exactly what we would expect someone to be licensed to believe if he knew the conditions under which the sentence is true. The sentence is true if and only if Barbara is confused. That is to say, at least for a straightforward declarative sentence, in specifying the conditions that have to hold for it to be true, we are in effect characterizing a central aspect of its meaning.

Seen from another angle, suppose that someone knows the meaning of "Barbara sekoilee" and knows all the relevant facts (or, not to be tendentious, knows everything in the world there is to know), then this person will know whether the sentence is true. How could this be unless meaning determined truth-value throughout the relevant possible states of affairs? And, if meaning does determine truth-value in this way, then a theory of meaning for a language will have to specify truth-conditions. (Indeed, many semanticists would go so far as to say that knowledge of truth-conditions for a sentence is knowledge of its meaning cf., e.g., [3]. They do so because they believe that knowledge of truth-conditions warrants whatever knowledge of meanings has traditionally been thought to warrant.)

If the meaning of a sentence includes as a part (or is identical to) truth conditions for this sentence, then any semantic theory for a language which purports to be a theory of meaning for this language must specify the truth-conditions for each sentence of the language. From this it does not follow that any semantic theory which provides a complete specification of truth conditions for sentences of this language is adequate. An SS theory which issues in theorems like (A) may entail (C), but (C) alone does not warrant its knower to believe that Barbara is confused if he further knows that "Barbara sekoilee" is true. This is because (C) does not specify truth conditions for "Barbara sekoilee" in an appropriate way.

What we have shown is that SS theories, though they may account for some aspects of our concept of meaning, cannot account for them all. For whatever knowing the meaning of an expression includes, it does not involve simply translating the expression into a semi-formal language, nor telling us which other sentence it means the same as, nor telling us which other sentence it has the same truth-conditions as. We turn now to MTS with an eye towards how it can compensate for what is deficient in SS; how is MTS able to provide an explicit characterization of what SS assumes and leaves unsaid?

SECTION 2

Model theory has traditionally been used as a mathematical technique for investigating certain properties of formal systems such as consistency, completeness, the finite model property and having a decision procedure. There is now a growing impression among linguists and philosophers that model theory can provide a theory of meaning for natural languages. This view has greatly come into its own in the last few decades largely because of the work of Kripke [19, 20], van Fraassen [38], Hintikka [10], Montague [29, 30, 31], Lewis [24], and others. These authors have developed MTS for formal systems of many valued, sortal, free, tense, demonstrative, counter-factual and modal logics. These results have encouraged many researchers to believe that MTS may be sufficiently powerful to provide a theory of meaning for substantial fragments of natural language. There are many competing approaches; each, however, seeks to characterize (or define) a relativized concept of truth (at a world, time, or whatever other index is deemed relevant). Here I will focus discussion on Montague Grammar, in particular his theory in [31] (hereafter, PTQ). What I have to say about PTQ extends obviously to any MTS approach. Montague personally was not interested in a theory of understanding. My discussion, however, is directed not to Montague, but instead to those semanticists who are interested in formal semantics as a theory of understanding, and to those who have argued that MTS constitutes a real advance over SS. I focus on PTQ because it is familiar and because many semanticists who are interested in semantic competence employ the theory of PTQ or some variant of it [33].

In PTQ, Montague proposes a general theory of syntax and MTS. He treats a fragment of English which includes simple quantification and some intensional verbs. His theory involves three distinct phases: English expressions are assigned a syntactic analysis with respect to a categorial grammar. This syntax is translated into the syntax of a tensed intensional logic with various nonlogical constants. Finally, the expressions of this intensional logic undergo

model-theoretic interpretation. This interpretation proceeds by linking linguistic entities with nonlinguistic entities in two ways: method of extension and method of intension.

The extension of an expression from some language L is determined relative to an interpretation A of L and a world w and time t in A (i.e., relative to the model <A<w, t>> of L). In short, it is the object the expression denotes in A at w and t. The intension of this expression is the meaning, sense or concept correlated with the expression. Instead of treating intensions as basic, as some kind of ideal abstract entity or mental representation, Montague defines the intension of an expression as a function: it is the function which, for every possible world w and time t (in A), picks out exactly those objects in A which make up the extension of this expression in A at w and t. We need not go into any great detail. Suffice it to say that the culmination of the various definitions, translations, rules and other apparatus within PTQ result in theorems like the following:

(E)   "Barbara sekoilee" is true in an interpretation A at a world w and a time t (in A) if and only if the extension picked out by the intension of "Barbara" in A at w and t is a member of the extension picked out by the intension of "sekoilee" in A at w and t.

(I)   The intension of "Barbara sekoilee" in an interpretation A is a complex function from the set of possible worlds and times in A onto the set of truth values, true and false, where this complex function is arrived at by composing the intension of "Barbara" with the intension of "sekoilee." The intension of "Barbara" is a function from possible worlds and times (in A) to individuals in A. Similarly, the intension of "sekoilee" in A is a function from possible worlds and times (in A) to functions from individuals in A to truth values (alternatively, one can say, from possible worlds and times to classes of individuals). (Montague has different intensions for proper names and he treats predicate intensions as arguments of proper name intensions in

composing the two functions. Neither of these points, however, affects the present discussion. I have chosen these intensions of expository purposes.)

It is held by many MTS theorists that there are important advantages PTQ offers over its SS competitors [cf. 3, 24, 29, 32]. It is distinguished from an SS approach inasmuch as instead of linking expressions of one language with expressions of another (i.e., instead of stopping at phase two in PTQ), PTQ links expressions to non-linguistic entities (the third phrase in PTQ). Our question is, Why should these links sign post an advance over SS? What advantages accrue to PTQ is virtue of having consequences like (E) and (I) that do not accrue to SS theories?

The PTQ embodies some very special claims about the fundamental nature of semantic interpretation, and about the way in which syntax and semantics systematically correlate. This correlation embodies the familiar Fregean principle of compositionality: stated crudely, this is the principle that "the meaning of the whole is a function of the meanings of its parts." The correlation is realized in Montague's work by giving the syntax the form of a simultaneous recursive definition of the sets of well-formed expressions of each syntactic category of the language, recursively building up larger phrases and clauses from smaller ones, and associating with each syntactic formation rule a semantic interpretation rule that specifies the interpretation of the constitutent phrases. Most semanticists argue that an adequate theory of meaning must embody this kind of compositionality; otherwise, it would be impotent to account for the obvious and essential fact that we can understand hitherto unencountered sentences.[6]

Evaluation of a semantic theory for some language is not limited to whether or not it embodies a principle of compositionality alone. It involves also, to some extent, evaluating how accurate a map the theory provides of the logical geography of the language, i.e., the logical consequences, truths, equivalences and other logical properties and relations. After all, part of understanding a language involves knowing which sentences stand in logical relationships (like logical consequence) to others. Someone who did not know that whenever a sentence of the

form ⌜*P* and *Q*⌝ is true, then sentence ⌜*Q*⌝ is true, cannot be said to understand English or at least one important word in English, "and." One important benefit MTS offers is a way to define these important logical notions. (If we consider a subset *K* of the models determined by an interpretation for some language, we can define a sentence *O* as *K*-valid if it is true in each of these models in *K* If *K* is the set of models (determined by any interpretation) in which all the logical words of the language ("not," "or," "and," etc.) receive the extensions usually given by logicians to these words, then these will be the logically possible models for *L*. Then *K* validity is logical-validity. In PTQ, Montague effects this restriction by a set of meaning postulates. Meaning postulates are ways of placing restrictions on the interpretation of expressions. We could have a notion of logical validity based on the subset of models in which all of the meaning postulates are true [30:236; 31:263].)

Giving an account of compositionality and of logical consequence, therefore, are two central goals for PTQ. But - and this is a big "but" - these two goals are also central for SS. Katz seeks to embody a Fregean compositionality in his theory. His dictionary assigns a meaning ("lexical reading") to each basic expression of the language. Projection rules in his theory can be regarded as semantic operations, where there is a projection rule corresponding to each phrase structure rule. These projection rules combine recursively the readings for each node immediately dominating lower nodes [14, 18]. The more vital notion of entailment (and the family of notions definable in terms of it) Katz attempts to define not in terms of classes of models (nor in terms of inference in some formal deductive system), but rather in terms of containment of (parts of) one reading in another [14, 15, 17, 41].

None of the arguments in the critical literature shows that Katz's theory cannot in principle accommodate these two essential semantic features. And what's more important - and this is very important - the translation argument, the argument MTS theorists themselves have preferred in criticism of SS, was certainly not preferred to show that SS cannot account for compositionality or logical consequence. This is so because just as I can know that one sentence

translates another without understanding either, I can know that the first entails the second without understanding either, without knowing what either means (though, perhaps, knowing that one sentence implies another is part of knowing what each sentence means). And, also, I can know how the parts of expressions combine to issue in the meanings of the larger expression without understanding this expression. If all we wanted from a semantic theory were to account for *these* two aspects of language, then no reason in principle has been preferred for preferring MTS over SS. Therefore, if SS is deficient in a way that MTS is not, then there must be another aspect of language that an adequate semantic theory must address which MTS addresses and SS does not.

The deficiency critics of SS emphasize is that SS fails to provide a connection between expressions and extralinguistic entities. Barbara Hall Partee, for example, writes:

Semantics [a la Montague and Thomason] has always been the study of the relations between expressions in a language and the non-linguistic subject matter that the expressions are about ... No amount of ... interlinguistic connections can serve to tie down the extralinguistic content of intensions. For that there must be some language-to-world ground [42].

Quotes of this sort can be produced ad infinitum. According to these authors, PTQ represents an advance over SS because it *requires* realizing a connection between expressions and extralinguistic entities. Contrary to SS, MTS proponents intend to break out of the "confines of language." Earlier we saw the importance of having a semantic theory that offered an explicit and general way of accounting for the relationships that hold between any sentence and a situation, where the sentence's truth conveys information about that situation. In virtue of understanding the sentence "Barbara sekoilee," I can come to have a belief about the nonlinguistic world, namely, the belief that Barbara is confused, upon hearing this utterance. A theory which never moves beyond mentioning language cannot accommodate this feature of

language, for it is only by using language that we can talk about a nonlinguistic world. But, still, we must ask whether PTQ issues in theorems which engineer transitions from utterances to assertions. We have no reason beforehand to assume that any linguistic/nonlinguistic link a theory forges will license ascriptions characteristic of language understanding. I will now argue that PTQ, like SS, does not provide enough to bridge the gap between utterance and assertion.

Suppose that Frank utters the words "Barbara sekoilee," and all I know about Frank's language is that (E') and (I') hold:

(E') "Barbara sekoilee" is true in Finnish if and only if whatever "Barbara" picks out is one of the things "sekoilee" is true of.

(I') The meaning of "Barbara sekoilee" in Finnish is the proposition which results from taking the meaning of "Barbara" as argument of the meaning of "sekoilee."

It would be quite remarkable if I were able to discern what Frank asserts when he utters "Barbara sekoilee," provided that (E') and (I') constituted the whole of my knowledge about Frank's language. Knowing that (E') or that (I'), at best warrants my believing that Frank asserted that something named "Barbara" has the expression "sekoilee" true of it. It would remain a mystery to me which thing it is, and exactly what is true of it.

Unless a sentence uttered is about language, reference to language must be eliminated entirely by any semantic theory which seeks to provide a theory of meaning; whatever we come up with has got to take its knower from the perception of the sequences of sounds to their characteristics. Once you understand the motivation for this condition you should see that PTQ, apart from whatever other riches it may yield, is as inadequate as SS. Both from the start take a wrong direction. We are never told straight out what the truth conditions or meanings of sentences are. Instead of fixing an interpretation of names and predicates, these are left open in

PTQ. The notions of truth and denotation are defined relative to a given interpretation, which includes a given set of possible individuals, worlds, and times. (E) and (I) tell us how to derive the truth conditions of, and the proposition expressed by, the sentence "Barbara sekoilee" only relative to an interpretation A and a given world w and time t in A. In order to complete the disquotation and get at the actual truth conditions and propositions expressed by this sentence we need to specify (single out) the actual interpretation and the actual world and time. In this regard, it is illuminating to compare PTQ with Davidson's semantic theory.

Davidson's theory differs from PTQ in at least one important respect. Davidson [4] argues that the kind of structure needed to account for language understanding is either identical with or closely related to the kind given by a definition of truth along the lines first expounded by Tarski [36]. Such a theory (by means of a set of axioms) entails for every sentence in the language a statement of the conditions under which it is true, expressed by biconditionals of the form "S is true if and only if p." [S here refers to the sentence whose truth-conditions are being given, and p is that sentence itself. If the language in which these truth conditions are being stated does not include the language to which S belongs, then p will have to be a translation of S.] This condition of adequacy excludes MTS theories because these theories move in a direction different from that proposed by Davidson's conditions. Since MTS theories substitute a relational concept for the single place truth-predicate, such theories cannot carry through the last step of the recursion of truth (or satisfaction) which is essential to the quotation lifting feature of the truth-condition biconditionals [5].

Put somewhat differently, from a relativized truth-theory we cannot derive an absolute truth-theory. Thus, suppose, for example, language L consists of one sentence, "Barbara sekoilee." An MTS theory for L along the lines of PTQ would issue in a theorem something like:

(1) $(A)(p)$ ("Barbara sekoilee" is true in A at p iff the extension of "Barbara" in A at p satisfies "sekoilee" in A at p),

where "*A*" ranges over interpretations and "*p*" ranges over possible worlds. (We omit reference to times.) From a relativized truth-theory for *L* like (1) we cannot derive an absolute truth-theory for *L* like (2):

(2) "Barbara sekoilee" is true iff Barbara is confused.

The weakest addition to (1) we could make in order to derive (2) from it is the following:

(3) [EXISTENTIALS] (]*A*)(]*p*)(*x*) ((the extension of "Barbara" in *A* at *p* = Barbara) & (*x* satisfies "sekoilee" in *A* at *p* iff *x* is confused) & ("Barbara sekoilee" is true in *A* at *p* iff "Barbara sekoilee" is true))

The first two clauses in (3) essentially say that, in order to understand L, we must know, in addition to (1), the base clauses in an absolute truth theory for L, i.e.,

(4) The extension of "Barbara" = Barbara,

(5) (*x*) (*x* satisfies "sekoilee" iff *x* is confused).

The last clause in (3), essentially says that we must further know that interpretation A is the actual interpretation and some world *p* in *A* is the actual world. Knowing that *A* is the actual interpretation and *p* is the actual world licenses us to infer that truth in *A* at *p* is absolute truth.

What can we conclude from the fact that (1) alone does not imply (2)? Hartry Field raises this question in other context [44]: he asks whether the facts that, for example, (6) contains a

semantic term where (4) does not, give theories which employ base clauses like (4) an advantage over those which employ base clauses like (6).

(6) "Barbara" denotes what it denotes.

After a long investigation, in which he finds no adequacy condition on an absolute truth theory which rules out (6) but not (4), he concludes that there is unlikely to be any philosophical purpose or interest that theories which employ clauses like (4) serve better than those which employ clauses like (6). Partee endorses Field's conclusion. She writes [43], pp. 321-22:

As Hartry Field argues, a Tarskian truth definition has at its basis a listing of denotation conditions for the primitive terms in the form (7), and for the primitives we might just as well start with the form (8).

(7) "Snow" denotes snow.

(8) "Snow" denotes what it denotes.

Partee agrees with Field [44] (and Harman [9]) that:

The real work of the truth definition and similarly for a Montague-style possible world semantics, comes in the specifications of how the interpretations of the infinite set of sentences can be determined by a finite set of rules from the interpretations of the primitives.

The idea here is that truth-conditional semantics illuminates meaning not by assigning truth-conditions but through exhibiting the roles of logical words "and," "or," etc., in its

recursive clauses. Partee sees Tarski-style truth theories and MTS style theories equally inadequate when it comes to specifying the meaning of lexical items.

One author, Richmond Thomason, taking an uncharacteristically Quinian line, goes further by arguing that we *cannot* reasonably expect semantic theories to tell us anything important about the meaning of lexical items. He writes:

The problems of a semantic theory should be distinguished from those of lexicography .... A central goal of (semantics) is to explain how different kinds of meanings attach to different syntactic categories; another is to explain how the meanings of phrases depend on those of their components .... But we should not expect a semantic theory to furnish an account of how any two expressions belonging to the same syntactic category differ in meaning. "Walk" and "run," for instance, and "unicorn" and "zebra" certainly do differ in meaning, and we require a dictionary of English to tell us how. But the making of a dictionary demands considerable knowledge of the word [37:48-9].

To ask the semanticist to give a specification of the meanings of words would be to ask too much, since it would require of him that he construct a world encyclopedia.

Each of these authors has gone wrong because he or she has failed to appreciate the differences between an absolute truth theory and MTS. First, this can be seen with regard to Partee's and Field's claim that there are no advantages in absolute truth theory with base clauses like (4) has over a theory, e.g. an MTS theory, with base clauses like (6). Simply note that if these authors were right, then a Davidsonian truth theory would tell us no more about lexical semantics than Montague's theory. But we have shown that this is false. Adding (6) to PTQ will not license the kinds of reasoning we have been probing, reasoning we have argued is characteristic of language understanding. Adding (4) will. (6) does not eliminate reference to language in ways that (4) does.

What about Thomason's argument that lexical semantics is not part of semantics proper since to distinguish the meanings of any two terms frequently requires more information than we can reasonably expect a semantic theory to provide us with? We cannot reply to him that a semantic theory which does not specify the meanings of the lexical items of a language *L* fails to specify the knowledge requisite for understanding *L*. Thomason's position apparently is that we cannot reasonably expect a semantic theory to specify all this knowledge. Semantics proper, according to him, is to specify the meanings of the connectives involved in inference. But Thomason is wrong here. Why should we think that the specification of the knowledge required for understanding lexical items in our language demands as much knowledge as Thomason thinks? Put somewhat differently, what do we expect to achieve by eliminating reference to language in the base clauses of PTQ? Again, we want a theory which will provide truth conditions (and/or meanings) of sentences of the language in such a way that someone who knows these truth conditions (or meanings) would be licensed to believe that the speaker asserted, or would be licensed in believing what the speaker asserted about the world. Our question is what do we need to know about the difference (to borrow Thomason's own example) between the words "run" and "walk" to guarantee such competence? Presumably clauses like (9) and (10):

(9) (x) (x satisfies the predicate "run" iff x runs).

(10) (x) (x satisfies the predicate "walk" iff x walks).

Someone who had this knowledge would be licensed to believe that Barbara runs when he hears the words "Barbara runs" uttered by a reliable speaker and he would be licensed to believe that Barbara walks when he hears the words "Barbara walks." This knowledge does not seem at all

to require considerable nonlinguistic knowledge. In fact, if anything, it seems to be paradigmatic of linguistic semantic knowledge.

What does all this add up to? One response is to say that our results are unsurprising since MTS is primarily valuable as a theory of logical consequence rather than as a theory of meaning. These two kinds of theory have different goals which have induced salient differences in approach. A theory of logical consequence is concerned with the validity of forms of argument, represented by inference schemas. Therefore, it must attend to a multiplicity of possible interpretations of a sentence schema: the notion it requires is that of truth under an interpretation. A theory of meaning, as we have portrayed it here, is concerned only with a single interpretation of a language, the correct or intended one: so its fundamental notion is that of meaning or truth-simpliciter.

However, despite their differences in goals, these two theories have been closely allied historically. Throughout the subsequent course of both subjects, theorists of meaning have borrowed from theorists of logical consequence many of the concepts devised by logicians: MTS being a primary example. The differences in goals between the two subjects raises the question, How far can the devices employed by logicians be made to serve the different purposes of semanticists of natural languages? The upshot of our investigation is that MTS can serve them no better than, and is consequently as deficient as, SS.

SECTION 3

Many Montague grammarians and other proponents of MTS would agree with these last points but argue that in characterizing the collection of all interpretations of a language we also do specify a particular one, the actual interpretation, and that this specification of the actual interpretation also would involve specifying the actual world, thus enabling us to characterize absolute truth. After all, Tarski himself describes MTS as the general theory of which the

absolute theory is a special case [36:156]. Montague showed no inclination to single out a unique interpretation of English, but he did note that "not all interpretations of Intensional Logic will be reasonable candidates for interpreting English" [PTQ:263]. And in EFL he says [29]:

To be specific, a sentence would be considered true with respect to an analysis or a possible world i if it were true (in the sense given earlier) with respect to the actual model and i. This relativization to i would be eliminable in the same way once we were able to single out the actual world among all possible worlds.

The question we have been pursuing here is what form a semantic theory should assume, what kinds of procedures for presenting meaning and truth-conditions should a semantic theory take if it is to successfully characterize the linguistic knowledge which distinguishes speaker from nonspeaker. Montague apparently agrees here that his theories do not suffice for this purpose (although they may succeed in characterizing part of our semantic competence, e.g., our competencies to determine logical consequence, ambiguity, compositionality, etc.). To do a complete job, we need to go on to define the unrelativized sense of a sentence and the unrelativized truth conditions [cf. also 32]. In the above passage, Montague says that, if we adopt his approach, a complete job would involve singling out one interpretation to determine the meanings of the various sentences of the language, and in addition, one world in this interpretation to determine the truth conditions for these sentences. If an interpretation can be singled out and along with it the actual world, then presumably someone who understands PTQ can use it to interpret sentences from the fragment of English PTQ addresses itself to. But this is because he brings to bear his knowledge of what the actual interpretation of his language is and which world is the actual one. This is knowledge which PTQ does not state.

In our discussion of what we must add to an MTS theory (e.g., (1)) for L in order to derive from it an absolute truth theory (e.g., (2)) for L, we argued that the smallest addition

would include adding the base clauses of an absolute truth-theory for *L* (*"N"* denotes *N*, "P" is true of *P*'s, etc.), and, also, a statement that truth in some interpretation *A* (for *L*) at some world *p* in *A* is absolute truth. Put somewhat differently, a semantic theory for *L* must state that *A* and *p* are the actual interpretation and world respectively. Montague, however, seems to be recommending that we pass over the articulation of the base clauses - which would essentially involve constructing an absolute truth-theory for *L* - and instead single out the actual world and interpretation directly. Richmond Thomason, a proponent of Montague style semantics, seems to take a similar line. He agrees that Montague's theory is abstract in the sense that:

it not only allows a multiplicity of interpretation assignments, but a multiplicity of interpretation structures. That is, interpretations can differ in the material that are used to construct the space of possible denotations as well as in the particular semantic values they attach to basic expressions [37:50].

But Thomason thinks that:

in itself, this is not damaging; one might conclude that it is merely an empirical matter to construct an appropriate set of entities and possible worlds for one of Montague's fragments of English [37:50].

Both Thomason and Montague are over-zealous about what we can reasonably expect to accomplish by appeal to MTS. In conclusion, I will argue that the route Montague and Thomason apparently opt for will not work.

First, it is not clear how to go about specifying the actual interpretation. Returning to (E) and (I): singling out the actual interpretation would involve, e.g., determining which function "Barbara" denotes. But how would we specify this function? Is it the function which, given a

possible world w as argument, has a value that "Barbara" denotes in world w? The trouble with this suggestion is that unless some further rule is laid down to deal with the notion expressed by the phrase "what `Barbara' denotes in world w," we have not successfully eliminated reference to language, and therefore, we will not be able to derive theorems needed to do the intellectual work we are interested in. Perhaps we can specify the actual interpretation by saying that in it "Barbara" denotes the function which, given a possible world w as an argument, has as value the thing which is Barbara in world w. What in the world does this mean? Do we really need to understand it to understand the sentence "Barbara sekoilee?"

On the other side, Montague and Thomason seem to be saying that if we want to move from relativized truth conditions to absolute truth conditions we need to single out the actual world among all possible worlds. This certainly is no easy task either. How much about a world do we need to know before we can distinguish it from all other worlds? Presumably a lot. There presumably is a class of worlds in which the number of trees in Canada is even and one in which the number is odd. So far are we from being able to single out the actual world from all others that we do not even know which class it falls in. But do we need to distinguish the actual world from all others to understand our language? From the point of view of PTQ and MTS theories in general, what we are seeing is that in order to understand a language one must have enough knowledge to single out the actual world. And this - need it be said? - is more than any speaker knows. Indeed, Montague's semantics seems, for contingent sentences, to collapse the distinction between understanding a sentence and knowing whether it is true.

Notes

The idea for this paper derives from some comments Donald Davidson has made on model-theoretic semantics in several of his papers. I would like to thank him and John Wallace.

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1. Cf. [2], [24], [29], [30], [31], [32].

2. Cf. [8] for further discussions of these theories and their differences.

3. Cf. [3], [4], [5], [10], [24], [29], [31], [32], [35].

4. For arguments supporting these claims, cf. [22], [23].

5. One large issue that I will not address is the issue of whether the linguist's conception of a "competence theory" can be satisfied either by a structural semantics or a model-theoretic semantics. The problem is how to characterize what's in the "speaker's head." For MTS the issue is the status of the model theory; for SS, the issue is the status of the metalanguage in which the mappings are given. What is innately given or antecedently learned that enables a monolingual child in a monolingual community to learn the semantics of his language?

In another paper (`The Concept of Meaning and its Role in Understanding Language,' *Dialectica,* forthcoming), I argue that this issue is a non-issue. It arises only if, as many do, one views semantics as a subfield of psychology. If we assume that questions about knowledge and understanding of language are psychological questions, then semantics should be a subfield of psychology. However, I argue that semantics properly understood, is a subfield not of psychology but of epistemology. Since it is, we need not worry about what's in the speaker's headwhatever that may mean.

6. An exception to this compositionality principle is Game Theoretic Semantics. Cf. [11], [34], [40].

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