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THE PLACE OF PRAGMATICS IN MODEL THEORY

by

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0. INTRODUCTORY REMARKS

How much semantics can be handled in the syntax? How much pragmatics can be handled in the semantics? And conversely, how much syntax can be handled in the semantics? How much semantics can be handled in the pragmatics? The answer to all these questions is the same: of the components of grammar actually proposed in the literature, each has been expanded to handle a lot more phenomena than advisable for its own good. For example, the treatment of semantic generalizations in the syntax is amply illustrated in the various stages of transformational grammar, while the treatment of pragmatic generalizations in the semantics is exemplified by the various performative analyses of non-declarative sentence moods (FN.1). It is the goal of the present paper to outline a theory of discourse which

- (a) provides clear standards for the borderlines between the components of a general framework consisting of a *Syntax, Semantics, Lexicon, Context, and Pragmatics*;
 - (b) indicates how the different components interact in the course of interpreting the use of an expression by a speaker relative to a context.
- The interaction of components will be summarized in terms of a "Speaker Simulation Device" (SID).

Our point of departure will be Montague Grammar, since this type of grammar is the only framework presently known which relates syntax and semantics of natural language in a systematic and coherent manner. Montague Grammar and the standard model theoretic approach on which it is based fail, however, to account for the distinction as well as the interaction of semantics and pragmatics. We may therefore interpret the following pages as an attempt to find a place for pragmatics in model theory.

Our method of creating such a place is both radical and simple. Based on a reinterpretation of model-theoretic semantics from the 'verifying mode'

to the 'synthesizing mode', we arrive at two types of model, the token-model and the context-model, both of which are assumed to be part of a speaker simulation device, neither containing any real objects. It is proposed to treat the literal meaning of expressions in terms of the token-model, the subjective reality of the speaker in terms of the context-model, and the use of expressions relative to the context (i.e. pragmatics) in terms of matching the token-model and the context-model.

1. MEANING AND USE

What is a meaning? Of the many answers that have been given to this question, we will be concerned here only with two, namely

- 1) speech-act theory, as presented in various forms by AUSTIN (1962), GRICE (1957), SEARLE (1969), WUNDERLICH (1976), and others,
- 2) model-theoretic semantics, as developed by TARSKI (1936), CARNAP (1947), KRIPKE (1963), MONTAGUE (1974), and others.

Speech-act theory defines meaning as what the speaker intends, as what a speaker really meant when (s)he said something. This intentional approach to meaning is closely related to aspects of *language use*. In the following let us refer to meaning defined in terms of speech acts, rules of conversation, felicity conditions, or use conditions as meaning².

Model-theoretic semantics, on the other hand, defines meaning as a relation between expressions and the objects, or sets of objects, to which the expressions refer, or which the expressions are said to denote. The paradigmatic case of this approach to meaning is the logical concept of a *proper name*. For example, the meaning, or denotation, or referent of the proper name *John* is the actual person so named. A *predicate* like *walk*, furthermore, is said to denote a set of individuals, containing elements which have the property of walking. FREGE (1892) completed the assignment of kinds of objects to the major parts of speech by proposing that *declarative* sentences should be defined to denote truth-values. This proposal developed into the view (DAVIDSON 1967) that the meaning of a sentence may be equated with its truth-conditions. Recent developments in model-theoretic semantics, finally have led to quite detailed analyses of meaning in natural language by formally specifying the model-theoretic objects which serve as referents, either in terms of complex translations or in terms of meaning postulates (MONTAGUE 1974).

Each of the two approaches to meaning mentioned in (1) and (2) above captures a legitimate and important aspect of meaning in natural language. But unfortunately, in their present form the two approaches are pursued in a way that renders them incompatible. Speech-act theory has no account of how the literal meaning of an expression depends on its surface structure. The speaker meaning is furthermore claimed to represent the primary notion of meaning, so that all other accounts are derivative (GRICE 1957). Model-theoretic semantics, on the other hand, while providing a highly developed technique to analyze the literal meaning of expressions, is in its present form unable to provide natural accommodations for the use-aspect of natural language.

Before we turn to the question of how to reinterpret the speech-act approach (meaning²) and the model-theoretic approach (meaning¹) in such a way as to make them compatible, let us consider how meaning¹ and meaning² should in general be related. Since meaning¹ is defined as the literal meaning of expressions and meaning² is defined as what the speaker/hearer has in mind in a certain utterance situation it is reasonable to relate them in the following way:

3) use of meaning¹ = meaning².

In other words, by using a certain expression with a certain literal meaning (meaning¹) relative to a context we may achieve a communicative effect (meaning²) which goes far beyond the literal meaning encoded in the token surface. In ironic use, for example, meaning² may be even directly contrary to meaning¹.

The necessity to distinguish between meaning¹ and meaning² may also be illustrated in connection with the somewhat hackneyed example (4):

4) Can you pass the salt?

Uttered at the dinner table, (4) is used as a request (normally) and the intended response is passing the salt. Uttered to someone disabled by disease or accident, on the other hand, (4) may be used as a *bona fide* question, and the intended response would be 'yes' or 'no'.

So does (4) have two meanings depending on the context? The answer is yes if 'meanings' in the preceding question is read as meaning². The answer is no, however, if 'meanings' is read as meaning¹. (4) has only one literal meaning, but this meaning may be used in many different ways in many different contexts, creating a whole spectrum of meanings².

The content of formula (3) may be found implicitly in the previous literature, especially-speech act literature. But nobody seems to have drawn the stringent consequences which follow from it, both for speech-act theory and model-theoretic semantics. The consequence for speech-act theory is that we cannot study the use of a meaning by a speaker in a context unless we have an independent description of the literal meaning that is being used, much as we cannot study the use of a tool relative to a certain object before we know the tool's, exact shape, size, and material. Which brings us back to the analysis of meaning¹ in general and model-theoretic semantics in particular.

As shown by Montague, we may formally describe the literal meaning of expressions in a fragment of English in terms of translation into a model-theoretically interpretable language (intensional logic). Thus, given any linguistic expression in the surface fragment, we may characterize its literal meaning (meaning¹) in terms of the denotation conditions associated with its formal translation. But how can we get in this system from a formal characterization of meaning¹ to a formal characterization of meaning²?

It is curious that the standard model-theoretic approach, as represented by Carnap, Kripke, and Montague (a) completely abstracts from the speaker/hearer and (b) provides no analysis of lexical meaning. Rather, the formal model is seen as a *representation of reality*, and the denotation conditions (truth-conditions) are read as if it were the purpose of a formal interpretation to find out whether a formula is 1 or 0 relative to a model at an index. *In praxi*, however, the model structure is not independently given, but must be specified by the logician before (s)he can start with a formal interpretation of a formula. In as much as we may imagine different states of affairs, we may define the formal model structure as we see fit. Thus, the explicit specifications of a formal model is logically and empirically unrewarding on the standard approach. The sole purpose for actually defining a formal model structure would be to *illustrate* how a model-theoretic interpretation works (on the compositional or non-lexical level).

2. PROBLEMS OF THE STANDARD MODEL THEORETIC APPROACH

While we may define the formal model to represent any state of affairs we like, there are systematic restrictions on the definition of the model structure imposed by the meaning of the words of the language under interpretation (assuming the model structure is used to interpret a natural

language). Compare for example (5) and (6):

- 5) The red circle rises.
- 6) The square circle rises.

Whereas we may define a model structure such that (5) is 1 (true) relative to one index and 0 (false) relative to another, intuition requires that there should be no index in the model structure relative to which (6) would be 1.

One way to treat the restrictions induced by the intuitive word meanings on the definition of the model structure is to exclude certain model structures from consideration. This is the *meaning postulate approach*, as used by Montague in PTQ (MONTAGUE 1974, chapter 8). Meaning postulates are external restrictions on model structures which delimit the class of what Montague calls 'logically possible' models. This terminology is somewhat misleading, however. What is at issue is not logical possibility but rather the speakers intuitions regarding the semantic interdependence in the denotation of different words. For example, a model where the denotation of *man* does not overlap with the denotation of *human* would be no more linguistically reasonable than a model where the denotations of *square* and *round* are not disjoint.

While the method of meaning postulates permits to maintain that assumption of the standard approach according to which the model structure is viewed as a representation of reality and the denotation conditions are viewed as instructions to find out whether a sentence is 1 or 0 relative to an index, meaning postulates are an extremely cumbersome method for formally implementing lexical interdependencies. This leads to the question: how could we separate the *lexical aspect* of word meaning from what we might call the *referential aspect*? This question is quite parallel to our earlier question of how to separate the description of literal meaning from the speaker meaning in model theoretic semantics.

The traditional model-theoretic approach, according to which meaning (denotation, reference) is stipulated to be a *direct relation* between expressions and model-theoretic objects not only eliminates the possibility for a well-defined lexical semantics in model-theoretic terms, but also raises serious *ontological problems*. If meaning is the relation between an expression and the object it refers to, must the object be real? If yes (and philosophers in the traditions of nominalism and realism decidedly

think so), we are faced with the question of what to do with language expressions for which there simply are no real objects as possible referents. Take for example *the smallest prime number greater than 11*, *John's last hope*, but also expressions other than noun phrases such as *in*, *and*, *to*, etc. There are no real objects to which these expressions may be said to refer. Thus one either has to expand one's notion of what is real in order to give these expressions meanings, or one has to deny meanings to incomplete expressions, postulating that only complete sentences have a meaning by themselves (FN.2). The latter view (which originated with RUSSELL (1906) later lent implicit support to the performative analysis of non-declarative sentences.

Another problem with the traditional model-theoretic approach concerns the treatment of *context-dependent expressions* or indexicals. Compare for example (7) and (8):

- 7) Bill saw Mary at the station.
8) I saw you here.

In (7) the truth-value depends on the denotation of the constants *Bill*, *see*, *Mary*, and *at the station*, as specified by the model. In particular, *Bill*, *Mary*, and *at the station* are to be defined as denoting particular individuals and a particular place, respectively. In (8), however, the situation is quite different insofar as it would be intuitively wrong to assign fixed denotations to the indexicals *I*, *you*, and *here*.

One way to treat indexicals within the standard model-theoretic approach is the so-called *coordinates approach* (MONTAGUE 1974, chapter 3, LEWIS 1972): in addition to the coordinates specifying a possible world and a moment of time, additional coordinates are defined for each context-dependency aspect to be treated. LEWIS (1972), for example, uses a different coordinate for possible speakers (pronoun *I*), possible hearers (pronoun *you*), possible places (pronoun *here*), possible indicated objects (pronoun *this*), and even for possible previous discourse, respectively. In short, the coordinates approach permits to retain the assumption according to which meaning is a direct relation between expressions and referents by defining a context of use as an extended point of reference.

The intuitive interpretation of the model structure as a representation of reality, however, suffers under the coordinate approach. Since the model structure is assumed to specify a state of affairs at an index, one

would expect that this state of affairs *is* the context. Instead, the coordinates approach introduces a second kind of reference mechanism: while the denotation of regular constants is specified over the denotation function, the denotation of indexicals is specified over numerous additional context-coordinates. Furthermore, to define the context as an arbitrary n-tuple of external coordinates fails to capture the highly specific interaction between context-dependent expressions and a coherent context (i.e. situation).

Additional problems raised by the standard approach concern non-literal reference such as vague reference and metaphoric reference. Since the standard approach characterizes the meaning relation as a direct mapping between the expression and the state of affairs provided by the model (denotation), the only way to handle non-literal meaning assignments is to postulate ambiguities.

While Montague's model-theoretic analysis is oriented towards the analysis of literal meaning of surface structures and essentially limited to sentence semantics, there is another approach, called *discourse semantics*, which is oriented towards the utterance situation and intersentential inferences. There is no question that model-theory may also be interpreted in the sense of discourse semantics. Is the discourse-semantic version of model-theory subject to the same difficulties as the sentence-semantic version?

In discourse semantics, a context is usually defined as a *set of propositions*. One aim of the analysis is to study the inferences of a context, or how the inferences of an expression vary in conjunction with different contexts. This approach, represented in various forms by HINTIKKA (1976), STALNAKER (1970, 1978), BARTSCH (1979), GROENENDIJK & STOKHOF (1975), KARTTUNEN & PETERS (1978) and others, is of special interest because (a) it is based on alternative notion of *context* (different from the coordinates approach), and (b) it may be viewed as a study in modeling contexts and speech-act situations.

However, modeling situations and the literal meaning of surface expressions in the *same* model, with a *direct* relation between expressions and referents, inevitably leads either to extremely 'standard' contexts or extremely 'non-standard' meaning assignments to surface structures. It also leads to violations of the Fregean Principle (FN.3).

In summary, both the sentence-semantic and the discourse-semantic version of the model-theoretic approach suffer from the same old problem of

the standard approach, though in different from. This problem is what we have described as the fusion of the lexical and the referential aspect, which follows from the assumption that 'meaning' should be defined as a direct relation between expressions and referents. The source of the problem must be sought in the failure to distinguish between literal meaning and the use aspect of meaning in natural language. After all, which 'meaning' is in the standard approach supposed to be constituted as a direct relation between the expression and the model-theoretic object, meaning¹ or meaning²? It is the problem of the standard approach that it cannot provide a clear answer to this question. Since sentence-semantics has no room for pragmatics defined as a coherent theory of use and discourse-semantics has no convincing account of literal meaning of expressions, neither version of the standard model theoretic approach can provide for a clear distinction between semantics and pragmatics.

Such a distinction is indispensable, however. Every time we study the meaning of a word or sentence we must decide what to treat as part of the literal meaning and what in terms of use. If we rob the field of pragmatics of its legitimate regularities, we gravely obstruct our ability to develop a viable theory of pragmatics. As the same time we obstruct our ability to arrive at a viable theory of semantics (overloading).

3. REINTERPRETING THE FORMAL MODEL-STRUCTURE

We have seen that the difficulties of the standard model-theoretic approach all stem from problems arising with the semantic treatment of natural language. For example, the need for providing interpretations to context-dependent expressions (indexicals) and the problems constituted by vague and metaphoric reference come from natural language. And the need for a model-theoretic account of the lexical intuitions of the speaker/hearer comes likewise from natural language. This has led the representatives of the standard approach to occasionally scoff at natural language as illogical or even as beyond any consistent logical analysis. The source of the problem, however, must be sought in the failure to distinguish between the literal meaning and the use-aspect of meaning in natural language.

Let us turn now to an alternative approach which preserves the formal and descriptive merits of model-theoretic semantics while accommodating formula (3):

3) use of meaning¹ = meaning².

This new grammatical framework, first presented in HAUSSER (1979a), separates the lexical aspect of meaning from the referential aspect (cf. Section 2) by treating

- 9i) *literal meaning* in terms of model-theoretic *synthesis* in a lexical space representing the speaker/hearer's lexical intuition;
- 9ii) *context* in terms of a model-theoretic representation of what the speaker/hearer perceives and remembers in a given utterance situation;
- 9iii) *reference* in terms of matching the synthesized literal meaning with the context.

Thus our alternative approach is based on the construction of two models, one representing the literal meaning of the token, the other representing the context. The former model is called the *token-model*, the latter is called the *context-model*. The speaker's use of a literal meaning (meaning¹) relative to a context is treated in our system as the *matching* of the two model theoretic structures. Thus pragmatics is sandwiched between the token-model and the context-model, inside the head of the speaker/hearer. The process of *reference* is regarded as part of pragmatics, while the construction of the token- and the context-model shares to a degree the goals of sentence- and discourse-semantics, respectively.

We arrive at the token-model by reinterpreting the intuitive role of the formal model-structure. Rather than treating the model-structure as a representation of reality and the denotation conditions as instructions to determine the truth value of formulas relative to an index, let us view the model structure as a representation of the lexical intuition of the speaker/hearer and the denotation conditions of a sentence token as instructions to synthesize or construct a model (or set of models) relative to which the sentence would be true. Thus the purpose of semantically interpreting an expression is not to determine its denotation relative to a model (in a model structure at an index) given in advance and regarded as a representation of reality (at that index), but rather to construct a denotation (or model) that would satisfy the expression and that is regarded as a *formal representation of its literal meaning* (meaning¹).

We assume that the synthesis of a token meaning is executed in a partially defined model structure, called *lexical space*, which is assumed to be part of a speaker simulation device (SID). What is required for the synthesis of a token meaning? While the logical operators like \neg , \wedge , λ , etc.

in the translation of a token receive their meaning in terms of the denotation conditions associated with these operators (where the denotation conditions are specified in a metalanguage or in terms of certain operations), unanalyzed logical constants like *man'* or *walk'* are assigned their denotations by the model-structure.

The structuring principles of a partially defined model structure regarded as a lexical space are

- 10i) the category/type/denotation correspondence inherent in Montague Grammar, and
- 10ii) the speaker's intuition concerning the semantic interrelations between constants of equal type, such as inclusion, overlap, etc. of the sets denoted.

Take for example the expressions *cat*, *dog*, and *mammal*, which are of equal category, namely $t//e$. They translate into the unanalyzed constants *cat'*, *dog'*, and *mammal'*, which are of type $\langle s, \langle \langle s, e \rangle, t \rangle \rangle$. This type uniquely determines the *domain/range structure* of the functions which serve as the denotation of these expressions:

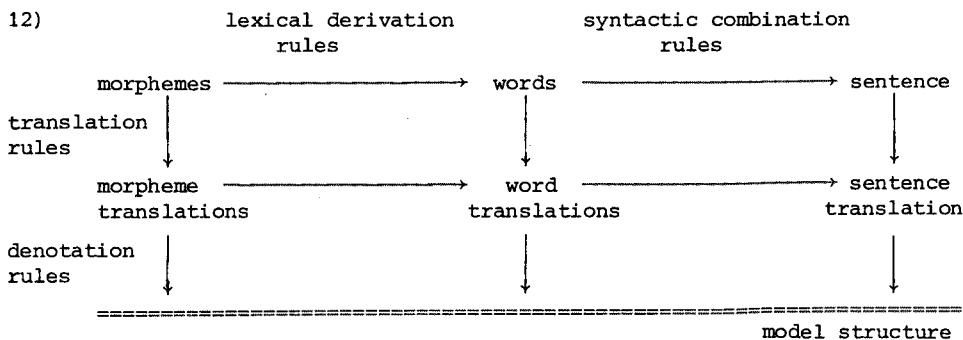
$$11) \quad (IxJ \rightarrow ((IxJ \rightarrow A) \rightarrow \{0,1\})).$$

In order to implement the lexical intuition of an English speaker/hearer we define the denotation of *cat'* and *dog'* in the lexical model as disjunct sets (extensionally speaking). Furthermore, we define the denotation of *cat'* and *dog'* as subsets of the denotation of *mammal'*. In this way, we arrive at a definition of lexical meaning which avoids the use of paraphrase (which would be circular) and which employs the model theoretic technique without identifying the model structure with reality. Our new form of model-theoretic *lexical semantics* is clearly compatible with Montague's *sentence semantics* (e.g. PTQ, EFL, UG). All that is changed by our reinterpretation is the process of assigning denotations to the unanalyzed constants in the translation formulas.

To synthesize a token in a lexical space of an SID means to set the denotations of the constants in the translation formula into certain interrelationships specified by the logical operators in the formula. For example, to synthesize the meaning of *John walks*. we have to set the denotation of *j* as an element of the denotation of *walk'*. Note that the partially defined model structure of our lexical space differs from the partial models proposed in FRIEDMAN et al. (1978). In Friedman et al. the model is conceived as a partially defined representation of reality, which means that

as new expressions come up in a text, new denotations are defined in the model. Thus, in order to interpret *John walks*, at an index a denotation is assigned to, e.g. *walk'*, if it has not been specified already. The evaluation of expressions relative to indices in the Friedman model structure is still intended to determine truth values. Our lexical space, on the other hand, is a partially defined model structure not because certain aspects of reality have not been filled in yet, but because the model structure specifies only the semantic interrelations of constants according to the speaker's lexical intuition. A completely specified model (or denotation) comes about only once the synthesis instructions associated with the logical operators present in the translation of a token have been executed.

Since the lexical space serves solely for the interpretation of unanalyzed logical constants (on the basis of which the token-model is synthesized), some remarks on the structure of the surface lexicon are in order. In line with philological tradition, we distinguish three kinds of surface entities: morphemes (or lexemes), words, and sentences (of various moods and degrees of elipsis). We assume that words are *derived* from a limited number of morphemes (or 'roots', cf. VENNEMANN 1974, p.348) via lexical derivation rules. Sentences are derived from words via the usual syntactic rules. Lexical derivation rules differ from syntactic rules not only with regards to domain and range of the respective rule types, but also in that syncategorematic operations are strictly prohibited in the definition of syntactic rules, while they are permitted (and quite frequent) in the definition of lexical derivation rules. Schematically, the syntactic and semantic derivation of a sentence in our grammar may be characterized as follows:



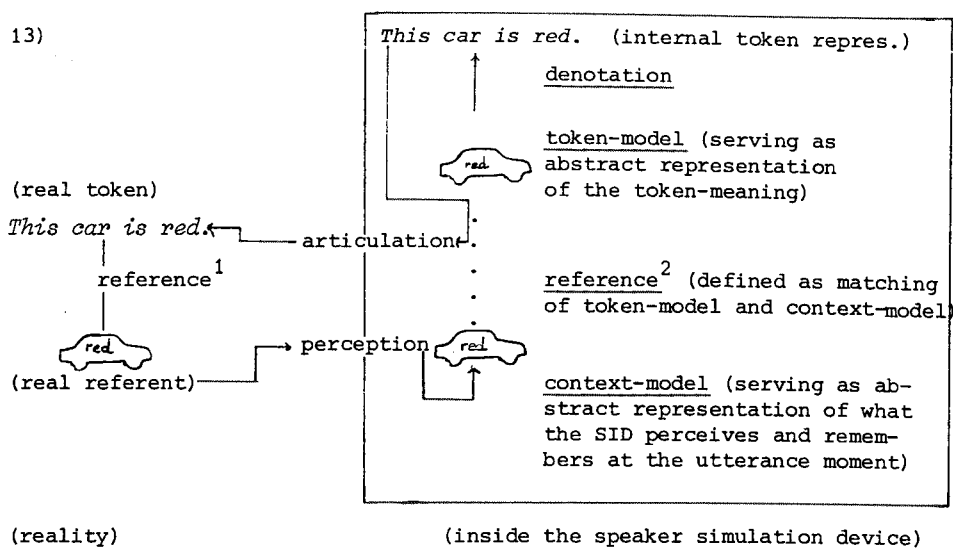
It is assumed that unanalyzed logical constants are introduced only via *morpheme translations* (and possibly lexical derivation rules on the translation level). As illustrated in (12), the model-theoretic synthesis of a

token meaning starts with the morphemes (or rather the unanalyzed logical constants in their translation), whereby the model-theoretic construction of the complex sentence meaning is simultaneous to (or parallel with) the surface syntactic derivation of the sentence. Our lexical analysis differs from Montague as well as Dowty in that these authors take *words* as the basic entity of their lexical analysis, rather than morphemes. Thus, in Dowty's analysis lexical derivation rules map words into derived words, whereby the lexical rules are regarded as a variant of the syntactic rules. The model-structure, furthermore, is interpreted in the traditional way as a representation of reality, whereby some lexical intuitions are implemented in terms of meaning postulates while others are implemented in terms of complex translations. At the center of our lexical theory, on the other hand, is the idea to treat the model structure as a lexical space. Complex lexical meanings on the word level are characterized solely in terms of complex logical translations, and not in terms of meaning postulates. (For a discussion and examples of surface lexical analysis see HAUSSER 1979b.)

4. THE SPEAKER SIMULATION DEVICE (SID)

While the switch from the "verifying mode" to the "synthesizing mode" in the interpretation of model-theory provides for an analysis of the lexicon and removes the indicated ontological problems of the standard approach, it cannot by itself suffice as a complete analysis of meaning, in particular that aspect of meaning which is constituted by the *use* of a literal meaning by a speaker relative to a context. Furthermore, in order to satisfy the needs and purpose of traditional language philosophy, we must somehow reestablish the connection to *reality* which was severed when we reinterpreted the formal model-structure as a lexical space. The question then is: how do synthesized models relate to reality?

As already indicated, in order to handle the use-aspect of natural language and as a bridge pier between the token-meaning and reality, we complement the synthesized token meaning in our system with a formal context. This formal context is regarded as a model-theoretic representation of what the speaker/hearer perceives and remembers at the moment of a token interpretation. Schematically, the interaction between the token-model, the context-model, and reality may be indicated as follows:



(13) pictures an SID (speaker simulation device) in that kind of speech-act situation which is taken as the *paradigmatic* case by the standard approach. That is a situation with an expression (i.e. "This car is red.") and a state of affairs containing a 'real' referent (car) and property (red) such that there is a *correspondence* between the expression and the 'model' (which is identified with a real situation). The basic goal of the standard approach is to capture the Aristotelian notion of truth, which is defined as a correspondence between what is said and what is (cf. TARSKI 1944).

While the standard approach limits attention to the relation between the 'real token' and the 'real referent' in (13), thus defining meaning as a direct relation between expressions and model-structures, our alternative approach takes this relation apart into several sub-mappings by routing the relation between the 'real token' and the 'real referent' through a speaker (SID). This has numerous consequences:

- 14i) Since the literal meaning of the 'token representation' in the SID is characterized in terms of a *synthesized* model, where the basic sets A, I, and J of the model-structure (cf. MONTAGUE 1974, chapter 8) cannot possibly contain any real objects, but must be interpreted as consisting of purely abstract memory spaces in the SID, the *ontological objections* justly raised against the standard approach *do not apply* (FN.4).
- 14ii) Since we distinguish between denotation (i.e. the relation between the token-representation and its synthesized meaning) and reference

(i.e. the relation between the token-model and the context-model),
semantics and pragmatics are effectively separated and distinguished.

- 14iii) By reinterpreting the model-structure as a lexical space, which assigns partially defined denotations to the unanalyzed logical constants in the translation language according to the speaker/hearer's lexical intuitions, we arrive at a *viable theory of the lexicon.*
- 14iv) At the same time we create the need, and the room, for a *coherent notion of context*, defined as a model theoretic representation of what the speaker/hearer perceives and remembers at an utterance moment under consideration.
- 14v) By distinguishing between the formal context and reality, we are able to describe *cases of perception or memory error.* (Such a case is discussed in DONNELLAN 1966.) (FN.5).
- 14vi) By distinguishing between the real token and the token representation in the SID, we are able to describe cases of *acoustic misunderstanding* as well as cases of *high-level speech errors.*

The standard approach describes the speech-act situation from the view point of an outside observer, who looks at the expression and the state of affairs, but has no access to the inside of the speaker/hearer. Our alternative approach, on the other hand, describes the speech-act situation from the view point of the speaker/hearer. While the standard approach is interested solely in modeling valid inferences of expressions in a literal or standard interpretation, our alternative approach is interested in the general phenomenon of communication. In order to analyse different types or uses of expressions, our alternative approach models not only literal meaning, but also the interpretation of this literal meaning relative to a context inside the speaker/hearer. After all, the utterance or interpretation of an expression presupposes in principle a speaker and/or hearer, and thus tokens in principle have a use aspect relative to the utterance- and/or interpretation-context. Thus, the goal of our formal analysis is similar to that of artificial intelligence, whereas our methods in the analysis of literal meaning employ, preserve, and extend the formal techniques of model-theoretic semantics (FN.6).

5. THE STRUCTURE OF THE INTERNAL CONTEXT

On the whole, the alternative approach is more complicated than the standard approach. But then, the alternative approach can handle phenomena (e.g. metaphoric reference, propositional attitudes, cf. HAUSSER 1979b), which the standard approach, in virtue of its basic set up, cannot treat. Also, the alternative approach provides the framework for a natural treatment of phenomena which have been analyzed within the standard approach in rather unsatisfactory ways (e.g. context-dependency (FN.7), non-declarative sentence moods (FN.8) and the lexicon (FN.9). And conversely, the alternative approach can account for those cases which the standard approach has been specifically designed to handle. Consider once more example (13).

Assuming that

- 15i) articulation is proper,
- 15ii) reference is an instance of *literal reference* (defined as a complete match between the token-model and the context-model), and
- 15iii) perception is accurate,

our alternative approach comes to the same result as the standard approach. That is, the expression in (13) is evaluated as true relative to the indicated situation. Thus, our alternative approach captures as a *special case* both, the Aristotelian notion of truth and the prototype of utterance situation analyzed by the standard approach.

At this point, the following two questions need to be raised:

- 16i) How much of the new framework is worked out in detail and how much is presently only intended?
- 16ii) How much of the new system needs to be complete in order to be viable as a framework for ongoing linguistic analysis in syntax, semantics, and pragmatics?

Of the subsegments of the token/referent loop there are two the formal nature of which need not be of concern to the linguist. These two subsegments are (a) articulation and (b) perception. For the linguistic analysis it is sufficient to limit attention to the relation between the token-representation and the context-representation inside the SID, whereby the assumption of properly working articulation and perception in the SID is a presupposition for the study of normal discourse. While ultimately the difficult problem of simulating articulation and perception has to be solved in order to arrive at the distant goal of building a SID that can actually communicate in a natural language, this particular subject matter

has no direct influence on the formal analysis of the syntax, semantics, and pragmatics of natural language. In those cases discussed in the literature which crucially depend on misperceptions (DONELLAN 1966) (or mispronouncements, though no actual example comes to mind) it is sufficient to describe the discrepancy between different speaker contexts (FN.10).

Let us turn now to the remaining segments of the token/referent loop. The by far best developed sub-segment is the mapping from the token-representation to the representation of its literal meaning, that is, the logical translation and the associated synthesized model. The reason is that this segment has been analyzed in detail within Montague Grammar, and we have shown that only a relatively minor reinterpretation of formal model-theory permits to utilize the results of Montague Grammar within our alternative framework.

The next sub-segment indicated in (13) is the mapping from the token-model to the context model, called *reference*². Intuitively, we view *reference*² as a matching of the two formal models. In HAUSSEER (1979b, section 4) three different types of *reference*² (i.e. literal, vague and metaphoric reference) are informally described in terms of three different kinds of matching. But the question is now: what are the formal rules of *reference*² (and pragmatics in general)?

In order to formally analyse the matching of the two models we need to know their formal nature. In the case of the token-model, the formal structure is determined by the surface structure of the token representation under interpretation. In the case of the context-model, on the other hand, we have made no assumptions besides that it should be a model-theoretic representation of what the SID perceives and remembers. This assumption, however, naturally induces a number of structural properties on the context which go far beyond the structural features induced by either the coordinates approach or the proposition approach (cf. Section 2 above).

One important distinction in the definition of context is that between a *speaker-context* (or utterance-context) and a *hearer-context*. The speaker-context and the hearer-context may be quite distinct, which is one reason why attempts to base the analysis of meaning on the notion of a "standard context" are not appropriate. Take for example a letter. The author of the letter (in short, the speaker) synthesizes the token meaning in relation to his speaker-context, and then articulates the real token on paper. The real token in this case has an extended existence and may travel to far away places. The recipient of the letter (in short, the hearer) synthesizes the

same token meaning as the author of the letter (provided the two speak the same language) and interprets the token relative to his hearer-context, which will differ from the speaker context in time, place, personal history, etc. Indeed, the only occasion where the speaker- and the hearer-context are identical is when a person talks to him- or herself.

Whether a token is interpreted relative to the speaker- or the hearer-context has consequences on the interpretation of indexicals. Take for example the sentence (17).

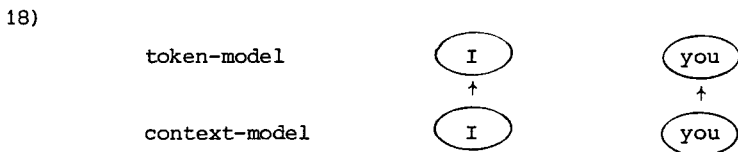
17) I see you.

According to our analysis of context-dependency in HAUSSER 1979b,c, (17) translates into (17'):

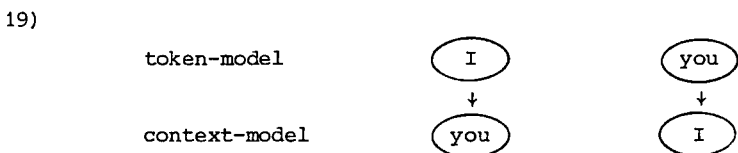
17') $\lambda x \epsilon [\Gamma_1(x)]^1 \text{ see}'(x, \lambda P \lambda y \epsilon [\Gamma_2(x)]^1 P(x))$,

where the context-dependency aspects introduced by *I* and *you* are formally treated in the translation in terms of the context variables Γ_1 and Γ_2 , respectively.

If (17) is interpreted relative to a speaker-context, the direction of the reference mapping is bottom up and the interpretation of *I* and *you* is as indicated below:



If (17) is interpreted relative to a hearer-context, on the other hand, the direction of the reference mapping is top down and the interpretation of *I* and *you* is as follows:



On the level of the context, *I* and *you* link up with the SID in question and the addressee of this SID, respectively. Note that we regard the reconstruction conditions of context-variables as the definition of the

meaning of these context-dependent expressions. Thus the literal meaning of an expression like (17) is characterized independent of any particular context.

Next consider the interpretation of tense and modal operators in the token-representation. While on the standard approach expressions may be interpreted relative to different indices in the model-structure, we assume that in our framework the token-representation is synthesized always relative to the same abstract index, called the *zero-index of the token*. This zero-index is then equated with the 'present' moment and place of the speaker- or hearer-context. If the token-translation contains tense or modal operators, the interpretation of these operators is relative to the zero-index of the token.

While the nature of the rules for the interpretation of context-dependent expressions relative to a context in our system is fairly straightforward and has been discussed in more detail at other places, the formal nature of the pragmatic strategies that lead to non-literal interpretations is still mysterious. Generally speaking, in the interpretation of non-literal uses we assume that the system proceeds from the literal use to the derived use via a sequence of pragmatic inferences. Consider our earlier example "Can you pass the salt?" in its use at the dinner table:

20)

token-model	Can you pass the salt?
context-model	You ask me whether I can pass the salt. I may assume that you know that I can pass the salt. ⇒ You want me to pass the salt to you.

Similar analyses can be given for other instances of non-literal uses, as described in HAUSSER (1979b). It is a matter of further research to systematize such informal description in order to arrive at a theory of pragmatic inferences suited to describe metaphoric, ironic, etc. uses, which are so common in natural language.

Let us turn now to the internal structure of the context-model. One problem with the traditional treatment of context and the model-structure in general is that the external reality presents an infinity of facts, some known, some unknown, some present, some past, and some still in the future. Thus it is practically impossible to incorporate all these details in a

formal representation (though this is what has to be done in an approach that regards the formal model-structure as a representation of reality). In our system, on the other hand, we need only account for what the speaker/hearer knows or believes at the utterance or interpretation moment, whereby we treat the difference between knowledge and believe simply in terms of different degrees of subjective certainty.

In terms of which parameters should the context of the SID be organized? Let us take the *present* moment and place of the SID as the *zero-index* of the context. The subjective past of the SID is organized along the internal time axis, backward from the zero-index, while the spatial orientation of the context may be organized according to the subjective notions of front, back, left, right, up and down of the SID at the zero-index. Besides these primary notions of time and space, we may incorporate derivative time and space structures in the memory of the SID, such as knowledge of history, cities, or countries.

Further parameters organizing the context at each successive zero-index are the so-called external input parameters. Assuming that the SID is modeled after a person, the input parameters would be something like

I see:
I hear:
I feel:
I taste:
I smell:

In addition we must assume so-called internal input parameters representing desires, fears, instincts, etc.

Whereas the actual content of these parameters will be in a form characteristic of the particular medium (optical, acoustical, etc.), we may assume (for reasons of linguistic analysis) an intermediate *context-representation*, where the content of the input parameters is stated in the form of *propositions* of a suitable context-language. These propositions are then synthesized as the context-model, on the basis of the same lexical space as the token model.

We postulate the above parameters not merely to 'psychologize' our notion of context. Rather, they are necessary for the interpretation of context-dependent expressions (context-variables). With regards to the interpretation of non-literal use, furthermore, we cannot expect that a theory will render linguistically satisfactory formalizations if the framework operates on a smaller basis of contextual information than the

speaker/hearer does in daily life.

In as much as we state the content of the context-parameters in terms of propositions, our approach is similar to the propositional approach to context. In as much as we treat different aspects of context-dependency in terms of different context-variables and distinguish between different parameters, on the other hand, our approach shares intuitive similarities with the coordinates approach. The basic difference between our notion of context and the other two notions, however, is that we regard the context as a *speaker internal* representation of structures which may be real as well as fictional, whereas the coordinates approach and the propositions approach treat the context as a speaker external addition to the representation of reality constituted by the traditional model structure.

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FOOTNOTES

1. This paper is based in part on HAUSSER (1978a,b,1979a,b,c), where specific encroachments onto the territory of neighbouring components have been described and analyzed.
2. For a discussion see HAUSSER (1979b), section 2.
3. A grammar where the Fregean Principle is applied to the natural surface (taking words as the basic elements) is called a *surface compositional grammar*. The Surface Compositionality Constraint, formalized in HAUSSER (1978b), provides the principled standard for drawing the line between semantic and pragmatic aspects of meaning in natural language.
4. Cf. the discussion of a strictly intensional logic in HAUSSER (1979b).
5. For a reanalysis of the Donnellan example (concerning "The man with the Martini...") see HAUSSER (1979b), section 4.
6. An example is the analysis of propositional attitudes in HAUSSER (1979b), section 6.
7. See HAUSSER (1979a,1979c) for a criticism of traditional model-theoretic notions of context, as well as an alternative proposal (i.e. to treat context as a model-theoretic representation of what the speaker perceives

and remembers).

8. See HAUSSER (1978a), (1980b) for criticism of model-theoretic treatments of non-declarative sentence moods in terms of mood operators or underlying performative clauses, as well as an alternative proposal (i.e. to treat mood as a particular mode of syntactic composition which results in characteristic types of possible denotation).
9. See HAUSSER (1979b) for an account of the structure of the lexicon within the framework of our alternative model theoretic approach (i.e. within the SID).
10. This was shown in HAUSSER (1979b, section 4).

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