

LOGICAL STRUCTURES IN LANGUAGE*

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The intensive development of techniques of descriptive linguistics during recent years has not been accompanied, at least among linguists, by a parallel development of the theory of meaning. Linguists have in general been relatively unconcerned with the problem of giving an account of meaning, and they have self-consciously attempted to avoid founding their descriptive science on a semantic or partially semantic basis. The motives and the consequences of this attempt have often been misunderstood. As is generally recognized, the vagueness and elusiveness of semantic notions have, of course, been one primary motivation. Naturally, linguists have tried to operate on as firm a basis as possible. But an even more powerful motivation is that semantic notions appear to be useless or misleading, even if we accept them unquestioningly.¹ The linguist avoids semantic foundations in the study of linguistic form for the simple and sufficient reason that this course is apparently the only one that enables him to arrive at a clear insight into grammatical structure. He thus finds himself studying language as an instrument, with almost no concern for the uses to which the instrument is put.

I think there is ample justification for rejecting any appeal to meaning in the study of linguistic form. But it is necessary to make a clear distinction between the appeal to meaning and the study of meaning. While the first has been a constant source of confusion, the second is clearly an integral part of a full-scale description of language. Rejection of the appeal to meaning in grammatical description does not require and should not support a corresponding rejection of the study of meaning. In this paper I would like to suggest that the results of a purely formal study of the structure of language can lead quite naturally to the study of meaning in ways which may be fruitful and revealing.

Before considering this question, it will be necessary to clarify somewhat the object of formal analysis and the nature of some of its results, focusing attention particularly on the notions "structure of a language" and "grammar of a language."

By a *language* in this discussion is meant a set of sentences all constructed from a finite alphabet of phonemes (or letters). These sentences may not be meaningful, in any independent sense of the word, nor need they ever have been used by speakers of the language. It is quite easy to construct sequences of English words which are quite without meaning and outside the linguistic experience of speakers of English who will, nevertheless, immediately recognize them as English sentences. A grammar of a language is essentially a theory of the set of sentences constituting the language. Grammatical research aims at determining the principles of construction underlying this set of sentences, and a grammar is a statement of these principles. More concretely, one can think of a grammar as being a device which generates all of the grammatical sentences of the language under analysis without generating non-sentences. The theory of grammar is concerned with the precise specification of how these sentence-generating devices operate.

Clearly, it would be absurd to try to give rules of sentence construction directly in terms of phonemes or letters. One would not hope to construct a grammar of English on any reasonably limited scale in terms of rules of phoneme succession alone. For this reason a linguist will search for units which function more directly in sentence construction, let us say morphemes or words. It will be much more efficient to give a joint description of the word structure of sentences and the phoneme structure of words, than a direct description of the phoneme structure of sentences. Briefly, this

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¹For discussion of this point see my "Semantic Considerations in Grammar," *Georgetown Univ. Monograph Series in Linguistics*, vol. 8, pp. 141-150 (1955) and *Syntactic Structures*, The Hague, Mouton and Co., 1957, p. 9.

is the motive that impels the linguist to develop higher levels of linguistic analysis. He tries to fragment the vast complexity of a language into parts, each of which is in itself of a rather simple structure, and is subject to easily stable regularities.

To answer the question whether there are linguistic levels beyond the levels of phoneme, morpheme, and word, one may inquire into the consequences of attempting to construct an English grammar (sentence-generating device) in terms of these levels alone. It quickly becomes apparent that this task is of hopeless complexity.² For the same reason that an English grammar must recognize such units as morphemes and words, it must also recognize phrases of varying degrees of complexity. Many of the problems that arise when one tries to construct a device that generates word sequences directly, vanish when one describes sentences in terms of phrase structure — a type of description known as constituent analysis and similar to that which is traditionally called parsing.³ Any theory of linguistic structure must, accordingly, accommodate a theory of phrase structure as a higher level of analysis, above the level of morpheme or word.

Once the notions of phrase structure have been formalized, one can inquire into the possibility of constructing a grammar of English, for example, that utilizes the descriptive devices available on this level for generating English sentences. Although such a grammar may be far superior to the weaker ones in which phrase structure plays no role, there is still a large residue of inefficiency that suggests that an even higher level of description is needed. There is a class of sentences that can be effectively described in terms of phrase structure. These are traditionally known as simple declarative sentences such as *John is reading the book*. This can be divided into a noun phrase *John* and a verb phrase *is reading the book*, which itself consists of a verb *is reading* and an object noun phrase *the book*, and so on. But only at a rather exorbitant cost can such analysis be extended to sentences like *What is John reading?* There is no natural way to analyze such sentences into a hierarchy of

phrases, and any artificial solution that can be employed immediately translates itself into great complexity. Following the policy illustrated above in the development of the level of phrase structure itself, one may seek to retain, in some different way, the simplicity of the phrase structure grammar of simple declaratives by accounting for such sentences as *What are they reading?* The method for accomplishing this becomes clear when it is observed that there are strict formal correspondences between the sentences included in the phrase structure description and those that have not been incorporated. To every simple declarative such as *John is reading the book*, there is a corresponding passive *the book is being read by John*, a corresponding yes-or-no interrogative *Is John reading the book?*, a corresponding pair of interrogatives *What is John reading?* and *Who is reading the book?*, etc. Furthermore, these correspondences are quite simply describable. It is not difficult to define what may be called grammatical transformations, that is, formal operations that convert any sentence of a declarative form into a corresponding passive, interrogative or other form. One can extend the scope of the grammar by adding these grammatical transformations to the phrase structure description. Instead of attempting to account for such a sentence as *What is John reading?* directly in terms of phrase structure, it is derived as a transformation of the sentence *John is reading a book*, which is itself simply derived on the phrase structure level. Detailed analysis of English shows that this manoeuvre leaves one with a simple phrase structure grammar and a simple transformational grammar, which jointly appear to exhaust grammatical sentences, instead of an extremely complicated phrase structure grammar by which all sentences are derived in a uniform manner. Hence the motives that lead one to recognize a "higher" and "more abstract" level of transformational analysis are just those that led one to develop the level of phrase structure in the first place. By so doing, one can show that what appears to be a complicated and irrational system is really composed of simple components put together in a regular manner.

²In fact, it can be shown that it is impossible to construct a finite device that generates all and only English sentences word by word, although description in terms of the higher levels we discuss below apparently avoids this consequence. See my "Three Models for the Description of Language," *I.R.E. Transactions on Information Theory*, Vol. IT-2, No.3, pp. 113-124 (1956), and *Syntactic Structures* p. 3.

³Cf. Z. S. Harris, *Methods in Structural Linguistics* (Chicago, 1951), R. S. Wells, "Immediate Constituents," *Language* 23.81-117, and Chomsky, *op. cit.*, for discussion of the logic of such description.

The central and fundamental notion of linguistic description is that of "linguistic level." To be fully adequate, the description of a language like English must be framed in terms of such linguistic levels as phonemes, morphemes, words, phrase structure, and transformations. Each linguistic level provides a certain point of view from which to characterize the sentences of the language. By combining these points of view one can construct a relatively simple and revealing grammar of English, though to ignore any of them would lead to a grammar of great complexity. Thus each sentence of English can be considered as a sequence of phonemes, a sequence of morphemes, a sequence of words, a sequence of phrases (in various ways), and finally, as a sequence of operations (i.e., grammatical transformations) by which the sentence is derived from simpler sentences.⁴

The general theory of linguistic structure is concerned with the abstract properties of these linguistic levels. Each level provides a certain way of representing utterances; each has a certain descriptive potential which it makes available for grammar construction. An important part of general linguistic theory is the exact statement of how, at each level, this potential is made available. That is, it is important to define a correspondence between the level of phrase structure and a certain type of sentence-generating device that utilizes the notions of phrase structure in generating sentences. From the grammar of a given language it must be possible to reconstruct the underlying phrase structure, and the system of phrase structure for a given language must be convertible into a sentence-generating device. The study of the general properties of linguistic levels is thus, at the same time, a study of the logical design of sentence-generating devices. When one speaks of the "grammar of English" one refers to the device that has been constructed to generate English sentences. When one speaks of the "structure of English" one refers to the particular formulation of the set of linguistic levels reconstructed from this grammar. To say that certain grammatical transformations are part of the structure of English, is to assert that to generate the sentences of English in an effective manner, a grammar of English must incorporate these grammatical transformations.

When one actually attempts to construct an English grammar, he finds that there is a basic dichotomy of sentences into a), a *kernel* of basic sentences that can be generated by the phrase structure grammar, and b), a set of derived sentences that are formed from kernel sentences by repeated transformation. As kernel sentences, one finds it necessary to choose what are usually called simple, active declarative sentences, with no complex noun phrases (like *proving that theorem*) or verb phrases (like *see him coming*). These complex phrases, as well as passives, interrogatives of various types, sentences with conjunction, even noun phrases that include adjectives seem to be more efficiently derived by transformation than by means of the kernel grammar that uses only the notions of phrase structure.

The approach to linguistic structure and to the syntactic description of English that I have sketched so far is a purely formal one. It is motivated solely by the desire to construct the simplest possible device for generating English sentences, and to investigate the logical properties of devices of this sort. I noted at the outset of this paper that linguists very generally attempt to avoid any appeal to meaning in constructing grammars, and that this course is apparently imposed on them by the nature and object of grammatical research. The approach I have just outlined is thus in accord with this general tendency. I also mentioned, however, that rejection of the appeal to meaning does not entail rejection of the study of meaning. I would now like to suggest that the results of the purely formal inquiries sketched above have some bearing on the problems of semantic description.

Suppose then that one has constructed a grammar that generates English sentences using the devices of phrase structure for the kernel sentences and grammatical transformations for all other sentences. He can give a complete structural description of a sentence by tracing its development in the actual operations of the grammar. Equivalently, and as has been pointed out above, since the grammar corresponds to a system of levels, he can give a complete structural description of a generated sentence by stating how it is represented on each linguistic level. It would be very strange if this involved structural apparatus, revealed

⁴Notice that transformations can be applied to transforms of other sentences. E.g., from the passive *The book is being read by John* (itself derived from *John is reading the book*), we can form, by further transformations, such sentences as *Is the book being read by John?*, *What is being read by John?*, *I don't know what is being read by John*, etc.

through formal analysis, played no role in the way language is actually put to practical use. Hence, it appears reasonable to ask how the structural description of a sentence, as provided by the grammar, relates to the way in which the sentence is used and understood – in brief, how it relates to the meaning of the sentence.

A first approach to this problem is suggested by sentences which, for one reason or another, happen to be represented in alternative ways on some linguistic level – that is, sentences that are generated in more than one way in the grammar. One can give a kind of proof of existence for the relation between structural description and meaning by showing that sentences which are ambiguous in structural description are correspondingly ambiguous in meaning. One does, in fact, find that this is true in a significant number of cases.

The most trivial instances of semantic ambiguity with a syntactic origin are to be found on the lowest levels of word and morpheme. There are many utterances that can be analyzed into words or morphemes in more than one way, with corresponding variation in meaning. Such phrases as *a name* (*an aim*) or *the sun's rays meet* (*the sons raise meat*) are obvious examples. In such cases one can clearly see that a difference in the way the sequence of phonemes is represented on the level of words or morphemes determines its meaning.

For a less transparent case one may turn to the level of phrase structure. It is not hard to find sentences which are unambiguous in their phonemic and morphological structure, but which can be analyzed in more than one way into phrases – that is, which are generated by several paths in that part of the grammar corresponding to the level of phrase structure. The sentence *They are flying planes* is a good example. This can be analyzed as *They – are – flying planes*, where *flying planes* is the noun phrase object, or as *They – are flying – planes*, where *are flying* is the verb. In the first case, it might be interpreted as *Those specks on the horizon are flying planes*; in the second, as *My friends, who are pilots, are flying planes*. In this case the alternative phrase structure analyses involve a difference of segmentation, very much as in the case of *a name*. But this is not always the case. In the sentence *Flying planes can be dangerous*, the noun phrase *flying planes* can mean either *planes that fly* or *to fly planes*. There is only one way to segment this sentence,

but the internal structure of the noun phrase *flying planes* permits an interpretation as an adjective *flying* plus noun *planes* or as a certain transform of a verb phrase with *planes* being the object of *fly*. Although this ambiguity is expressible on the level of phrase structure, it actually has a transformational origin, as will be shown below.

Study of phrases formed with the morpheme *ing* provide many other illustrations of semantic ambiguity with a structural origin. Consider, for example, the sentence *The police were ordered to stop drinking after midnight*, which can be given several different interpretations, corresponding to the various paths by which it can be derived in the grammar. This is a complicated case that cannot be fully analyzed without a detailed study of transformational structure, but it is easy to see that the question of whether the police are being censured hinges on placement of the constituent boundary before or after *drinking*. A more subtle point is involved in the ambiguity of the sentence *I don't approve of John's cooking* (or *drinking, driving, etc.*). This may either mean that I disapprove of the way John cooks or that I disapprove of the fact that he cooks (i.e., I think his wife should cook). The ambiguity is one of the structure assigned to the phrase *John's cooking*, which can be understood either as a modifier plus noun construction or as a transform of the sentence *John cooks*, embedded into the verb phrase *approve of X* as a unit. Again the ambiguity is in the phrase structure interpretation, and its origin is transformational.

It is clear even from these few hints that the transformational history of a sentence cannot be neglected even in the study of ambiguities that are marked on the level of phrase structure. One finds, on further investigation, that there are ambiguities that are completely unmarked on the level of phrase structure, even though they are clearly describable in terms of transformational development. As a simple example, consider the three noun phrases:

- (1) *the growling of lions*
- (2) *the raising of flowers*
- (3) *the shooting of the hunters*

The first two are unambiguous, but different in interpretation. The phrase *growling of lions* indicated that the lions are doing the growling, while in the case of *the raising of flowers*, the flowers are being raised. The third phrase, however, is ambiguous. It may mean that the

hunters are doing the shooting or that the hunters are being shot. But neither the difference in manner of interpretation between the first two cases, nor the ambiguity of the third, is explicable on the basis of the constituent structure of these phrases. In all three cases there is a noun derived from a verb (viz., *growling*, *raising*, *shooting*) followed by a prepositional phrase. To gain some insight into this situation one must investigate the transformational structure of English. In attempting to construct an English grammar, one finds that the grammar is much simplified if the complex noun phrases such as those cited above are dropped from the kernel and reintroduced as transforms of simple kernel sentences. To every simple noun-verb sentence such as *lions growl* there is a corresponding noun phrase verb+ing-of-noun such as *growling of lions*. Furthermore, to every verb phrase of the form verb-noun there is a corresponding noun phrase verb+ing-of-noun. Therefore, since the sentence *John raises flowers* has the verb phrase *raise flowers* this transformation will give a noun phrase *raising of flowers*. These two transformations operate on kernel sentences of different structure, but they convert them into a noun phrase of the same form. This accounts for the intuitive difference between the way in which we understand the phrases *growling of lions* and *raising of flowers*. But, as kernel sentences, both *The hunters shoot* and *They shoot the hunters* are possible, and these sentences are, respectively, of the forms to which the two transformations given above apply. In both cases, the result of applying these transformations is the noun phrase *shooting of the hunters*. Just as the ambiguity of *a name* is correlated with the fact that it is represented in two different ways on the morphological level (or equivalently, that it can be generated by two different paths in the grammar), so the ambiguity of *shooting of the hunters* can be traced to the fact that it is represented ambiguously on the transformational level, being derivable from two distinct kernel sentences. Since there are no kernel sentences *The flowers raise*, or *They growl lions*, the phrases *growling of lions* and *raising of flowers*, each having a unique transformational origin, are not similarly ambiguous.

The ambiguity of the phrase *flying planes* in the sentence *Flying planes can be dangerous* can be explained on the basis of transformations very similar to those just discussed. Sentences of the form noun-verb can regularly be converted into noun phrases of the forms verb+ing-noun. Similarly, verb phrases of the form verb-noun can be converted, by a second transformation, into noun phrases of the same type. Since both *Planes fly* and *They fly planes* are kernel sentences, there are two origins and two distinct transformational histories for the phrase *flying planes*. The phrases *screaming children* and *proving theorems* are not subject to the same ambiguity, since they have unique (but distinct) transformational histories. The first comes from *Children scream* (there is no kernel sentence *They scream children*); the second, from *They prove theorems* (there is no kernel sentence *Theorems prove*).

Although phrases with the morpheme *ing* are a particularly rich source of semantic ambiguity with a high-level structural origin in English, it should not be thought that this phenomenon is limited to such cases. To take just one of many examples of a quite different kind, consider the sentence:

(4) *They don't know how good meat tastes.*

This can mean either that they are unacquainted with the taste of good meat, or that, being vegetarians, they don't know how satisfying the taste of meat is. In the first case, the phrase *how good meat tastes* is a transform of, e.g., *Good meat tastes wonderful*; in the second case, it is a transform of *Meat tastes very good*. Again, the transformations involved are of a very general type in English. And in this case, too, one can find such unambiguous sentences as:

(5) *They don't know how good the meat tastes.*

(6) *They don't know how the good meat tastes.*

The occurrence and nonambiguity of these sentences is explained by the fact that *The meat tastes very good* and *The good meat tastes wonderful* are sentences, while *Good the meat tastes wonderful* and *Meat tastes very the good* are not.⁵

One could cite many other cases of ambiguities that can be accounted for in the same way. We conclude that knowledge of the

⁵That is, of the two transformations that yield (4) in two different ways from two distinct sources, thus accounting for its ambiguity, only one yields (5) (from *The meat tastes very good*) and only one yields (6) (from *The good meat tastes wonderful*). If the two non-sentences cited were in fact grammatical, then (5) and (6) would also have two sources each.

transformational history of an utterance is essential to understanding the utterance. More generally, an important factor in the way utterances are understood is the way these utterances are represented on all of the various linguistic levels.

The relation between formal grammatical structure and meaning can be shown by considering cases of the opposite extreme; namely, pairs of sentences that are understood and used in a similar way. Just as one would expect a sentence that is ambiguous in meaning to be represented in more than one way on the same level, one would hope to find that similarity in meaning might be marked by similarity of representation. Again, there are a significant number of interesting and important cases where this is true. Consider briefly one case in which identity of transformational history determines sentence type, that is, the general way in which a sentence is actually employed.

It is evident to any speaker of English that the sentences *Did John eat an apple* and *Who ate an apple*, are sentences of the same general type, that is, interrogatives, as opposed to *John ate an apple*. Yet if one examines the formal structure of these sentences, up to the level of phrases, he finds that they have very little in common. *Did John eat an apple?* normally has a rising intonation, while *Who ate an apple* has the same falling intonation as declaratives. Similarly, *Who ate an apple* has the normal NP-Verb-NP order of declaratives, instead of the inverted word order of questions. It is difficult, in fact, to find a reason for classifying the sentence *Who ate an apple* as an interrogative at all, though this is obviously the intuitively correct analysis.

On the transformational level, however, the situation is different. Both *Did John eat an apple?* and *Who ate an apple?* must be dropped from the kernel. *Did John eat an apple?* is formed by a question transformation from the kernel sentence *John ate an apple*. *Who ate an apple?* is formed from *Did John eat an apple* by a second transformation. Thus both of these derived sentences have the question transformation as part of their transformational history. When the analysis is carried further to sentences like *What did John eat?*, one finds that this is transformationally derived by exactly the same path as is *Who ate an apple?*, that is, it is formed from the question *Did John*

eat an apple by a second transformation which happens to be structurally equivalent to the transformation that gives *Who ate an apple*.⁶

In short, the sentences *Did John eat an apple?*, *Who ate an apple?*, and *What did John eat?* all have the question transformation in their transformational representation. They are thus distinguished, as interrogatives, from *John ate an apple*. And the sentences *Who ate an apple* and *What did John eat* are distinguished from *Did John eat an apple*, as a special subclass of interrogatives, by a second, subsidiary transformation. Transformational representation thus corresponds fully to one's intuitive classification of these four sentences, though there appears to be no basis for this classification on lower levels. One can conclude from cases like this that similarity of transformational development is reflected in similarity of meaning, in the broadest sense of this word.

We have here been investigating the rather obvious hypothesis that understanding of a sentence requires knowledge of its syntactic pattern; consequently, that two sentences of the same pattern will be semantically similar, and a sentence that falls in the overlap of two patterns will be ambiguous. The evidence that we have brought in support of these last two propositions supports the general hypothesis, from which they are drawn, namely, that in order to understand a sentence it is necessary to know its syntactic pattern.

It is important to bear in mind the abstract nature of the notion of syntactic pattern as it has been analyzed above. By the syntactic pattern of a sentence is meant its set of representations on the various linguistic levels; in particular, the levels of phrase structure and transformations. Two such sentences as *What did John eat?* and *Who ate the apple?* thus have the same syntactic pattern, on the highest level, despite their difference of word order. And *Who ate the apple?* and *John ate the apple*, despite their similarities in such formal features as word order and intonation, are of quite different syntactic patterns. There are many other cases in which superficial formal similarities prove to be quite misleading as to syntactic pattern. Consider for example, the following sequences:

(7) *The book seems interesting.* (8) *The child seems sleeping.*

⁶See *Syntactic Structures*, pp. 7, 8, for details.

The first of these is a perfectly good sentence, but despite the superficial similarity of word class structure, the second is not a sentence of English at all. It is thus quite clear that the notion of syntactic structure with which human beings operate in making intuitive decisions about grammaticalness is quite a subtle one. It is not until one has performed a full-scale transformational analysis, with a corresponding deepening of the concept of "syntactic pattern," that one can provide an explanation for the apparently irregular behavior of the verb *seems*, and many other similar anomalies.⁷

I would like to comment briefly on another important way in which transformational analysis can be useful in the study of meaning. One can often learn a great deal about the syntactic form of a sentence, especially about its phrase structure, by asking how a sentence behaves under various transformations. For example, consider the sentences:

- (9) *All the children laughed at the clown.*
- (10) *John worked at the office.*

Consider the behavior of these sentences under the passive transformation: One may say:

- (11) *The clown was laughed at by all the children.*

but not:

- (12) *The office was worked at by John.*

Thus "laugh at" is treated as a single verb with the object "the clown," while "at the office" is a prepositional phrase following the intransitive verb "worked." Supporting evidence for this analysis comes from a second transformation that moves a prepositional phrase to the beginning of a sentence, thus resulting in:

- (13) *At the office, John worked.*

but not:

- (14) *At the clown, all the children laughed.*

This is, incidentally, no isolated instance. I think that most of the criteria that can be used to determine phrase structure are transformational in origin. By determining how a sentence behaves under various transformations, one learns much about its syntactic pattern, and, therefore, if our earlier argument is valid, about its meaning as well.

I think it is interesting to notice how similar this is to some of the methods of semantic analysis employed by certain contemporary British philosophers. For example, in discussing the difference in meaning between the words *know* and *believe*, John Austin⁸ observes that to question belief one asks *Why do you believe?*, while to question knowledge, one asks *How do you know?* In other words, sentences with *know* and *believe* behave quite differently under certain transformations. More generally, I think that it may be possible, and perhaps quite important, to find a link between the very subtle and productive analysis of meaning practised by many philosophers, of a variety of schools, and the kind of analysis of structure that modern linguistics may be able to provide.

Notice that I am not saying anything new or startling when I point out that *the child seems sleeping* is not a sentence, or that *at the clown* is not a prepositional phrase in the sentence *All the children laughed at the clown*. In fact, if this information were startling, it would probably be incorrect. The linguistic study of syntactic pattern does not attempt to show that sentences are not what we think they are. Its goal is rather to explain why sentences are what we intuitively know them to be; that is, to give a kind of rational reconstruction of this intuitive knowledge.

I have been discussing some approaches to the theory of meaning from a point of view which is rather remote from the practical concerns of the field of documentation. I think that this is unavoidable. The study of meaning is in a woefully backward state—I do not think that it can yet claim any significant results that have immediate practical implications for such problems as those of information retrieval. No one yet knows how to draw clearly the boundaries of this domain of inquiry. What I have suggested is that the theory of linguistic structure may be able to incorporate a part of the vast and confused tangle that is called the problem of meaning; or at least it may provide concepts useful for the study of this problem.

There are several ways in which one could advance further exploration. For example, it has been suggested that the kind of artificial language that logicians often study, for various special purposes, might constitute a bridge between vernacular language and some sort of

⁷Cf. *ibid.* for some discussion of such cases.

⁸"Other Minds," reprinted (from the *Proceedings of the Aristotelian Society* Supplementary vol. XX (1946)) in Flew, ed., *Logic and Language*, vol. 2.

machine language. This idea seems to have some merit. A natural extension of it would be an investigation of the possibility that the kernel sentences that underly discourse may constitute a bridge between vernacular language in all of its variety and complexity and the restricted artificial language of the logician. Thus one might anticipate a succession from actual discourse, to underlying kernel, to logical language, to machine language. At present, one can only speculate about such matters, since the attempt to apply linguistic notions in these areas has not yet been made. But it may be that our understanding of linguistic structure is reaching a point where the attempt is practicable.

In summary, I think that linguistics may have much to offer in the study of the way meaning is conveyed in language, even though such questions have been at the very periphery of recent linguistic work. The syntactic devices that the linguist discovers by his purely

formal analysis play an important role, quite naturally, in the use of language. Transformational analysis, in particular, permits one partially to reduce the problem of explaining how language is understood to that of explaining how kernel sentences are understood, where the kernel sentences underlying a given sentence are thought of as elementary building blocks out of which by various operations, the sentence is constructed. Since the kernel sentences underlying a given utterance seem, in a way, to incorporate the basic content of the utterance, such analysis also seems to suggest a means for investigating the organization of connected discourse,⁹ a task which has hitherto been beyond the reach of linguistic analysis. It is difficult to foresee how deep an insight into meaning, and the structure of discourse, may be provided by such syntactic investigations, but at this early stage, I think there is reason for hoping that they will be quite revealing.

⁹Cf. Z. S. Harris, "Discourse Analysis," *Language* 28.1-30 (1952) and "Discourse Analysis: A Sample Text," *ibid.*, 474-94.