ABSTRACT. Taking the well known sentence ‘snow is white’ the paper shows that a proper analysis of elements of English of this kind demonstrates that truth-conditions cannot be given as the semantic analysis of such units. Since there are different applications of ‘snow’ and of ‘white’, the sentence cannot be judged as true or false, only uses of it. It is shown that these uses are indeterminate in number and should not be regarded as a case of ambiguity. A semantics is sketched within which the core meanings of the constituents as well as their multireferentiality can be represented.

It is explained why natural languages cannot be regarded as formal languages in Tarski’s sense, and why this is an advantage for natural languages rather than a handicap.

The paper does not support a conclusion that the semantics of natural languages does not admit of rigorous analysis. It says only that such an analysis will have to use tools other than the standard set-theoretic semantics known since Tarski as ‘formal semantics’. Obviously other formal tools must be available to capture the data of the semantics of a language like English.

Much recent work on the semantics of natural languages has been guided by the following assumptions (e.g. Davidson, 1967; Montague, 1974):

(i) A natural language like English is, or can be represented as, a formal language in Tarski’s sense.
(ii) In particular, the sentences of a natural language like English can be given truth-conditions in Tarski’s technical sense of that notion.
(iii) Giving the truth-conditions of the sentences of a natural language contributes to specifying what it is to understand that language.

Claims (i) and (ii) are about the characterization of the expressive power of a language. Claim (iii) links a certain semantic representation to the explanation of one of our cognitive capacities. One could hold (i) and (ii) without holding (iii). Below, however, we will consider definitions that one might give for ‘natural language’, and reflections on these suggest that restricting oneself to (i) and (ii) is unlikely to yield theoretically interesting results.

The purpose of this paper is to show that all three of these claims are false. Thus alternative approaches to the semantics of natural languages

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are needed. One of these will be briefly sketched later. In the first, negative part of the paper my strategy will be to take a well known example from the literature, and to back my conclusions by a detailed examination of the semantics of that sentence. The sentence is:

(1) Snow is white

Hence the related truth-conditional formula:

(2) ‘Snow is white’ is true if and only if snow is white.

As a separate proposal, not the only way of thinking of the semantics of language understanding is:

(3) ‘Snow is white’ means that snow is white.

I shall present considerations below to show that claim (3) too needs to be rejected. It is worth noting that the example originated with Tarski. But he used it only as an informal illustration of technical matters. He himself did not believe that the techniques he developed could be applied to natural languages (see Tarski, 1936). In the following I will bypass the problem of the paradoxes of truth that Tarski discovered, and will concentrate on other considerations that deal more specifically with features of natural languages as such.

I. NEGATIVE ARGUMENTS

Let us consider the constituents of the sentence: ‘snow is white’. The subject expression ‘snow’ is a mass term. Thus its most natural interpretation would be in mereological terms (see Pelletier, 1979). The extension of ‘snow’ is, then, the sum of all entities that are parts of one scattered particular, snow. We need not worry about maximal parts. The semantics – if not what we know about physics – would allow snow to dominate all of reality. There are minimal parts, however. Not all parts of snow are themselves snow. If one uses some of the set-theoretical proposals that have been made about mass terms (Gabbay and Moravcsik, 1973) one would still have to come up with a characterization of the extension that would coincide with what the mereological analysis yields; i.e. all of the snow in the world.

The differences between the mereological and set-theoretical approaches represent a conflict to which we alluded before. For those interested only in a representation of expressive power, uniformity of
technical representation is of paramount importance. Hence the insistence on set-theoretic representation, regardless of what it does or does not show about understanding. For those who think that any interesting analysis of natural languages should also have some relevance to how the mind understands language, uniformity is less important. It is more important to offer a representation that can be used to study how the human grasp of quantitative concepts differs from our grasp of concepts that contain qualitative individuating features.

Let us consider now the full extension of ‘snow’. Even if we restrict ourselves to the actual world and not raise problems about the modalities, the obvious falseness of the sentence under consideration strikes us immediately. Of course not all snow is white. Much of it is grey, or even black, and some of it is colored in a variety of other ways. Yet, there must be a reason why to the initially unreflecting mind the sentence seems true. (Similar considerations apply to ‘grass is green’; this too is obviously false when taken literally, since much grass is brown, yellow, etc., and yet in some ways we think that the sentence says something that is true.)

We begin making headway with this puzzle when we consider: what are the constituents of snow? There are the flakes before they fall to the ground, there are the flakes together as a snow cover on the ground, there is snow turning into slush, there is the melting snow, etc. Not all of these are white. Are we to restrict the extension to some privileged items among the ones mentioned? It seems odd to restrict snow to be just the falling flakes. The fallen snow is for many contexts the snow we most often talk about. But the snow on the ground is often not white. Furthermore even if we restricted the extension to falling flakes, it still would not be true that all snow is white. For on account of pollution in the atmosphere many of the flakes falling in different parts of the world are already black or grey before becoming visible to us.

One might also try to exclude melting snow and slush by talking only about dry snow. But this raises the question: how dry? Some snow is very good as material for snowballs, but would be regarded as not good for skiing. But even when listening to ski reports we hear about wet snow, and the announcer does not mean to confront us with a contradiction. These considerations show that the problem is not merely one of taking dry snow and snow melted into water, and ponder where on this continuum one wants to draw the line, and how arbitrary such a line would be. The truth of the matter is, rather, that for different uses
and in different linguistic contexts items with different constituencies count as snow.

Perhaps the situation can be remedied by bringing in purity. Snow is white when it is pure snow. Thus we think of snow in the Alps or the Himalayas as pure snow, not affected by pollution, and think that the sentence under consideration applies to that. Other kinds of snow can then be called snow in derivative senses. Is this not like describing something under idealized conditions? Such an analogy fails on many counts. First, we do not attach meaning to words in a natural language with our view only on items in the extension that qualify only under idealized condition. Pure water in a scientific sense may be H₂O, but pure water in the ordinary sense is drinkable water, and thus water that contains several ingredients besides H₂O. Pure snow is more like pure potable water. Just like healthy grass is green in certain seasons, and pure water is drinkable, so pure snow is unpolluted snow, and such snow is white. But what if the source of whatever makes some flakes already in the sky grey or black were not to have human intervention as its cause? Snow flakes could be grey or black on account of changes in the atmosphere that have natural causes. So black snow need not be such because of pollution.

To say “this is not snow any more” and “this snow is not white” is not to say the same thing. Thus the statement that snow is white cannot be taken as expressing partly the nature of snow. At most it is an empirical generalization, which we are now rephrasing so as to be about pure snow. But since we do not know what the source of coloring is in all cases, and there are cases of snow falling already grey and black, we cannot even accept this statement as true.

One might say: “snow is white; in different contexts this may not be the same degree of whiteness. What we mean in different contexts is that the snow is white enough.” Such thoughts bring us to the question: what counts as white?

‘White’ too is a mass term. In its extension, mereologically interpreted, we find the sum of all the white items that are parts of the one scattered particular that white is. Meaning in this case is difficult to define, since white is a simple basic perceptual quality. The O.E.D. seems to acknowledge this, since in addition to saying that it is produced by, e.g., reflection of light and is without hue, it adds that it is the color of snow and milk. One can safely assume that these are given
merely as examples that are paradigmatic in many ordinary contexts, rather than as substances that must exhibit the color in question.

More informative specifications of the meaning of ‘white’ rely on contrasts. White contrasts with yellow, grey, light brown, etc. Of course when we juxtapose these colors we must admit that the boundaries are not sharp, and thus a color word like ‘white’ suffers from vagueness. We shall leave, however, this point aside, because though Tarski’s definition of a formal language, and hence of a language over which we define truth-conditions, cannot suffer from vagueness, various technical ways have been developed to handle this semantic phenomenon. In any case, this is not what seems to me essential to natural languages in such a way as to make them not suitable to be treated as a formal language.

Contrast-dependency by itself does not pose a threat to formalizations in terms of truth-conditions as long as the contrasts stay fixed. This, however, is not the case. In some contexts we contrast ‘white’ with ‘yellow’, and in others with, e.g., ‘off-white’. In some cases ‘white’ contrasts with ‘grey’, and in others even the slightest deviation of whiteness from pure white to a shade of grey.

Furthermore, in different contexts we invoke different criteria as to what counts as white. E.g. a white shirt is white even if it has spots on it. In fact, this will be true even if the spots were already made in the factory. Again, how much white snow has to cover a landscape for us to say that the fields are white? Surely many patches of brown are permissible. Or for that matter, a white suit need not be pure white; it is a white suit as long as it contrasts with a light brown or yellow suit.

This last point shows that the variations in the extension of ‘white’ are not random, but depend on the variety of human interactions with the environment and the resulting utility of drawing the boundaries in many ways. We also draw the distinctions in different ways depending on the artifacts we produce. E.g., on US highways there are white and yellow lines. Everything counts as white that is not distinctively yellow, even if it is worn, dirty, etc. On the other hand, when a painter consults a customer on the color in which the walls of a room should be painted, every shade becomes crucial. So in the cases of shirts, walls, books, roads, etc. different extensions are involved. Once, however, we fix the appropriate context, the extension remains fixed also.

This variation of extension and its link to contexts created by the variety of human interactions with the environment that we find in the cases of ‘white’ can be seen also from the evidence we surveyed...
concerning ‘snow’. In the case of a snowfall the exact shade of white seems irrelevant. In the case of a snow-storm we count also ‘heavy’, i.e. wet snow. In the case of “there is enough snow in the Sierras” as issued in the context of a ski report, only relatively dry snow counts. Here, too, the linguistic variety is derivable and predictable from the variety of possible interactions with the environment.

In view of these considerations we can come to appreciate the complexity of extensional variations in the uses of the compound NP ‘white snow’. We need to consider which use of ‘snow’ is being utilized, and which use of ‘white’. Yet this is not a case of typical lexical ambiguity. It is not like the case of ‘bank’, where two unrelated meanings happen to be attached to the same word. ‘White snow’ is not ambiguous, but is subject to a variety of predictable extensional variations.

Thus even if we regiment English by assigning separate words to different word meanings so as to avoid ambiguities like that of ‘bank’, we still have problems with the schema:

‘Snow is white’ is true (in L) if and only if snow is white.

For, e.g. the extension on the left side could be interpreted as covering all of the snow that is on the streets and is not blackened completely by traffic conditions and pollution, while the right side is taken to be applying only to snow that fell in the high mountains and other places away from the effects of human interactions. So the left side covers a lot more than the right side. Hence it is not true that the truth of the left side depends in all cases on the right side expressing what is the case.

II. FORMAL REPAIRS?

Formal semantics assumed, since Frege, that the paradigmatic case of a sentence with semantic analysis is one for which we can specify an intensional content that stays fixed as long as the language to which the sentence belongs does not change. Furthermore, this intensional content depends on the intensions of the parts, and it determines truth or falsity. But already Frege knew that this will not hold for certain cases such as those in which indexicals like ‘here’ or ‘now’ occur. Modern formal semantics invented a formal device, namely that of restricting interpretations according to indices that constrain the extensions of the parts of
the sentence, and hence the conditions of application for the whole sentence. This enables us to give formal representations of sentences with spatial, temporal, or speaker and hearer relative indices. This original list has been extended over the past decade to cover communicational factors and perceptual situational factors. Thus one might ask: why not add another index, call it the quality-dependent contextual index, and continue with formal semantics as before?

In spite of its surface attractiveness this proposal has several flaws. In order to place these into proper perspective let us reflect on what indices really are. Formally – one might say, mechanically – they simply limit or relativize truth to a frame of application within which variations in extension and truth do not arise. It is crucial, then, that all legitimate indices take what is intuitively a large but well defined extension and restrict, or constrain this. Furthermore, for most of the standard indices we can find individual lexical items to which these are linked. The phenomenon that we uncovered is not linked to a specific subvocabulary of English. Practically the whole descriptive vocabulary is affected with the possible exception of the language of mathematics (Moravcsik, 1989). We saw, however, that not all recently introduced indices are linked to specific words. But there is another key difference between our multireferentiality and the other phenomena mentioned. The others are cases of restricting application. Not all spaces, not all speakers, count. But in our cases the various practical contexts create rather than restrict extension. It is not as if we could survey all of the possible future extension-creating contexts that our future and possible interactions with the world can create. Thus the intuitive idea that underlies the practice of relativizing truth is missing in our type of case. The expanding ranges of application and contexts cannot be described in a rigorous way, while this is possible in the cases in which the introduction of indices is legitimate.

All of this does not mean that we have a case of linguistic anarchy. We can describe in general terms what leads to the emergence of the variety of reference fixing contexts. We can also explain why in cases of natural languages this is needed. But the emerging contexts do not fit the mould of taking space, time, perceptual information, etc. and then relativizing to specific parts of clearly described general notions. Thus the device in our case would be a mere ad hoc technical device without any explanatory power. This does not mean that there will be no precise rigorous treatments of semantics in natural languages,
but that – as Tarski himself saw – these will not be centered on truth-conditions. If there are no conceptual constraints on relativizing truth to indices, then the device becomes an ad hoc way of treating anything, and the indices introduced end up as merely contents of a conceptual wastebasket. Within such a framework the claim that natural languages can be given truth-conditional analyses becomes a trivial remark instead of an interesting and informative remark that would lead, whether true or false, to an increase in our understanding of the nature of natural languages. Indexing should be a clearly constrained practice, to follow the dictum Dr. Suppes often enunciated in his seminars: “better to be clearly wrong than to be vaguely right.”

III. FORMAL SEMANTICS AND THE MIND

Why should resolutions about questions concerning formalisms lead to interesting theses about language understanding and cognition? Let us consider what a natural language is. A natural language is a language that can be learned by a human or sufficiently humanlike creature as his or her first language under normal circumstances. This characterization, though not precise, allows us to view the question of whether a given invented ‘artificial’ language is or is not a natural language as an open empirical issue. The alternative of construing a natural language as one that we come upon in anthropological research and a nonnatural language as one that happened to be invented in an A.I. center is a theoretically uninteresting characterization. Thus, right from the start, the very notion of a natural language is linked to a characterization that involves cognitive capacities. It leaves open the question whether all natural languages have either in their syntax or in their semantics interesting common formal characteristics. Thus since the very notion of a natural language is a partly psychological concept it would be odd not to seek characterizations of the semantics that shed light on aspects of cognition.

Even if someone is interested only in representing expressive power, introducing arbitrarily indices is not illuminating. Furthermore, it is yet to be shown that apart from relations to cognition the class of natural languages constitutes in terms of purely formal properties a ‘natural’ class. Those of us interested in exploring the nature of natural languages, as defined above, will look for alternative approaches.
IS SNOW WHITE?

The evidence considered so far shows that there will be a difference in levels between where we specify the meaning of what a sentence expresses and even in strictly qualitative terms the proposition that it expresses. Of course, we know that such a distinction is drawn in the case of standard indices of space, time, etc., but in this case we are drawing this distinction within the domain of the purely qualitative, and not in the realm of external factors such as speaker, spatial position, etc. Now ambiguity and the kind of multireferentiality that we explored are seen as blemishes in a language from the standard logical point of view. Let us, however, consider reasons for maintaining that for a natural language ambiguity and multireferentiality are advantages.

First, a natural language is a diachronic phenomenon. Thus optimally it should have the kind of semantic structure that facilitates changes in extension caused by conceptual changes rather than a formalism that posits rigidly different meanings for every change in extension. If every new conceptual wrinkle requires the introduction of new words, thinking and communication will be hindered, especially in situations in which meanings and concepts are fluid with no sharp criteria of application or clearly marked extensions.

This phenomenon can be illustrated by considering the type of case in which – either in science or in philosophy – we start with an ordinary expression like ‘having a part of something’, or ‘force’, turning it into a metaphor as we try to forge a technical concept, and eventually give the word a technical meaning. In such cases it is very helpful if we can look at layers of intensional content and can say: “this much remains constant, this is what is changing.” In sum the diachronic and dynamic dimensions of natural languages demand that there be possibilities of gradual meaning and extension change. The multireferentiality illustrated above enables a language to fulfil this function.

Secondly, a natural language is often used for person-to-person communication. In many such contexts both speaker and hearer prefer that some indeterminacy of meaning remain in the semantics of the words used. For example, “you left the door open” uttered in the presence of people affected by noise, warmth, etc. in the same context as the speaker, can be a report, or a request, or a command to close the door. Furthermore, what counts as open depends on whether we are considering cold air coming in, or light seeping in when none is wanted, or whether we worry about being overheard. Both speaker and hearer
might want a piece of language that can be interpreted flexibly with regard to these alternatives.

Thirdly, natural languages are learned at various stages of development. This learning is facilitated by words having many senses and by multireferentiality. For example, terms like ‘father’ and ‘mother’ are learned by a child first in purely social, functional ways (source of warmth, care, etc.) and with extension fixed for only conceptually simple and statistically dominant types of cases. Meanings are enriched later on, and thus more contexts are generated in which reference and extension need be fixed. Even at a mature stage we need to be able to project meaning in order to understand sentences like ‘he was like a father to me’. Other examples requiring a flexible intensional content include words like ‘sick’ or ‘healthy’. In these cases we first associate the word with observable circumstances and only later grasp the essential underlying conditions (typically unobservable) that govern application. This, in turn, enables us to understand varieties of new contexts in which the extensions of these words need to be fixed.

Reflection on the semantics of the vocabulary of a language like English shows that most of the lexical items are affected by the kind of multireferentiality that we have been considering. This is hardly surprising, since most of the vocabulary involves items that come to be used either in the context of humans interacting with the environment or in contexts in which humans interact with each other. Both of these types of contexts are flexible, and within them new contexts requiring the fixing of extension open up all the time. There is no a priori way of delineating for all times all of the ways in which humans will interact with the environment or with each other.

We cannot build into the meaning of a word all of the contexts in which extension has to be fixed (Moravcsik, 1990, Ch. 6). There will always be a ‘slack’ between what can be legislated now and what will – semantically – challenge us in the future. Who knows in which ways humans will interact with snow? Or in which ways the color white will assume great importance for some practical task? Who could have predicted the extensions of legal meanings that needed to be constructed in order to deal with laws required for activities in outer space? The same situation arises in the case of human interactions. Who could predict all the different ways in which the extension of ‘family’ is being fixed and will be fixed? Instead of manufacturing constantly new words that show
no semantic relatedness to each other, we can rely on multireferentiality to ease transitions.

Before sketching the outlines of a semantic theory that accounts for the layers and structures of meaning required, let us summarize what was shown about truth in this essay. Of course, it is agreed by all that sentences of English and other natural languages can be true or false. Our issue was whether these sentences have truth-conditions in Tarski's sense. What has been shown is that most English sentences can express a variety of truths, even when we consider only intensional content and ignore relativity to space, time, and speaker. Hence the mechanism that Tarski invented for formal languages will not be suitable for the dominant parts of natural languages. We need a semantics within which we can distinguish sentential meaning from the proposition expressed, even within the strictly intensional content. We need also a theory within which layers of meaning are distinguished, both for words and sentences, to represent the required structures.

IV. MEANING AND DENOTATION RECONSIDERED

One way of accounting for the salient facts uncovered with regard to meaning and reference would be to divorce meaning from reference. Such a view has been sketched in some writings of Putnam. Such an approach, however, seems to face difficulty in a theory such as ours that attempts to account for a variety of language use, other than purely contemplative and descriptive ones. Language is also used to give direction and guidance for action, and to formulate answers to questions involving considerations of denotation. The key example for language use combining meaning and denotation is that of explanation. We need intensionality to formulate explanations, and we need denotation guided by the intension to arrive at the explanandum.

One solution involves the following key theses: (i) meanings are explanatory schemata, giving salient necessary conditions for lexical application. (ii) There are three layers of semantic content, apart from standard indexicality. First, meaning specified as explanatory necessary conditions, then a variety of contexts within which denotation is to be fixed, and then the denotations and truth that emerge within the contexts specified on the second levels (Moravcsik, 1990, Ch. 6).

Explaining what something is has typically two stages. First, to give a general framework of how to locate the items under consideration
on a conceptual map. We can do this, for example, also for the much discussed concept of a game. Then we focus on the area within which the items are that the investigation is focussing on. For example, ballgames practiced by many people in the U.S.A. We then distinguish within this area games such as baseball, football, volleyball, basketball, etc. This is clearly the explanation we need in everyday discourse, whether for the actual or potential player or the spectator. Neither of these constituencies demand that we distinguish a given game from all actual and possible games of all types; an impossible task in any case.

This two-stage process proposal corresponds to our semantic intuitions. Take, for example, the expression ‘equal treatment’. One would first specify in general terms what equal treatment is (e.g. treating others regardless of differences in worth, status, character, and not placing them lower on a preference scale with respect to desired goods than others, including oneself). People may understand equal treatment on that level, and agree that it should be extended to a certain set of humans. But then we need to take the second semantic step, namely to come to an understanding and agreement as to what counts as equal treatment in this context.

Brief reflection should convince us that the meanings of words like ‘walk’, ‘snow’, ‘white’, and indeed all or most of the descriptive English vocabulary have structures that requires two-step application procedures like the one just outlined. This is because their uses reflect a variety of interactions between humans and between humans and the environment. This variety and the ensuing dynamics of denotational contexts must be reflected in the lexical semantics. This means that we should be able to ‘read off’ the ways in which contexts for denotation emerge within the framework of sentences within which these words occur. The aspects along which contexts emerge are predictable, the total emerging set is not. Let us now apply this theory to a typical sentence such as: ‘the child walks’.

The meaning of ‘child’ is, roughly: “a human, with appropriate conditions of individuation, and persistence, less than full age as determined by the conditions governing various human interactions.” This meaning requires generating contexts for fixing reference, because the extensions will be different for ‘child labor’, ‘child vs. adult (as in legal matters)’, or ‘she is still a child’, as used in discussions of maturity.

The same considerations apply to ‘walk’. The meaning is: “locomotion with legs by putting one foot in front of the other with one foot on
the ground at all times, covering appropriate ground.” The criteria for how much ground need be covered vary depending on various types of agents; child in various senses, sick person, healthy adult, etc. At this stage, then, we have an incomplete proposition, roughly the meaning of: “human less than full appropriate age is moving legs one after another always touching ground with one, covering appropriate ground.” This incomplete proposition constrains but does not fully determine extensions and truth. To arrive at those, we need to consider the different denotational contexts for both lexical items, and then see which combination is expressed in a text or by a speaker. At this stage only, do we have fixed denotations and thus truth or falsity.

The analysis of ‘snow is white’ has the same structure. The meanings of ‘snow’ and ‘white’ are specified in terms of necessary properties adding up to an explanatory scheme. Then, as we saw earlier, on the basis of the explanatory schemes extension fixing contexts are generated, depending on the variety of interactions between humans and between humans and the environment. For each of these contexts determinate extensions can be assigned, unless standard indexical relativization is needed as an additional level. The conclusion is: only some ‘kinds’ of snow have some ‘kinds’ of whiteness. The Tarski apparatus would require that we should be able to answer our original question: “is snow white?” with a determinate reply. But this we cannot do. Too many snows, too many whitenesses, too many combinations.

There is also psychological evidence for this way of cutting up the conceptual pie. For the kind of knowledge required to understand the meanings of ‘the child walks’, and ‘snow is white’ seems distinct from the one required for fixing extension within a given qualitatively prescribed context. The first kind of knowledge is just general comprehension of syntactic and semantic conditions. The second type involves knowing more detail about what can or cannot be expected from children in various contexts, how people interact with snow, etc. A person could be very good at comprehension on the first, more general level, and be bad at the second level. Conversely, some people can become good at denotation fixing once the general conditions are clarified for them.

This way of looking at comprehension has important consequences that should be utilized in educational projects. For example, people might come to understand that a good physician should care for his or her patients. It is, however, a second step to spell out all of the different
contexts for caring, from bedside interactions to decisions reached in a hospital about allocating resources. Finally, it takes further training to help people understand what counts as caring in the various contexts. Even in very different fields we can detect an analogous distinction. For example, it is one thing to understand a mathematical claim in general, and a distinct matter to determine whether it is true or false. An adequate semantics should account for that. Of course, in that case, the various contexts will have more to do with types of proofs and calculations than with humans interacting with the physical environment.

In view of these considerations we can return to sentence (3) listed in the Introduction, and see that it is false. ‘Snow is white’ does not mean that snow is white, because without further context specification for extensions there is no proposition that snow is white. Rather, we need to grasp an incomplete proposition, look at the relevant lexical items, such as ‘appropriate’, that show why and how contexts for extension and truth need to be generated, and then move to the specification of complete propositions. At this point the task of linguistic comprehension is completed, and questions of verification take over. In this way, our analysis keeps truth, leaves meaning and extension linked, but without the apparatus of truth-conditions in Tarski’s sense, and takes note of certain cognitive facts concerning language processing. This is as it should be, since as we saw the concept of a natural language is essentially tied to cognitive facts.

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COMMENTS BY PATRICK SUPPES

I agree with much of what Julius has to say about the highly context-dependent nature of the meaning of much natural language. I do want to remark in detail on various specific issues, and here and there map out some areas of disagreement between us. Still, much of what he says is in agreement with the work Colleen Crangle and I have done on context-fixing semantics (for example, Suppes and Crangle, 1988).

**Propositions.** To my surprise, Julius in several instances stands by what is more or less the standard concept of proposition. Thus in Section 3 he talks about “the proposition that it expresses”, referring to a sentence. It is exactly this pernicious tendency to think that a sentence expresses some unique proposition that I have argued strenuously against in my various papers on congruence of meaning. Just as in geometry there is no one notion of congruence, so in the theory of meaning there is no one fixed and definite concept of synonymy. Given the relativization of context of much else that he has to say, I suspect that this usage on the part of Julius is just a hangover from the bad old days when he might have believed in such fanciful objects as propositions.

**Meanings as Explanatory Schemata.** I like this general idea of Julius’s but I find it hard to fill in the details of how we actually operate mentally with such schemata. Until we can think through how such schemata are actually used in either producing or comprehending language, which means a rather developed theory that separates meanings from syntactic considerations, it will be hard to get beyond the generalities.
It is easy to start out by saying that model-theoretic semantics will not do and to turn to a discussion of procedural semantics to start to specify what one might mean by ‘explanatory schemata’. Then one begins to think about all the mysteries of memory and perception as well as the puzzles about the mechanisms or computations for paraphrasing that are part of our language ability. The more one reflects on them, the deeper the mystery becomes. Even if we have a baptismal christening, the mysteries remain. It is a touchstone of the realism and power of theories of cognition to test them against their capabilities for dealing with the kind of problems just mentioned. As yet, what we have is unfortunately far from satisfactory.

Language Learning. Julius also discusses language learning but does not pursue the topic very far. I want to mention that the mysteries alluded to in the previous paragraph are present in extra strength when we turn to language learning. How does a child extend in a natural way what he has learned in 18 months to the vastly greater amount he knows and is able to handle at 36 months? How is the grammar and semantics put together in such a way that by the age of 5 years most of the important features of language he or she will command have been learned? There are now literally thousands of developmental psycholinguistic studies full of useful information about this process, but we are as yet very far from having anything like a satisfactory theory. One conclusion does seem to be true and that is that children put meaning ahead of syntax. There is also some kind of case to be made for their learning meanings only in very restricted contexts initially and then gradually widening out. This seems like a natural simplifying hypothesis but how the internal machinery is put together and is able to compute so wonderfully, either in terms of production or comprehension, is still very much out of reach. Recently I have been working on machine-learning of natural language. What success we have had has been by essentially assuming away most of the tough problems we must ultimately face in language learning. Even if we have begun with nothing about the grammar of the language assumed, we have not adequately dealt in our research on machine-learning with the simultaneous intertwining of the learning of language and concepts. One thing that is evident is that there is an endless amount of practice involved. By the time the child reaches kindergarten, the child has heard millions of sentences and has uttered a very large number. It takes a lot of practice to get any good at language.
How are we to think about these mechanisms of practice? Obviously there is in learning a kind of automaticity, but our grasp of the details of these automatic or semiautomatic mechanisms of language handling are quite imperfect as yet.

REFERENCE