

CHAPTER 2

Linguistic processing of comparison

Comprehending comparatives

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Comprehending a sentence is a difficult process for the psychologist to account for, if only because the term "comprehension" can mean so many different things. One way to illustrate this variety is to consider someone's understanding of the sentence *John was hit by a train*. To test for his comprehension, we might ask him to answer one of the following questions: (1) "What was the speaker talking about and what was he saying about it?" (2) "What hit John?" or (3) "Is there a word in the sentence that is synonymous with *struck*?" Intuitively, these three questions all require comprehension, but each demands a different sort of knowledge. The first places emphasis on the listener's knowledge of the place of the sentence in ongoing discourse, the second, on his knowledge of paraphrase, and the third, on his semantic knowledge of the individual words of the sentence. Even in this over-simplified example, it seems obvious that comprehension has separate aspects that it might be important to distinguish in a theory of language comprehension.

In the present paper, therefore, we will examine the following proposal: that the several aspects of comprehension alluded to above correspond to several different "levels" identifiable in a transformational grammar of English, levels such as surface structure, deep structure, and lexical structure. In the present paper we will look at this proposal in some detail only for English comparison constructions. These constructions were chosen because the comparative itself is an interesting and important construction, and because much is already known about its linguistic and psychological properties. The conclusions we draw from this examination, however, should be easily generalizable, since the properties of the comparative to be discussed belong not just to the comparative, but to English as a whole.

In English, comparisons can be made in several different ways. First, there are *comparative* constructions, e.g. *John is taller than Peter* and *John is worse than Peter*. Second, there are *equative* constructions, like *John is as tall as Peter* and *John is as bad as Peter*. Third, both of these constructions can be negated, and this results in *negative comparatives*, like *John isn't taller than Peter*, and in *negative equatives*, like *John isn't as tall as Peter*. These comparison constructions can be related to each other in several different ways – for example, whether they have the same theme, whether they have the same presuppositions, or whether they are paraphrases of each other. The strategy here will be to point out their most important linguistic properties one at a time, and then discuss the aspects of comprehension that appear to correspond to these linguistic properties.

Linguistic analyses of comparisons

Surface structure

In English, generally, many choices about the use of one or another of almost equivalent constructions are governed by the discourse into which a sentence is embedded. The worn-out example of the active and passive constructions comes to mind immediately. The active sentence *The train hit the man* is used by a speaker who is talking about a train; for example, we might hear a discourse proceeding, “Yes, I saw the Trans-Europe Express come speeding down the tracks, and the train hit the man”. A passive sentence, on the other hand, allows the speaker to talk about the recipient of the action, e.g. “Yes, I saw a man running across the tracks, and the man was hit by the train”.¹ Although the issue is complex, the first part of the sentence is generally the “theme” – what the sentence is about – and the last part the “rheme” – what is said about the theme (HALLIDAY, 1967). Another example of a merely “stylistic” change in surface structure is the difference between “normal” and preposed subordinate clauses, e.g. *He went out after he ate dinner*, and *After he ate dinner, he went out*. In these cases, the whole first clause appears to function as the theme of the sentence (cf. CLARK and CLARK, 1968; E. CLARK, 1969). Still another example is the difference between, say, *John is the cause of my troubles* and *The cause of my troubles is John*.

¹ Notice, incidentally, that both these examples would in some sense be “better” if the second noun phrase in the second clause was indefinite with *a* replacing *the*; this follows from the notion that the first noun phrase in the second clause, if it has been the topic of conversation, has been mentioned before and must be definite, while the second has not and must normally be indefinite. In this regard, see VENDLER (1967) and WALES (1969).

The theme-rheme distinction is also applicable to comparison constructions. In *John is better than Peter*, the theme is *John*, and the rheme is *is better than Peter*. Without changing meaning, we could as easily say *Peter isn't as good as John* and thereby make *Peter* the theme of the sentence. Thus, our choice of a comparison construction is governed by what preceded it in discourse, as in the two sentences *I saw a boy running down the street, and the boy was faster than a bicycle*, and *I saw a bicycle yesterday, and that bicycle wasn't as fast as a boy running down the street*. Of course, there are other considerations in this choice, but a principal one is theme – what the speaker is talking about.

Comparison constructions have another attribute related to the order in which the terms are mentioned, and that is the concept of zero-point or origin. When we say *John is better than Peter*, we have a reference point in mind – the goodness of *Peter* – and we are comparing *John* to that point, saying that he is above it. The sentence *John is better than Peter*, then, has a temporary zero-point or origin that is used in making this comparison alone. This distinction might be called the variable-origin distinction, with *John* the variable, and *Peter* the origin. Note that the same notion underlies positive and negative comparatives and positive and negative equatives. It also underlies prepositional predicates like *John is above Peter (on the ladder)*, and *The book is on the table*. The choice of one term as the origin, then, also governs which construction may be selected in a discourse. This choice generally places the variable first and the origin second, although not necessarily so, as in the somewhat awkward *Better than Peter is John* and *Above Peter is John*.

Deep structure

The deep structure of comparison constructions has been fairly well established by LEEs (1961), SMITH (1961), CHOMSKY (1965), HUDDLESTON (1967), and DOHERTY and SCHWARTZ (1967) (although cf. CAMPBELL and WALES, 1969). These analyses show that comparative constructions like *John is better than Peter* and equative constructions like *John is as good as Peter* are both derived formally from two base strings, *John be Degree good* and *Peter be good*. These two strings are then conjoined by a series of transformations to form the appropriate comparative or equative construction. That is, when *Degree* is taken to be *more than*, then there is an intermediate form in the derivation something like *John be (more than Peter be good) good*, then *John be more good than Peter*, and finally, *John is better than Peter*. If the tenses of the two strings are different, the second copula cannot be

deleted, e.g. *John is better than Peter was*; and if the two adjectives are different, then neither the second adjective nor the second copula can be deleted, e.g. *John is taller than the desk is high*. Equative constructions are derived with *as-as* in place of *more-than*. Other constructions that are apparently also derived from *John be Degree good* include: *How good is John?*; *John is too good to lose the race*; *John is good enough to win the race*; and *John is so good that he cannot lose*. The latter three sentences are like the comparative in that a complete underlying base string comes to replace the *Degree* of the matrix base string *John be Degree good*.

The first point to be made about this analysis is that, at the level of deep structure, there is no direct relation between, say, *John is better than Peter*, and *Peter is worse than John*. The *better* sentence is derived from *John be good* and *Peter be good*, while the *worse* sentence is derived from *John be bad* and *Peter be bad*. The first might be paraphrased as "John is above Peter in goodness," and the second, as "Peter is above John in badness." Without more information than is given at this level, it is impossible to determine whether or not the *better* sentence means approximately the same thing as the *worse* sentence.

Secondly, this analysis identifies the presuppositions of the comparison constructions. In saying *John is better than Peter*, we presuppose that John and Peter can be judged on a scale of goodness, i.e. both John and Peter have a certain unspecified degree of goodness. Similarly, *Peter is worse than John* presupposes that both can be judged for their badness. The presuppositions of *better* and *worse* sentences are therefore different, unless we can show that judging someone for goodness and for badness are equivalent. There is much evidence to show that goodness and badness scales are *not* equivalent, and we will examine some of that evidence under "Lexical structure". But here, this lack of equivalence can be seen more readily on scales like *rich-poor*. Although it is perfectly acceptable to say that one millionaire is richer than another, or that one beggar is poorer than another, it sounds quite incongruous to say that one millionaire is poorer than another, or that one beggar is richer than another. Why? Because it is incongruous to think of a millionaire as somewhere on the pooriness scale, or a beggar as somewhere on the richness scale (cf. FLORES D'ARCAIS, 1966).

Lexical structure

Even more abstract than deep structure is lexical structure, that part of linguistic theory that accounts for synonymy, antonymy, and other semantic

Psychological evidence

As CHOMSKY has argued in his recent set of essays *Language and Mind* (1968), linguistics is a psychological science: it attempts to account for certain cognitive phenomena just as cognitive psychology does. Linguistics, however, is concerned with an idealized language capacity, while cognitive psychology is concerned generally with other cognitive capacities and processes. In the present paper, however, we are interested in a hybrid case, the comprehension of comparative sentences, which presumably is affected by linguistic as well as other cognitive capacities. What, then, does the linguistic model of the comparative have to do with the comprehension process under study?

The linguistic model is an attempt to account for a relatively restricted type of psychological data. It wants to explain people's ability to judge sentences as acceptable or not, and to account for their knowledge of paraphrase, ambiguity, discourse phenomena, and other important properties of language. In what sense are these linguistic capacities relevant to the process of comprehension? It will be argued in the following discussion that this knowledge about language is essential at certain points in the process of comprehension. Specifically, the surface, deep, and lexical structure of comparatives is knowledge that people must necessarily have before they can carry out certain kinds of comprehension tasks. Because of this, the linguistic theory of comparisons is a subpart of, or an element in, the psychological theory of comprehension of comparison constructions. In what follows, we will examine experimental data from comprehension tasks to see where and how the linguistic theory fits into the psychological theory.

The psychological data to be discussed have been reported elsewhere in much greater detail. One series of experiments (CLARK, 1969a, b, forthcoming; HUTTENLOCHER, 1969) examined the time it took subjects to answer questions about, or carry out instructions given by, comparison sentences. A second experiment (CLARK and CARD, 1969) examined the errors subjects made in trying to remember comparisons.

Surface structure

Linguistic analysis identified the first term of the comparison construction as the theme – what is talked about – and the rest of the comparison as the rheme – what is being said about the theme. In certain psychological tasks, this kind of information takes on primary importance. In instructions, for

instance, it is important to know the theme, for it usually designates the object that the instructions deal with, while the rheme usually indicates what is to be done with that object. The instruction, "*The fork is to be next to the plate*" is normally an instruction to place the fork next to the plate, not to place the plate next to the fork.

Huttenlocher, in a series of important experiments (HUTTENLOCHER and STRAUSS, 1968; HUTTENLOCHER, EISENBERG, and STRAUSS, 1968; cf. also BEM, in press) found that considerations of this sort were essential in children's ability to follow instructions. In attributive sentences, like *The red block is on top of the blue block*, the child was able to place the red block with respect to the blue block quite easily, but he was able to place the blue block with respect to the red block only with difficulty. That is, if he was to manipulate the block referred to by the subject, the instruction was easy to follow; if not, the instruction was difficult. In sentences with an explicit actor, however, the actor was easier to manipulate, even when, as in the passive sentence *The blue car is being pushed by the red car*, the logical subject (*the red car*) was not the theme. Thus, the theme or surface subject is chosen as the thing to be manipulated, except when there is a semantic reason – i.e. when one term refers to animated objects – that overrides this consideration.

Yet, there might be a semantic reason for choosing the subject of attributive sentences as the term to manipulate. As pointed out above, the two terms in *John is above Peter*, as well as in *John is better than Peter*, are asymmetrical: the second, *Peter*, is the zero-point or origin, and the first, *John*, is the "variable" term placed with respect to it. Since the first term has this "variable" interpretation, it is in some sense "animatable" and could well be perceived to be the object the instruction intends to be manipulated, just as the logical subject is in active and passive sentence instructions. So whether we consider the theme-rheme distinction, or the variable-origin distinction, the surface structure of a comparison should be directly implicated in tasks with comparisons as instructions.

Recently, I have given two types of comparison constructions to adult subjects as instructions for a simple task (CLARK, forthcoming). Subjects first read sentences like *The black dot isn't as low as the red dot* and then, with a red pencil, placed a red dot below a black dot already present to the right of the printed sentence. The sentences included the relations *higher than*, *lower than*, *isn't as high as*, *isn't as low as*, *farther left than*, *farther right than*, *isn't as far left as*, and *isn't as far right as*, and they contained either *the red dot* or *the black dot* as grammatical subject. Subjects were timed from when they began reading the sentence to their placing of the red dot. In a

second experiment, the procedure was very similar. Subjects first read sentences with the relations *better than*, *worse than*, *isn't as good as*, or *isn't as bad as*, and then pressed one of two buttons in a vertical arrangement. In this case, the sentence was to describe two things, one better or worse than the other, which were to be thought of as on a vertical axis with the better thing on top. Thus, for *The black dot isn't as good as the red dot*, the subject should place the red dot above the black dot by pressing the top button (to indicate the position of the red dot, as in the previous experiment). These subjects also were timed from the presentation of the sentence to their press of a button.

The results of these experiments confirm that in carrying out instructions, people can manipulate the subject of comparison constructions more easily than the predicate term. The mean time for correct responses was significantly lower for *the red dot* in the subject position for both the positive comparative and negative equative constructions. Similarly, the mean number of errors was significantly less on both kinds of comparison constructions when *the red dot* was in the subject position. (In these experiments, subjects were instructed to make as few errors as possible so that their reaction times would not be affected by a reaction-time vs. error trade-off; subjects with more than 12% errors were therefore not included in the reaction time analysis – most subjects had far fewer errors – although every subject was included in the error analysis.) The two important aspects of these results are that: (1) the results are the same as Huttenlocher's earlier result for attributive sentences, and (2) the subject position was easier to manipulate no matter whether the construction was a positive comparative or negative equative. As will be seen, this second result is quite different from results in a different kind of comprehension task.

A second psychological task in which theme takes on particular importance is the memory task, in which it is assumed that a person must comprehend a sentence before he can remember it. In such a task, a person is attempting to remember a previously presented sentence, and in doing so, he should quite naturally attempt to recall, among other things, what the sentence was about – that is, the theme. This expectation was nicely confirmed in a recent experiment (CLARK and CARD, 1969) in which people were required to recall comparison sentences of all types a minute or so after they were presented. One result was that the first term of a comparison was recalled correctly more often than the second term, and this was independent of whether the two terms were recalled in the correct or reversed order. That is, it appeared that people recalled the theme better just because they were attempting to

remember what the sentence was about and because that information was to be found in the theme of the sentence. Similar results have been found in the recall of active and passive sentences (cf. especially, ANDERSON, 1963; TURNER and ROMMETVEIT, 1968), so the superior recall of theme in comparison constructions is not an isolated fact.

Deep structure

Information about deep structure of a sentence should become important in tasks where the interpretation of the sentence is a necessity. One kind of task for which this is true is the simple reasoning task in which people are required to answer questions like *If John isn't as good as Peter, then who is best?* as quickly as they can.

To account for the role deep structure should play in such a reasoning task, however, we need a theory of question answering. A first step in this direction is contained in what has been called the principle of congruence (CLARK, 1969a), which makes certain assumptions about this process. First, it is assumed that people store the deep structure information from the proposition (*John isn't as good as Peter*) and from the question (*who is best?*), then search the proposition's deep structure for information congruent with that of the question. When such information is found, the answer is produced; when it is not found, the question must be reformulated, and the search must be carried out again.

Consider the above problem. The deep structure of the proposition contains (*John be good; Peter be good*), and that of the question contains (*X be good*); this notation, of course, does not characterize the second order comparative information, but that is irrelevant for the present purposes. Here, the deep structure of the question is congruent with that of the proposition, so the answer is directly forthcoming. But, if the question had been *who is worst?* (= *X be bad*) instead, there would be no deep structure congruence – because of the mismatch of *good* in the proposition with *bad* in the question –, so the initial search would fail. Only after reformulating the question, implicitly, as *Who is least good* (= *X be good*) is it possible to find congruence and produce an answer. Thus, the problem, *If John isn't as good as Peter, then who is best?* is an internally congruent one, while the problem *If John isn't as good as Peter, then who is worst?* is not. It was found that in a variety of problems of this kind – with both positive comparative and negative equative propositions – deep structure congruence led to significantly faster

solution times (CLARK, 1969a). The same result also held for the much more complicated set of 64 so-called three-term series problems (e.g. *If John isn't as good as Peter, and Dick isn't as bad as Peter, then who is best?*; CLARK, 1969a, b).

It is here that we can contrast the demands made by the instructional and question-answering tasks. In the instructional task, it was easier to manipulate the first term in a comparison, no matter whether it was the *A* in *A is better than B* or the *B* in *B isn't as good as A*. In the question-answering task, in contrast, it was easier to answer with the first term in positive comparatives (the *A* in *A is better than B*), but with the second term in negative equatives (the *A* in *B isn't as good as A*). This difference might be characterized as follows: When the subject asks, implicitly, "Which term is to be manipulated?", he always tries to answer it with the first term, utilizing information about the thematic properties of surface structure; but when he asks "Which is best?" or "Which is worst?", he always tries to answer it with the term congruent in deep structure with the question. These two different strategies, then, produce contrasting results. This is not to say that deep structure differences play no role in instructional tasks which obviously require interpretation of an instruction – for they do, as will be seen later on. It is rather that theme-rheme or variable-origin differences play very little if any role in question-answering tasks in which thematic or zero-point information is of little use.

Since interpretation is also of primary importance in remembering a sentence, deep structure should be essential in memory tasks as well. This is demonstrated for comparatives in the memory study (CLARK and CARD, 1969) in which people tried to recall, after a minute or so, comparison constructions of all types. The results of this study make it clear that people store the deep structure base strings of comparison constructions relatively independently of other information contained in the comparison. For example, the sentence *The boy is better than the girl* was often recalled as *The boy isn't as good as the girl* or as *The girl is as good as the boy*, and so on. In each of these cases, the subject has correctly remembered the base strings, *The boy be good* and *The girl be good*, but has made errors in the relative position of the boy and the girl on the goodness scale. The complement to this observation is that subjects rarely recalled *The boy is better than the girl* as *The girl is worse than the boy*, or as *The boy isn't as bad as the girl*, or as some other sentence in which the relative goodness is remembered, but in which the base strings, *The boy be good* and *The girl be good*, are changed to *The boy be bad* and *The girl be bad*. Deep structure information was there-

fore well recalled, especially relative to this kind of full or partial synonymy criterion.

Lexical structure

Certain "positive" adjectives, like *good*, were shown to have a simpler semantic structure than their "negative" counterparts, like *bad*, and so it has been hypothesized (CLARK, 1969a) that the comprehension and retrieval of these positive adjectives should take less time than that of negative adjectives.

Experimental evidence clearly confirms this hypothesis about the effects of lexical structure. In CLARK (1969a, b), it was found that deductive reasoning problems containing only *is better than* or *isn't as good as* were solved significantly more quickly than those containing only *is worse than* or *isn't as bad as*. This was also true in the instructional task (CLARK, forthcoming): instructions containing *higher than*, *better than*, *isn't as high as*, or *isn't as good as* were followed more quickly than instructions containing their opposites. A search through the previous literature for three-term series problems turned up much additional confirming evidence. Problems containing *better*, *warmer*, *taller*, *faster*, *farther*, *higher*, *older*, *deeper*, *happier*, and *more* were solved more easily than those with their antonyms (cf. CLARK, 1969a, p. 398). These same results, of course, also show that differences merely in the deep structure presuppositions of comparisons result in differences in solution time, and in this sense, the results also confirm that knowledge of deep structure affects comprehension.

A second hypothesis based on the lexical structure of antonyms is that the negative adjectives of comparison constructions should be stored in memory in a more complex form than their positive antonyms and should therefore lose their complexity over time and be recalled as their positive counterparts (CLARK and CARD, 1969). Evidence confirming this hypothesis was found in the study on the memory for comparison constructions (CLARK and CARD, 1969). The subjects in that experiment only rarely forgot the deep structure base strings of a comparison (e.g. *John be bad* and *Peter be bad*, from *John isn't as bad as Peter*), but when they did make errors on this feature, they were more likely to make negative to positive errors – i.e. *bad* to *good* errors – than errors in the negative direction. The tendency for negative or marked adjectives to lose their negative feature has also been noticed by GREENBERG (1966) and MARSHALL (1969) in free association data,

where the negative adjectives elicit their positive counterparts more often than the reverse.

In sum, the fact that there are asymmetries in the semantic properties of certain English antonyms has its counterpart in certain asymmetries in comprehension and memory. This parallel is not too surprising, when one considers that the semantic analyses of antonyms account for adjectival properties that are immediate prerequisites to comprehension. For example, knowledge that *good* and *bad* are antonyms is fundamental to the comprehension and solution of problems like "If John isn't as good as Peter, then who is worst?" The solution of "If John isn't as good as Peter, then who is shortest?", for example, is indeterminate just because there is no direct semantic connection between *good* and *short*.

Concluding remarks

We have considered three "levels" in the linguistic analysis of English comparison constructions – surface, deep, and lexical structure – and have shown how they correspond to certain results in a variety of comprehension tasks. The point that has been emphasized is that these three levels are not equally relevant in all aspects of comprehension, for each particular task will demand one type of comprehended information more than another.

The relation between the linguistic levels and the prerequisites of certain comprehension tasks can be recounted briefly. First, the surface structure differences among comparison constructions are chiefly ones of theme versus rheme, and of variable versus origin, and are closely related to the speaker's choice of what he is talking about and what he is saying about. Theme is important particularly in instructions, where it helps for the listener to know what the speaker means to be manipulated, for that object is usually indicated in attributive sentences like the comparative by the speaker's choice of theme. Theme should also be important in attempts to remember sentences, for there the listener is trying to recall what was said, and one method for doing this is to try to remember what the speaker was talking about (the theme) and then to reconstruct what he said about the theme. In both the following of instructions and the remembering of sentences, then, the comprehension and use of thematic information is basic, so linguistic facts about theme should be necessary for a full account of this aspect of comprehension.

Second, the deep structure of comparisons indicates that certain sets are similar to each other in their presuppositions: sentences containing *better*

than, *as good as*, and *best* all have similar presuppositions, and they differ from those containing *worse than*, *as bad as*, and *worst*, which also have similar presuppositions. When we assume that two sentences with the same presuppositions are more comparable than two without, we can show that certain question-answering tasks should be easy and others difficult. Also, we expect that one comparison construction should often be reconstructed from memory in place of another with the same presuppositions. Both these predictions are upheld in the appropriate psychological tasks.

Third, semantic structure should have noticeable consequences in tasks where knowledge of the lexicon is prerequisite for carrying out the task. The asymmetry of positive and negative adjectives was shown to affect the processes of following instructions and deductive reasoning, tasks which cannot be accomplished without knowledge of the meaning of comparative adjectives. The asymmetry was also found in a memory task in which subjects were apparently attempting to reconstruct a sentence from what they could remember of its meaning and therefore consistently made errors that were semantic simplifications of the sentences they were presented.

In the present paper, I have only sketched out a general account of the comprehension of comparatives, and have not covered certain important comprehension phenomena (cf. CLARK, 1969a; CLARK and CARD, 1969; FLORES D'ARCAIS, this volume; HUTTENLOCHER, 1969). Much more work is necessary before this sketch can be filled out in detail. One stumbling block at the present time is that too little is known about the demands different psychological tasks place on people. It seems clear in general that different tasks emphasize different linguistic abilities, but these demands need to be specified in much greater detail. Another stumbling block is that we know far too little about the relationship between knowledge about language and psycholinguistic processes like those in comprehension. Linguistics claims to account only for language knowledge or competence, not for the active psychological processes pertaining to language. But in the present paper, it has been proposed that aspects of this competence, when they are essential for comprehension, must play a part in the comprehension process. Knowledge is necessary for thought. But, along with others before me (cf. especially, FODOR and GARRETT, 1966; WATT, 1970), I have only pointed out that such competence must play a part and, in some cases, where it does so. I have said almost nothing about *how* it does so. It is to be hoped that these stumbling blocks are not insuperable, and that future work can fill out the present sketch to achieve a single harmonious picture of comprehension.

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