

LINGUISTICS

GRAMMAR AND THE FACTS OF LIFE

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1. *INTRODUCTION*. In addition to the kind of meaning that is generally recognized as semantic, language depends to some extent on knowledge about the world and on general reasoning processes, and there has been an increasing consciousness of this on the part of linguists in recent years. In the first place, there are conversational principles of the kind described in Grice (1975) — unspoken ground-rules, as it were, to which participants in conversations adhere, or from which they depart with calculated effects. In the second place, there are instances where the language user's factual knowledge comes into play. Thus, McCawley (1968:129) claims that "whether a speaker judges an expression such as Ziff's example *the shooting of the elephants* to be ambiguous depends on his knowledge of physics and biology and the strength of his imagination". "Evidently," comments McCawley (1968:146), "my imagination but not Ziff's is up to the task of imagining a gun with a trigger so large that an elephant could pull it; I suspect that the difference between my judgements and Ziff's may be the result of my having read *Babar* as a little boy and his not having done so". In another example, McCawley refers to the fact that his knowledge of music will come into play in deciding that the appropriate paraphrase for *The string quartets of Prokofiev and Ravel* is *The string quartets of Prokofiev and the string quartet of Ravel*. This kind of knowledge that is relevant to interpreting sentences has been referred to as encyclopaedic knowledge.

There are also matters of a rather different kind that are involved in meaning. In an unpublished draft manuscript, Jerrold Sadock refers to the two sentences:

(1) Bill has been married five times.

(2) Bill has been married more than once.

As he says, "it is quite counterintuitive to say that the grammar of English is solely responsible" for the fact that (2) cannot be false if (1) is true. "Moreover" he adds, "it can't be encyclopaedic knowledge, either, because there are an infinite number of sentences which could be substituted" for (1) (Sadock:1975:3) (e.g. *Bill has been married thirteen times*) without disturbing the relationship. He concludes: "Here it is our knowledge of the recursive rules of arithmetic

which assists us in drawing the correct conclusions rather than either our knowledge of English or encyclopaedic knowledge alone'.

So not everything about sentences is to be accounted for by purely semantic rules. Chomsky (1976:139) also recognizes this fact when he makes a distinction between (i) "a system of beliefs and expectations about the nature and behavior of objects" and (ii) "a system of language." He refers to the first as *common sense* and the second as *grammar*. He says that grammar interacts with other systems of knowledge and belief to determine how sentences are interpreted (Chomsky 1976:141).

Now, the examples I have quoted from McCawley and Sadock where non-linguistic knowledge seems to come into play in using language may seem rather special cases. McCawley's example about the shooting of the elephants concerns judgment as to whether a certain sequence is ambiguous or not, and, because McCawley has a flair for rather exotic examples, the point may mistakenly be believed to be exotic. His other example, about the quartets, involves recognizing a correct paraphrase, and happens to involve rather erudite knowledge, so again the example may seem somewhat special. Sadock's example is rather special, too, in that it involves a knowledge of arithmetic, in a way that is called on perhaps infrequently in ordinary conversation. But I believe that extra-linguistic knowledge plays a much more important role in the everyday use of language than it has yet been given credit for. We draw on it with great frequency and in quite ordinary circumstances. In the next section, I will illustrate this with an example.

2. *INTRANSITIVE USES OF THE VERB 'FLY'*. The sentences in (3) provide interesting contrasts with each other:

- (3) a. The bird flew to Western Australia.
 b. The plane flew to Western Australia.
 c. John flew to Western Australia.
 d. The timber flew to Western Australia (yesterday).

(3d) might be spoken by an employec at a timber merchant's who was answering a customer's query about some timber he had asked to be consigned to Western Australia.

Flew implies somewhat different facts in each of these sentences. In (3a), the bird is able to fly without any aid from anything or anybody else. In (3b), the plane could normally fly to Western Australia only if its controls were manipulated — though this might happen either on board or by remote control. In (3c), John could normally fly only inside a plane, or other similar vehicle, though he might be either the pilot or a passenger. In (3d), the timber could not be the pilot, but could only be the cargo, and could only fly with the help of a plane (and a pilot).

The question might be raised, therefore, whether there are, in fact, four

different meanings of *fly* involved in (3). Very roughly, we might try to formulate them as:

- (4) a. To go through the air¹ under the subject's own volition and own power. (bird)
 b. To go through the air under the subject's own power, but not volition. (plane)
 c. To go through the air under the subject's own volition, but not power. (John)
 d. To go through the air but under neither the subject's own volition nor the subject's own power. (timber)

An alternative possibility is that these do not exist as four separate meanings of *fly*; it is just that the word is vague in relation to various senses. Lakoff (1970) proposed a test for telling whether different senses of a word represent real ambiguities or mere vagueness as between the various interpretations. He cites sentences like (5) and (6).

- (5) Selma likes visiting relatives and so does Sam.
 (6) Harry kicked Sam and so did Pete.

There are different senses of *visiting relatives*, depending on whether Selma is visiting the relatives or they are visiting her. *A priori*, there are four possible ways in which these meanings could be combined, but in fact the sentence is only two-ways ambiguous. This is said to be due to the fact that the rule that reduces the second clause does so only if the meanings are identical. In (6), on the other hand, if we raise the question of whether the kicking was done with the left foot or the right, there are again four possibilities of combination. But this time, all four possibilities are compatible with the meaning of the sentence, so the collapsing rule must recognize *kick* as having a single meaning, regardless of whether the left foot or the right foot is involved. This distinction is therefore due only to the vagueness of the lexical item *kick*, and does not involve two distinct meanings.

Suppose we were now to try to apply Lakoff's test to the verb *fly*, as exhibited in sentences like those in (3), to see whether its different senses represent real ambiguities or just vagueness. Since there are four potential senses of *flew* that we have listed, it would seem that there ought to be sixteen possibilities of combination in Lakoff's test-frame:

- (7) X flew to Western Australia, and so did Y.

But as soon as we put real noun phrases in the positions of X and Y, we find

¹ It is obvious that this characterization is very rough, and that the manner of going through the air needs specifying. For many cases, the formulation 'to go through the air with the aid of wings' would serve, but there are other cases where this would not do. For instance, *The spear flew to its target* cannot be paraphrased in this way. It is interesting, in this case, that we cannot have a causative transitive: **Bill flew the spear to its target* (in the relevant sense). This again suggests that further specification is needed.

that some of the senses are simply non-starters for Lakoff's test. This is obvious in (8):

(8) 'The bird flew to Western Australia, and so did the plane.'

Just by looking at the sequence *the bird flew*, and without referring to the rest of the sentence at all, we know that the dominant sense in that sequence is that of (4a): 'to go through the air under the subject's own volition and own power'. The sense of (4b), 'to go through the air under the subject's own power but not volition' seems quite inapplicable, and so does (4c), 'to go through the air under the subject's own volition but not power', since birds do not operate as pilots of planes or book seats through airlines. It is possible for (4d) to apply: 'to go through the air but under neither the subject's own volition nor the subject's own power'. A bird could, after all, be transported as cargo in a plane. What we have, then, is a dominant reading for *the bird flew* involving (4a), and a less prominent, but still possible, reading, (4d). So far, we have not made any reference to the second half of (8), so the list of potential senses of the first half has been reduced on grounds quite other than those of the collapsing rule that Lakoff refers to. When we look at the second half of (8), we again find that the four potential readings of *fly* are reducible to two without any reference to the first half of the sentence. The dominant reading involves (4b), but again, (4d) is possible, since a plane could be transported as cargo on a bigger plane (possibly, but not necessarily, collapsed into parts). It is obvious that the question of which sense of *fly* is operative is answered by reference to the particular choice of noun phrase in the subject.

Lakoff's test, in fact, has almost nothing interesting to reveal about these sentences. Since the two halves of (8), taken separately, have only two readings apiece, of which only one is common to both halves, the result of Lakoff's test ought to be either that the only meaning of (8) is the one where the common reading is given to both halves (in which case we could say that there were different meanings for *fly*), or that all readings are possible (in which case the verb *fly* would be simply vague). That is, if *fly* involves true ambiguity, Lakoff's test would predict that the only reading of (8) should be one in which both the bird and the plane flew as cargo to Western Australia. But that is not the only understanding we can get from (8), nor even the dominant one. We can easily understand the sentence to apply to circumstances in which the bird flew by flapping its wings and the plane flew by the power of its engines ((4a) and (4b) respectively). Therefore, the collapsing rule works even when the two senses are different. Then, the test says, the different senses are just manifestations of vagueness. But if that is true, why can't we reverse them, so that (4b) is relevant to the first half of the sentence and (4a) to the second half? Their irreversibility shows that different meanings are involved, and not simply vagueness.

We are not concerned here with the breakdown of Lakoff's test, which has

been remarked on before.² What is interesting for our purposes is that the selection of senses of *fly* seems to depend entirely on what it is that is said to fly. The fact that *the bird flew* and *the plane flew* have different senses is entirely a function of the real-world fact that birds have volition and planes do not. And the fact that both of these have different senses from *John flew* is entirely a function of the real-world fact that people have no motive power of their own capable of propelling them through the air, whereas birds and planes have. And the fact that *the timber flew* differs from all of these is due to the reality that timber lacks both volition and power to fly. We would expect the facts to be the same for all languages, not because of any universal semantic facts, but because of universal pragmatic facts. Note also that *the bird flies* has a dominant reading involving (4a), and a less prominent one involving (4d). This is surely due to the fact that birds in the real world more often fly under the power of their own wings than as cargo on a plane, though the latter does sometimes happen.

We have already remarked on the fact that (8), *The bird flew to Western Australia and so did the plane*, can be understood to apply to circumstances where the bird flew by flapping its wings (using its own volition and power in accordance with 4a) and the plane flew by the power of its engines (using its own power but not its own volition, in accordance with 4b). But although two different senses are involved, it will be noticed that the use of the subject's own power is involved in either case. It is perhaps this common property about the flight that allows a reading of the 'so did X' sentence. Notice what happens in (9):

(9) The bird flew to Western Australia, and so did the timber.

The dominant sense of *the bird flew* in isolation is that of (4a), where volition and power are involved, but the dominant reading of *the timber flew* in isolation is that of (4d), where neither the volition nor the power of the subject is involved. So, as far as volition and power are concerned, no facts are shared by the two sequences. And it seems impossible to get a reading of (9) wherein the bird flew by flapping its wings and the timber flew as cargo on a plane. But if both the bird and the timber are thought of as being cargo on a plane, a possible reading results. I am not sure how to assess these facts. Obviously, there has to be a certain degree of similarity in the manner of flying to allow combinations of this sort, but the degree to which this matter is controlled by linguistic machinery is not clear to me. At least it seems to draw on the pragmatic facts.

As further evidence that pragmatic knowledge is involved in sorting out the senses of *fly*, suppose that we were confronted with a new word that we did not know, in a sentence like (10):

² See, for example, the discussion in Zwicky and Sadock (1975).

(10) The garsh flew to Western Australia.

In order to know which senses of *fly* were relevant, we would not need to know any facts of English grammar, but only what kind of entity (a) *garsh* was. If we were told that it was an animal with wings, we would immediately know that *the garsh flew* could be understood in senses (4a) and (4d), and that (4a) would be the dominant understanding in a sentence out of context, as (10) is. If, on the other hand, we were told that *garsh* was a substance of some sort, we would know that (4d) was the most relevant kind of sense.

3. *TRANSITIVE USES OF THE VERB 'FLY'*. All the examples we have discussed so far have involved intransitive uses of *fly*. Now let us examine some of the transitive uses.

(11) Paul flew the timber to Western Australia.

First, note that only planes or people (not birds or timber) could be the subject of *flew* in such a context, and so senses comparable to (4b) and (4c) would be relevant. But whereas, in the intransitive examples, human beings could have been associated with (4c) as the dominant reading and (4d) as a possible but less prominent reading, (4d) is not a possible sense of *flew* in (11). For instance, Paul cannot be a prisoner on a plane. But, once again, it is a fact about the real world that people cause things to go through the air and that planes do too, but that timber normally doesn't. And it is a fact about the world that when people fly things, they do so to some extent volitionally: they cannot be simply passive. So the facts about the world are sufficient to explain the linguistic restrictions.

But now notice that (11) involves a number of new ambiguities, which would not have been involved in any of the intransitive examples. The sentence could be understood differently in each of the following sets of circumstances:

- (12) a. Paul is the pilot of the plane in which the timber is carried to Western Australia.
 b. Paul is the manager of a timber mill in Victoria, and he consigned the timber to be carried to Western Australia as air freight.
 c. Paul is a resident of Western Australia who does artistic carvings which require a special kind of wood. He makes arrangements for the timber to be flown over to him from Victoria.

That the existence of this range of meanings is due to the choice of the lexical item *flew* becomes clear when we try to substitute other items for it.

- (13) Paul $\left\{ \begin{array}{l} \text{delivered} \\ \text{carried} \\ \text{conveyed} \\ \text{drove} \end{array} \right\}$ the timber to Western Australia. (a)

(14) Paul shipped the timber to Western Australia. (b, c)

(15) Paul $\left\{ \begin{array}{l} \text{forwarded} \\ \text{sent} \\ \text{consigned} \\ \text{despatched} \end{array} \right\}$ the timber to Western Australia. (a, b)

(16) Paul $\left\{ \begin{array}{l} \text{brought} \\ \text{imported} \end{array} \right\}$ the timber to Western Australia. (a, c)

Now consider (17):

(17) Paul flew the plane to Western Australia.

The most prominent meaning of the sentence is that Paul was the pilot of the plane. In (11), although Paul had the role of pilot, he was not the pilot of the timber, but of a plane that was not directly referred to. The meaning of (17) is different, and Paul's role in relation to the object of *flew* is different, too.

Actually, all four readings are possible for (17), if we imagine that a small plane could be carried as cargo on a larger one. If we compare (11) and (17), we see that the difference between having three readings and having four is dependent on what we choose to fly. We see only three readings in (11) because the other sense, which involves being the pilot of what is flown, seems unlikely for timber. And surely the only reason that (17) has one meaning more prominent than the others is that the other three depend on its being carried as cargo, and we tend not to expect that to be as common. It becomes clear, then, that the way we understand any of these sentences depends on what we know about the real-world facts relevant to what is referred to. If something can be piloted, then the most prominent meaning of (17) will apply to it; if it can be carried as cargo, then any of the three meanings of (11) will apply to it. And which meanings are pertinent depends on what we know of the circumstances. Notice that if we were presented with (18):

(18) Paul flew the whim-wham to Western Australia.

in order to know which of the interpretations were relevant, it would suffice if we were told some real-world facts about whim-whams. If it turned out that a whim-wham was a powered vehicle capable of flying, we would know that (18) could be interpreted to mean that Paul piloted it. It is absolutely inconceivable that the linguistic facts about (18) could be contrary to the real-world facts about whim-whams. If it turned out that they were pieces of raw material, then we would know that any of the other three meanings applied to it. It is also worth noticing that in a fairy story, we could interpret (19) as meaning that Paul was piloting the carpet.

(19) Paul flew the carpet to Western Australia.

That is, if we were told as a given fact that carpets had the power to fly, we would interpret accordingly. Furthermore, if someone invented a new form-

of cargo plane which operated without a pilot and was catapulted into the air by an enormous rubber band, which would launch it with sufficient momentum to get it to Western Australia, then if Paul were the person operating the rubber band, (11) could be used without any adjustment being required in English grammar. None of the four supposed meanings of transitive *fly* referred to above would apply to this situation; yet I would claim that the meaning of *fly* has not altered: we have just thought of a different way in which someone could cause something to go through the air with the aid of wings.

4. *THE REPRESENTATION OF MEANING.* The question I want to ask now is: how is just the right range of readings to be associated with a verb like *fly*? In a Generative Semantics system, one possibility would be to have different underlying semantic structures for which to substitute the lexical items when lexical insertion occurs. But if so, there would have to be some careful manipulation of verb and arguments to get just the right combinations for the right readings. In Interpretive Semantics, the lexical entry of *fly* might be shown with different sets of features for its varying uses, to facilitate different operations of the interpretive rules.

But the extent to which the linguistic facts tie up with the real-world facts is rather striking in all the examples we have discussed, with both intransitive and transitive *fly*. In any sentence where there is a human subject followed by *fly* followed by an object, any of the three interpretations listed in (12) will always be possible *a priori*. There is a common core of meaning in the three cases which we can phrase roughly as 'cause to go through the air'. The main difference is in the role assigned to Paul as causer. He can be the pilot of the plane that carried the timber, the despatcher of it, or the orderer of it. Likewise, in the intransitive examples, there is a common core of meaning, 'go through the air', and the main difference in the means of going depends on the real-world facts about the subject of *fly*.

I want to claim, then, that the understanding of sentences of the kind we have been considering will depend in some way on people's knowledge of and beliefs about the real world, with respect to:

- (20) a. The ways in which something can go through the air;
 b. What can cause something to go through the air; and
 c. whether something can be subjected to the kind of manipulation implied by (b).

Suppose that *fly* in its intransitive uses had a central core of meaning 'go through the air' (roughly), and that other aspects of understanding were a matter of pragmatic knowledge of the kind suggested in (20a). Likewise, suppose that *fly* in its transitive uses had a central core of meaning, 'cause to go through the air', and other details were supplied by pragmatic knowledge along the lines of (20b) and (20c). *A priori*, we could say, if we wished, that

a grammar generates all possible readings and that pragmatic knowledge eliminates whichever of them does not apply in a given situation. Alternatively, we could say that all that is generated by the grammar is the central core of meaning, and that pragmatic knowledge fills in the details. I believe that the latter is superior as a way of accounting for the facts. Notice that if we heard sentence (11) and didn't already know which of the potential roles could be played by Paul, and which was most likely, the sentence as spoken wouldn't tell us. All that would actually be conveyed would be the central meaning 'cause to go through the air'. It might be said in reply that it is possible that the sentence conveys the three potential roles for Paul; but if it does, then it conveys useless information, for the hearer must already know them. And, regardless of whether there is a linguistic representation of the three potential roles, it must also be a part of general knowledge that there are various ways in which you can 'cause something to go through the air'.

There has been a tendency for linguists in the not-too-distant past to think that a grammar must associate with lexical items a complete account of the meanings they can have in the language. But this seems to me to be based on a misconception. I would like to explain what I think that misconception is by referring to a difficulty that is encountered by ordinary lexicographers preparing dictionaries for publication and sale to the general public. The definition for the noun *cat* in *The shorter Oxford English dictionary* (Vol. 1, p. 273) begins:

1. A carnivorous quadruped, *Felis domesticus*, which has long been domesticated.

But, as J. R. Hulbert has pointed out (Hulbert 1955), a definition like this could apply equally well to other animals, including the dog, except for the Latin species name, *Felis domesticus*. And, as Hulbert remarks, "to the general reader the Latin means merely that presumably it is the zoological term for cat; so really he has got nothing from the definition" (Hulbert 1955:71.) Hulbert also cites Dr. Johnson as saying that in defining the simplest words it is impossible to avoid the use of more elaborate words. Johnson's solution to the problem of defining *cat* was to say simply 'a familiar domestic animal', and leave it to the reader's already-existing knowledge to identify what was meant.

Now, what this implies is that, at least in some cases, linguistic communication does not involve the wholesale transfer of a total meaning from one human mind to the other, as seems to be often assumed by linguists, but rather an attempt to meet the already-existing knowledge of the recipient, whatever that may be. We can think of the way in which language works to convey meaning not as a wholesale transfer, but rather as an operation on understanding, which attempts to provide hints and links with already-existing knowledge which will result in recognition of what is intended.

5. PRAGMATIC KNOWLEDGE AND SYNTACTIC STRUCTURE.

I want to take a step further now and suggest that knowledge of the real world does more in language than just augment the central core of meaning that we attach to a word. I want to show that it can also predict a number of aspects of sentence structure and grammatical relationships.

Our knowledge of the world tells us that there are certain objects that can go through the air. It also tells us that the ways in which they do this are different, and that the forces that propel them are different. Still, there is something that happens in each of the different cases that is constant. Birds, planes, men and timber may all fly under different disposing conditions, but nevertheless they all fly; that is, they can all go through the air. Normally mountains and rivers do not do this.³

I am making a distinction between the knowledge of the world that tells us that certain things are capable of this kind of action, and the further knowledge that some of them have their own volition and/or power, and that some of them haven't. The distinction is that first kind of knowledge constitutes a concept that is directly associated with the intransitive verb *fly* (is its meaning, in fact), whereas the second kind embraces bits of additional knowledge surrounding this concept. *To fly*, then, is to go through the air, regardless of whose motive power or volition is used.

Now, if we know what kinds of objects can go through the air, and we know what noun phrases refer to such objects, then we know what kinds of noun phrases can be the subject of the intransitive verb *fly*: the two sets are the same. So there is an induction from knowledge about the world⁴ (which provides the membership of the set in the first place) to knowledge about grammar (which tells us that the noun phrases that refer to members in this set can be subjects of the intransitive verb *fly*). Thus selectional restrictions between this verb and its subject noun phrases are a function of our knowledge about the way things are.

Another fact that we know about the world is that sometimes when things go through the air, the power and/or the volition of another entity is responsible for the action. What was part of the fringe knowledge before can now be drawn into the middle so as to form a new, augmented concept: that of X acting in such a way that Y goes through the air. But if we know the set of objects that can be so treated, and we know what noun phrases refer to them, we also know what noun phrases can be the objects of the transitive verb *fly*. The two sets are the same, and again there is an induction from knowledge of facts to knowledge of grammar. It is interesting to compare our knowledge about *fly*

with, say, our knowledge about the action of smiling. We know that it is not possible for individual X to act in such a way that, in the same event, Y smiles. However, it is possible for X to act so that, in the same event, Y flies. There are facts about the world that have linguistic correlates.

I now want to take a rest from flying for a minute, to explicate certain facts about grammatical structure. When I have done that, normal flights will be resumed. Let us call a noun phrase 'endocentric' if the external grammatical relationships for the whole phrase are the same as they would be for a noun that is part of it, if that noun were to occur alone. Thus, for instance, the whole underlined NP in (21) shows the same external number agreement as the single underlined noun in (22).

(21) *Young children* are amusing. (*is amusing)

(22) *Children* are amusing. (*is amusing)

Noun phrases which do not show this parallelism of function between the head noun and the noun phrase as a whole will be called 'exocentric'.

(23) *Building houses* is hard work. (*are hard work)

(24) *Houses* are hard work. (*is hard work)

The number agreement required by the whole underlined NP in (23) is different from that required by its constituent *houses*, when the latter occurs alone.

If we try to expand each of the kinds of noun phrases by adding a determiner that specifies the noun, we reveal a further basic difference in the structures:

(25) *The young children* are amusing. (*is amusing)

(26) *Building the houses* is hard work. (*are hard work)

The difference is that the exocentric NP, (26), contains an internal NP, *the houses*, and it is clear, too, that *houses* in (23) was an internal noun phrase. The endocentric noun phrase (25), however, contains no internal NP. Nor could it, without making the structure become exocentric.

It may be thought that this difference has to do with the fact that we have used a verb, *build*, in the exocentric NP, but not in the endocentric one. But this is not in itself the crucial difference, since we can also have verbs in endocentric NP's:

(27) *Sleeping children* are beautiful. (*is beautiful)

(28) *The sleeping children* are beautiful. (*is beautiful)

(29) *(The) children* are beautiful. (*is beautiful)

It is important to stress that in the examples given, when a verb+ING is inserted externally to an existing noun phrase, the result is an exocentric NP, and when one is inserted internally to the NP, the result is an endocentric NP.

Now a noun phrase that immediately follows a verb is normally called the object of that verb, and it follows from the nature of the structure of endocentric and exocentric NP's that grammatical objects can occur within exocentric ones but not endocentric ones. This has the further consequence that transitive verbs can occur with their objects only in EXOCENTRIC NP's,

³ I ignore here such non-literal expression as *time flies*.

⁴ When I speak of our 'knowledge of the world', it would perhaps be more precise to refer not so much to what we know as to what we think we know about the world.

not in ENDOCENTRIC ones. It is also obvious that if an intransitive verb is one which cannot be immediately followed by a noun phrase, and the sequence V_1+N occurs, that N cannot be analysable as an NP. Insofar as the N is part of an NP, that NP must extend to the left so as to include the V_1 ; for if the NP were entirely to the right of V_1 , it would be in the position of an object. Hence, intransitive verbs can occur ONLY in endocentric NP's, not in exocentric ones (in the way we have described above). If we ask what kinds of noun phrases a given intransitive verb can enter in order to form an endocentric construction, we get the following answer:

(30) Let N_a be the set of noun phrases that can act as subjects of a particular intransitive verb, V_1 . Exclude from the set those that consist only of a proper noun. Call the large residual subset of noun phrases N_b . Then V_1+ING can combine with any member of N_b so as to form an endocentric structure.

Likewise, if we ask what kinds of noun phrases a given transitive verb can combine with to form an exocentric structure, we get the following answer:

(31) Let M be the set of noun phrases that can act as objects of a particular transitive verb, V_t . Then V_t+ING can combine with any member of M so as to form an exocentric structure.

Let us return to the verb *fly*. We are now able to set up chains of implication. Given that our knowledge of the world tells us what objects can go through the air, and given that we know what noun phrases refer to such objects, we automatically know that the latter can be subjects of the intransitive verb *fly*. And given that it is an intransitive verb, we can predict certain endocentric noun phrases that will occur as a result of union between that verb and any member of a large, well-defined subset of the noun phrases. (by virtue of (30) above). In similar fashion, given that our knowledge of the world tells us what kinds of objects can be caused to go through the air, and that we know what noun phrases refer to them, we automatically know that the same set can be objects of the transitive verb *fly*. But then, given that we know that it is a transitive verb, and that we know what noun phrases are associated with it in this way, we can predict certain larger noun phrases formed in exocentric fashion from a union of verb+ING and one of the noun phrases (by virtue of (31) above).

The ambiguity of the famous (32) can therefore be partially explained by the fact that it is susceptible to either the analysis that *flying* is intransitive or the analysis that it is transitive.

(32) Flying planes can be dangerous.

Consequently, either endocentric or exocentric structure can be assigned to the phrase *flying planes*. The difference in number agreement can then be predicted, and becomes overt in (33) and (34).

(33) Flying planes is dangerous.

(34) Flying planes are dangerous.

Furthermore, the different structures predict different semantic relationships between the parts. For instance, the endocentric construction involves the attribute-head relationship, whereas the exocentric one doesn't.

We may sum up what has just been described, by saying that there are chains of implication, leading from knowledge of real-world facts to fairly detailed descriptions of the structure and relationships involved in certain sentences. We may represent the chains of implication as follows:

CHAINS OF IMPLICATION

A.	B.
1. FACT ABOUT THE WORLD: Some objects can go through the air, e.g., birds, planes, timber, people	1. FACT ABOUT THE WORLD: Some objects can be caused to go through the air, e.g., planes, timber, people, birds.
2. NP's REFERRING TO I can be SUBJECTS OF INTRANS. FLY. <i>The bird flew.</i>	2. NP's REFERRING TO I can be OBJECTS OF TRANS. FLY. <i>Paul flew the plane to W. A.</i>
3. Fly+ING can combine with a subset of such NP to form a larger NP with an ENDOCENTRIC STRUCTURE. <i>Flying planes can be dangerous.</i>	3. Fly+ING can combine with such NP to form a larger NP with an EXO- CENTRIC STRUCTURE. <i>Flying planes can be dangerous.</i>
4. An ENDOCENTRIC STRUCTURE ex- hibits the relationship ATTRIBUTE — HEAD	4. An EXOCENTRIC STRUCTURE of this kind exhibits the relationship VERB — OBJECT
5. In an ENDOCENTRIC STRUCTURE, there is number agreement between the HEAD-WORD and the next higher verb. <i>Flying planes are dangerous.</i>	5. In an EXOCENTRIC STRUCTURE, there is number agreement between the structure as a whole and the next higher verb. <i>Flying planes is dangerous.</i>

Thus, given certain facts about the real world, and some implicational generalizations that follow from them, it is possible to predict a number of facts about the grammar of certain sentences. How far such implicational chains can go in describing the relationships between real-world knowledge and language I am not yet sure, but it seems to be a direction worth exploring.

It will be noticed that I have said very little about 'underlying' structures of any kind. I have talked about real-world knowledge and about certain predictions as to surface structure that follow from this, and about certain ways in which sentences will be understood. It is obvious what kind of direction theory would move in if we pushed such thinking to its logical extreme. Whether we ought to push it that far is a matter for future exploration.

REFERENCES

- Bach, E. and R. T. Harms. (eds). 1968. *Universals in linguistic theory*. New York: Holt, Rinehart and Winston.
- Chomsky, N. 1976. *Reflections on language*. London: Temple Smith.
- Cole, P. and J. L. Morgan. (eds). 1975. *Syntax and semantics*. Vol. 3. *Speech acts*. New York: Academic Press.
- Grice, H. P. 1975. "Logic and conversation". In Cole, P. and J. L. Morgan. (eds). 1975. 41-58.
- Hulbert, J. R. 1955. *Dictionaries British and American*. London: André Deutsch.
- Kimball, J. P. (ed.). 1975. *Syntax and semantics*. Vol. 4. New York: Academic Press.
- Lakoff, G. 1970. "A note on vagueness and ambiguity". *Linguistic inquiry* 3, 357-359.
- McCawley, J. D. 1968. "The role of semantics in a grammar". In Bach, E. and R. T. Harms. (eds). 1968. 125-171.
- Onions, C. T. (ed.). 1964³. *The shorter Oxford English dictionary on historical principles*. Oxford: Oxford University Press.
- Sadock, J. M. 1975. *Chapter 1: Background*. Unpublished manuscript.
- Zwicky, A. M. and J. M. Sadock. 1975. "Ambiguity tests and how to fail them". In Kimball, J. P. (ed.). 1975. 1-34.