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SEMANTIC DISTINCTIONS AND MEMORY FOR COMPLEX SENTENCES

BY

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This investigation studied what people remember in recalling complex sentences, whether it is certain semantic distinctions or merely transformational markers. After short intervals 24 subjects tried to recall sentences of six kinds which formed paraphrase sets: S_1 *before* S_2, S_1 *and then* S_2, *After* S_1 S_2, S_2 *after* S_1, S_2 *but first* S_1, and *Before* S_2 S_1. (S_1 and S_2 denote first and second clauses in temporal, not linguistic, order.) Subjects remembered the underlying sense of sentences with S_1–S_2 clause ordering better than those with S_2–S_1 clause ordering, regardless of transformational complexity. Subjects also showed a response bias, hence better verbatim recall, for sentences with subordinate clause second and for sentences with S_1–S_2 clause ordering. Sentence confusions indicated that subjects remembered three semantic distinctions: the temporal order, order of mention, and main-subordinate relation of the two described events. A theory of memory for marked and unmarked semantic distinctions was used to account for the results.

INTRODUCTION

What do people remember when they remember sentences? It is a common observation that people, when asked to remember a sentence verbatim, often err by recalling a paraphrase of that sentence. Mehler's (1963) subjects, for example, often confused active and passive sentences in recall, but did remember the underlying sense of the sentences. Miller's (1962), and Mehler's (1963), answer to the above question was that subjects remember the underlying kernel string and transformation markers of a sentence independently, and that they are very likely to forget the markers alone. Fillenbaum's (1966) subjects, on the other hand, made lexical, not transformational, mistakes while preserving the underlying sense. They replaced *not open* with *closed*, *dead* with *not alive*, and so on. As Fillenbaum argued, people seem to retain semantic information which is not bound to the linguistic form in which it was originally expressed (cf. Sachs, 1967).

The purpose of the present study was to show that memory for sentences has a semantic, rather than a syntactic, basis. Transformational changes, which previous investigators have studied, also entail semantic changes (Katz and Postal, 1964). Do people remember the transformational markers, then, or their correlated semantic distinctions? Actives and passives, for instance, are used in distinct ways, even though in the most general sense they are synonymous: speakers place what they are talking about at the time as the grammatical subject in both actives and passives (Clark, 1965; Halliday, 1967*a*, 1967*b*; Johnson-Laird, 1968). To illustrate, Morton (1966) has pointed out that

I saw the house. The house was built by the man.

and

I saw the man. The man built the house.

are both natural two-sentence sequences, although

I saw the house. The man built the house.

and

I saw the man. The house was built by the man.

both seem somewhat odd. The first sentence in each pair introduces what the reader

expects to be the "theme" of the second sentence, but in the second two sequences the subject of the second sentence does not fulfil expectations. Thus subjects recalling a passive sentence might remember the semantic information that it was the recipient of the action that was talked about and not the actor, and this information would lead them to reconstruct a passive sentence. Because transformations generally entail semantic changes (e.g. questioning, negation, changes in emphasis, etc.), the experiments of Mehler (1963), Miller and McKean (1964), Gough (1965), Savin and Perchonock (1965), and others are difficult to interpret in strictly syntactic terms.

To demonstrate that people remember semantic distinctions that are not correlated with transformational changes, we chose sentences which contain a main clause and a subordinate clause (using *before* or *after*) and which describe two temporally ordered events. These sentences were selected because of two observations the second author had made in her study of the spontaneous speech of $3\frac{1}{2}$-year-old Scots children (attending the nursery school of the SSRC Cognition Project, University of Edinburgh). First, in describing two related events with two clauses, the children linked the two clauses by intonation and almost always placed them in chronological order. This they did before—and after—they began to mark co-ordinate and subordinate clauses with the appropriate conjunctions. Second, the children at first almost always placed subordinate clauses after the main clauses. These two facts, taken as organizing principles, can be independently manipulated in sentences with *before-* and *after-*clauses. Sentences with *after*-clauses first and *before*-clauses second satisfy the first principle—that events are mentioned in chronological order; but sentences with *before*-clauses first and *after*-clauses second fail to do so.

The opposition of the two principles in *before-* and *after*-clauses allows the experimental verification of a semantic explanation of memory. If the first principle is assumed to be basic to memory, then sentences with *before*-clauses second and *after-*clauses first should be easier to remember than their alternatives. If the second principle of subordinate clause ordering is assumed to be basic to memory, then sentences with *before-* and *after*-clauses second should be easier to remember. Evidence for the second principle alone would support Miller's (1962) transformational complexity model, since a complex sentence with subordinate clause first is presumably the transformation of a complex sentence with the same subordinate clause second. Evidence for both principles, however, would support the semantic explanation of memory as the most general explanation.

Method

Sentences. Sets of six paraphrases, six synonymous complex sentences, were constructed from pairs of simple sentences. To illustrate, the two simple sentences, *The boy tooted the horn* and *The boy swiped the cabbages*, formed the basis of the following paraphrase set:

(1) S_1 *before* S_2: *He tooted the horn before he swiped the cabbages.*
(2) S_1 *and then* S_2: *He tooted the horn and then he swiped the cabbages.*
(3) *After* S_1 S_2: *After he tooted the horn he swiped the cabbages.*
(4) S_2 *after* S_1: *He swiped the cabbages after he tooted the horn.*
(5) S_2 *but first* S_1: *He swiped the cabbages but first he tooted the horn.*
(6) *Before* S_2 S_1: *Before he swiped the cabbages he tooted the horn.*

In the notation designating the linguistic form of the paraphrases, S_1 and S_2 refer to the first and second clauses in temporal, and not linguistic, order. In the first three sentences, S_1 precedes S_2 in the linguistic order, and in the last three S_1 follows S_2.

A total of 432 complex sentences, constituting 72 such paraphrase sets, were constructed from 72 pairs of simple sentences of the form, *The boy tooted the horn*, that is, sentences with transitive, past-tense verbs and simple subjects and objects preceded by *the*. The subjects of both simple sentences used to construct each paraphrase set were the same and were replaced in every complex sentence by the appropriate pronoun. The common subject was used as a noun cue for each complex sentence. Subjects were therefore presented with a noun cue and complex sentence, such as,

The boy. After he tooted the horn he swiped the cabbages.

and were later given the noun cue alone and required to reproduce the sentence. The same noun cue was used for no more than two paraphrase sets. The simple sentences, all different from each other, had been randomly selected from sentences other subjects had composed for Clark (1965). The two simple sentences of each paraphrase set were assigned their temporal order randomly.

The use of noun cues as prompts has several advantages. First, it is natural. In everyday conversation one might ask someone, "What was it you just said about the boy?"; but one would be unlikely to ask, "What was it you said just after you had said the word *after*?" or some other question based on syntactic information. Second, the use of noun cues does not bias the results towards either the syntactic or the semantic explanation of memory. The cues, on any prior grounds, do not predispose subjects to use any of the six syntactic forms more often than any other, for the cues elicit both clauses of each sentence equally and give no indication of the subordinate conjunction or its placement. The important result, according to both syntactic and semantic explanations, is how often each of the six forms is misrecalled as one of the others; the two explanations differ only as to which confusions they predict. It is equally possible, therefore, for the confusions to support either explanation.

Procedure. For study, each subject was given a deck of IBM cards containing 72 pairs of noun cues and sentences, one from each paraphrase set. The 72 cards of paired cues and sentences were divided into 12 blocks of six with blank divider cards. For recall, each subject was also given a second deck of IBM cards which was identical to the first except that it contained only the noun cues. The subject was to write in the missing sentences beside the appropriate noun cues.

After an oral signal, each subject studied the first noun cue and sentence for 10 sec. at a second signal he turned over that card and studied the second pair for 10 sec.; he continued in this manner through the sixth pair. He then turned to the first card in the deck with the noun cues alone, and attempted to recall the appropriate sentence for the first noun cue. After success or failure on the first cue, he proceeded at his own pace (without intervention from the experimenter) to the second cue, third cue, and so on, through the sixth cue. After the sixth recall, he waited for the experimenter to signal him to study the first pair of noun cues and sentences in the second block. Then the procedure was continued as before.

Twenty-four subjects, all introductory psychology students at Carnegie-Mellon University fulfilling a course requirement, were run in groups of six. They were told that this was an experiment designed to study their memory for sentences. It was stressed that they should try to remember the sentences verbatim, and if they could not remember all of a sentence they should write down as much of it as they could remember. They were given an example of a card with the noun cue and its associated sentence printed on it, and a demonstration of the experimental procedure. The sessions lasted about 45 min.

Experimental design. The sentences were presented in a carefully counter-balanced design to free the data from all important position and sequence effects. The aims of this design were (*a*) to present a subject with six sentences, one in each of the six forms in an unpredictable order, in each block of sentences he received; and (*b*) to present each of the six sentences of one paraphrase set to a different subject but in the same position within the same block. Thus instances from the 72 paraphrase sets, and hence the noun cues, were ordered in the same way for all subjects. This order was constrained so that a noun cue occurred only once within any block of six successive cards. To accomplish the counterbalancing, six study decks of 72 paired noun cues and sentences were constructed with the following two properties: (*a*) Within the first (and each successive) block of six IBM cards of each deck, a 6×6 Latin square was formed from the six linguistic forms, the six positions (within the block), and the six decks. (*b*) Within the first six blocks and the last six blocks in each deck, another 6×6 Latin square was formed from the six linguistic forms, the six positions within each block, and the six blocks. The subjects were not told of these constraints, and there was no evidence that they perceived any of them. Each of the six study decks was given to four subjects.

RESULTS

The main results are shown in the matrix of confusions in Table I. The head of each column gives the form with which subjects were presented, and the head of each row gives the linguistic form of their responses. Recalled sentences were tallied when

their linguistic form was recognizable (*then* and *and* alone were counted as the conjunction *and then*) and when at least one of the two clauses was partly correct. This method of scoring was used since the temporal order and order of mention of two events were of greatest interest and since most verbatim errors within clauses resulted from substitution of synonyms for single words. Approximatly one third of the recalled sentences in the first twelve rows of Table I contained at least one lexical error, but the matrix of confusions for the errorless sentences closely matches the matrix shown.

TABLE I

CONFUSIONS AMONG SIX LINGUISTIC FORMS

Sentence recalled		*Sentence presented* (1)	(2)	(3)	(4)	(5)	(6)	Subtotals
Temporally correct	(1) S_1 before S_2	170	52	36	11	8	41	318
	(2) S_1 and then S_2	34	134	95	11	7	9	290
	(3) After S_1 S_2	23	40	83	10	1	9	166
	(4) S_2 after S_1	6	5	15	155	66	60	307
	(5) S_2 but first S_1	0	1	0	5	83	17	106
	(6) Before S_2 S_1	1	0	1	8	14	52	76
	Subtotals	234	232	230	200	179	188	1,263
Temporally incorrect	(1′) S_2 before S_1	3	4	3	23	30	29	92
	(2′) S_2 and then S_1	1	3	5	14	20	12	55
	(3′) After S_2 S_1	0	1	1	11	8	13	34
	(4′) S_1 after S_2	11	8	6	6	3	3	37
	(5′) S_1 but first S_2	3	2	3	3	4	2	17
	(6′) Before S_1 S_2	3	4	2	0	3	1	13
	Subtotals	21	22	20	57	68	60	248
	Blanks	15	12	22	10	17	20	96
	Miscellaneous	18	22	16	21	24	20	121
	Totals	288	288	288	288	288	288	1,728

The responses in the first six rows of Table I are synonymous with the presented sentences. Those in the second six rows have errors in temporal order in that they describe the two events as happening in reverse of the presented sentences. In the first three rows the responses have an S_1–S_2 clause order; in the next three rows they have an S_2–S_1 clause order.

A semantic explanation of memory was clearly supported by the data. Subjects remembered the underlying sense of S_1–S_2 sentences more often than of S_2–S_1 sentences, regardless of the linguistic form of the sentences. This effect is seen in the column subtotals for the first six rows in Table I; the subtotals 234, 232, and 230 for S_1–S_2 sentences are consistently larger than 200, 179, and 188 for the S_2–S_1 sentences. By an analysis of variance, these six subtotals differed significantly, both with the subjects as the sampling variable ($F = 9{\cdot}63$, $d.f. = 5, 115$, $p < 0{\cdot}001$) and with paraphrase sets as the sampling variable ($F = 12{\cdot}32$, $d.f. = 5, 355$, $p < 0{\cdot}001$). By Duncan's multiple range test, each of the S_1–S_2 sentences was significantly better remembered at $p < 0{\cdot}01$ than each of the S_2–S_1 sentences.

Not only did subjects remember the underlying sense of S_1–S_2 sentences more often, but they made fewer errors of temporal order for S_1–S_2 sentences. This complementary effect is seen in the column subtotals for the second six rows; the subtotals 21, 22, and 20 are consistently smaller than 57, 68, and 60. On the other hand, the sums

of the two subtotals in each column are approximately equal; i.e. subjects recalled at least part of the presented sentence equally well for the six linguistic forms. Therefore, subjects remembered the sense of S_2–S_1 sentences less often, not because they remembered fewer S_2–S_1 sentence fragments altogether, but because they made errors in the temporal order of the two events.

Two distinct response biases were found in recall—one towards S_1–S_2 sentences and the other towards sentences with subordinate clause second. The linguistic forms subjects preferred as responses are indicated in the row subtotals (the last column) in Table I. By a Friedman two-way analysis of variance by subjects, the first six row subtotals differ significantly ($\chi^3 = 58{\cdot}06$, $d.f. = 5$, $p < 0{\cdot}001$). First, subjects preferred S_1–S_2 sentences over S_2–S_1 sentences: they produced S_1 *before* S_2 more often than S_2 *after* S_1; *After* S_1 S_2 more often than *Before* S_2 S_1; and S_1 *and then* S_2 more often than S_2 *but first* S_1 (the second two differences are significant at $p < 0{\cdot}005$ by a sign test). Second, subjects preferred sentences with subordinate clause second over sentences with subordinate clause first: the differences between the two sentences with *before*-clauses and between the two with *after*-clauses were both significant (at $p < 0{\cdot}005$ by a sign test).

The sentences subjects recalled in literally correct form directly reflected this response bias. They recalled more S_1–S_2 sentences than S_2–S_1 sentences, and more sentences with subordinate clause second than sentences with subordinate clause first. The tally of literally correct recalls is found in the diagonal of the first six rows in Table I. By analysis of variance by subjects, these diagonal entries differed significantly ($F = 16{\cdot}69$, $d.f. = 5, 115$, $p < 0{\cdot}001$), and by Duncan's multiple range test, they fell into two groups: S_1 *before* S_2, S_2 *after* S_1, and S_1 *and then* S_2 were each significantly better recalled at ($p < 0{\cdot}01$) than each of the others.

So far we have discussed two effects, those of S_1–S_2 clause ordering and main-subordinate clause ordering. A third effect, immediately clear in the confusions in Table I, is the effect of order of mention. After two events were mentioned in a particular order in a presented sentence, they tended to be recalled in that same order in the recalled sentence. For example, the first three columns represent S_1–S_2 sentences, i.e. sentences in which S_1 was mentioned before S_2. The predominant confusions for such sentences were with other S_1–S_2 sentences, even when a temporal error had been made. Likewise, S_2–S_1 sentences were predominantly confused with other S_2–S_1 sentences.

Discussion

To review the main findings: subjects were better able to remember the sense of S_1–S_2 sentences than of S_2–S_1 sentences. Their accuracy for sense was not related to transformational complexity. Their preferences for mode of response, however, were. In expressing what they remembered, subjects showed a bias towards sentences with subordinate clause second, but also towards S_1–S_2 sentences. Their literally correct recalls—as opposed to their sense-preserving responses—were in direct agreement with this response bias. Furthermore, subjects often remembered only the order of mention of two events, confusing the S_1–S_2 sentences with each other and the S_2–S_1 sentences with each other.

The theory that subjects remember kernels plus transformation markers (Miller, 1962) cannot account for the present results. It does not predict the subjects' superior memory for S_1–S_2 sentences over S_2–S_1 sentences or their memory for order of mention of two events, although it does predict their superior memory for sentences with subordinate clause second (if these sentences are assumed to be transformationally simpler than sentences with subordinate clause first). It will be shown that this

latter finding can be included within a more general theory of memory for semantic distinctions, a theory which also predicts the first two findings.

The theory we propose to account for these data rests on the concept of marked and unmarked semantic distinctions. Many semantic features, such as the singular-plural feature in English, consist of two forms—the syntactically simpler, unmarked form, and the more complex, marked form. Singular nouns are unmarked, while plural nouns are marked, usually by an added *s* (see Greenberg, 1966). Analogously, semantic distinctions in sentences can be marked or unmarked. The semantic-distinction theory states that: (*a*) in reading sentences, subjects extract as objects of memory certain semantic distinctions; (*b*) subjects suffer memory loss by forgetting that a distinction was marked or, less often, unmarked, or by forgetting particular distinctions altogether; and (*c*) when attempting to recall earlier material, subjects reconstruct sentences based on the semantic distinctions they remember.

Thus subjects can forget two things—the marking of a distinction, or the distinction itself. They will forget that a distinction was marked, however, more readily than that it was unmarked. To illustrate, subjects might be presented with *open* and *not closed* to recall under appropriate circumstances. We assume that forms with *not* are marked, and those without are unmarked. At times subjects would forget the open-closed distinction, and recall *not open* or *closed* instead of the presented words. But in making errors of marking, they would recall *not open* as *closed* more often than *closed* as *not open*. This asymmetry is indicated in Table II, a hypothetical matrix of confusions for marked and unmarked forms. If the two forms were confused with each other equally, the matrix would have equal diagonal and equal off-diagonal entries. A marked form, however, is mistakenly recalled as an unmarked form more often than the reverse. Compared to a symmetric matrix, the upper right cell is increased and the lower right cell decreased by these asymmetric marking errors. This effect will also produce an apparent response bias towards the unmarked form, as seen in the row totals (see also Marshall, in press).

TABLE II

HYPOTHETICAL CONFUSION MATRIX OF MARKED AND UNMARKED FORMS

		Presented form	
		Unmarked	*Marked*
Recalled form ..	Unmarked ..	highest	third highest
	Marked ..	lowest	second highest

In the present experiment there seemed to be three main semantic distinctions subjects extracted for memory: the temporal order, order of mention, and main-subordinate relation of the two described events. The three distinctions are made of the events themselves and can be independently realized in the six linguistic forms. In *Before he swiped the cabbages he tooted the horn*, the tooting happened first and the theft second, in temporal order. But the theft was mentioned first and the tooting second, in order of mention. Furthermore, the tooting in the main clause was fixed in time and the theft in the subordinate clause was placed in time relative to the tooting. The last distinction is the main-subordinate relation of the events. The three distinctions were important to the present subjects, since they preserved each of them, respectively, in 84, 88, and 74 per cent. of their responses (excluding blanks and miscellaneous responses).

Of the three distinctions, two occur in marked and unmarked form; each marking serves to relate one distinction to another. Order of mention can be marked. Usually,

order of mention indicates temporal order directly. It becomes marked when something in the sentence indicates that the event mentioned first actually occurred *after* the event mentioned second. In the above example, the tooting happened before the theft, but was mentioned after the theft. Thus the sentence is marked for order of mention, as are all S_2–S_1 sentences. The main-subordinate relation can also be marked. The usual unmarked form is with the main event mentioned first. The distinction is marked in sentences which mention the subordinated event first, as in the above example and all other sentences with subordinate clause first. Marking for order of mention indicates a specific interaction between order of mention and temporal order, whereas marking for main-subordinate relation indicates an interaction between main-subordinate relation and order of mention. The six presented sentences are given in Table III with their appropriate markings.

TABLE III

MARKED AND UNMARKED SEMANTIC DISTINCTIONS

Linguistic forms	*Semantic distinctions*	
	Order of mention	*Main-subordinate relation*
(1) S_1 before S_2	unmarked	unmarked
(2) S_1 and then S_2	unmarked	(unmarked)
(3) After S_1 S_2	unmarked	marked
(4) S_2 after S_1	marked	unmarked
(5) S_2 but first S_1	marked	(unmarked)
(6) Before S_2 S_1	marked	marked

The theory proposed here fits the data well if we assume these three distinctions, two of which can be marked. Order of mention will be considered first. Table IV gives a classification of order of mention errors in a confusion matrix. The upper half-matrix resembles the hypothesized configuration in Table II, as it should. The lower half-matrix, containing temporal errors too, must be considered separately. If subjects had made symmetrical marking errors, this half-matrix also should be symmetrical about its main diagonal. But some subjects must have remembered order of mention while forgetting temporal order. When presented S_2–S_1 sentences, such

TABLE IV

MATRIX OF CONFUSIONS BETWEEN S_1–S_2 AND S_2–S_1 SENTENCES

Recalled form		*Presented form* S_1–S_2 *Sentences (unmarked)*	*Presented form* S_2–S_1 *Sentences (marked)*	*Totals*
	S_1–S_2 Sentences (unmarked)	667	107	874
Temporally correct	S_2–S_1 Sentences (marked)	29	460	489
	Subtotals	696	567	1,263
	S_2–S_1 Sentences (unmarked)	21	160	181
Temporally incorrect	S_1–S_2 Sentences (marked)	42	25	67
	Subtotals	63	185	248

subjects had their choice of recalling a marked temporally correct sentence (the cell with 460) or an unmarked temporally incorrect sentence (the cell with 160). Most subjects, preferring the unmarked form, chose the latter temporally incorrect sentences. When presented S_1–S_2 sentences, however, such subjects had to choose between an unmarked temporally correct sentence (the cell with 667) and a marked temporally incorrect sentence (the cell with 42). Again most of them chose the unmarked form, increasing the number of temporally correct responses. The cell with 160 had been inflated, and the cell with 42 deflated, because of memory errors towards the unmarked form. This reasoning would explain the important finding that subjects remembered the underlying sense of S_1–S_2 sentences more often than of S_2–S_1 sentences.

TABLE V

MATRIX OF CONFUSIONS BETWEEN SENTENCES WITH SUBORDINATE CLAUSE SECOND AND SENTENCES WITH SUBORDINATE CLAUSE FIRST

Recalled form		*Presented form* *Main-subordinate order (unmarked)*	*Subordinate-main order (marked)*	*Totals*
Without order of mention errors	Main-subordinate order (unmarked)	359	131	490
	Subordinate-main order (marked)	45	150	195
	Subtotals	404	281	685
With order of mention errors	Main-subordinate order (unmarked)	26	66	92
	Subordinate-main order (marked)	11	12	23
	Subtotals	37	78	115

The main-subordinate relation, with its errors and errors of marking, produces a matrix of confusions (Table V) very similar to that of order of mention. (The two co-ordinate sentences are disregarded for the moment.) The upper half of the matrix is as predicted. The lower half is explained with the same reasoning as before. That is, when subjects had forgotten the order of mention but not the main-subordinate relation of two events, they tended to produce the unmarked sentence in recall. This inflated the upper right cell (with the 66) in the lower matrix, as well as the upper left cell (with the 359) in the upper matrix.

It was the unmarked forms that subjects most often preferred as their mode of recall. S_1 *before* S_2, which was completely unmarked, was used most often. *Before* S_2 S_1, which was marked for both order of mention and main-subordinate relation, was used least often. The other two subordinated forms, both marked on one distinction, fell in between the two extremes. The unmarked co-ordinate form was used more often than the marked form. The present theory would predict these biases, just as it predicted the bias in the above hypothetical example (Table II). A tendency for a distinction to lose its marking makes the unmarked form more frequent.

The three semantic distinctions mentioned above, to be of use, must have independent linguistic justification. All three, of course, have obvious syntactic origins. The

presented sentences have purely syntactic devices to distinguish first and second events in temporal order, first and second events in order of mention, and main and subordinated events. Which forms are unmarked and marked, however, is a more difficult question. When a distinction is unmarked in a sentence, that syntactic form is simpler or more primary. One traditional way linguists have decided on which form is primary is to rely on an impressionistic judgement of frequency of usage. As mentioned before, young Scots children talk about events in their order or occurrence and almost never reverse the order. It is easy to see why In telling stories and in talking about events around them, they indicate the order of events. The reason might be that they know it is important to do so, or that they necessarily recall events in the order in which they happened, or otherwise. Whatever the reason, before they have at their command the use of subordination and certain relation words, the only way they can indicate temporal order is through order of mention. Order of mention, therefore, would seem to indicate the temporal order of events to young children, and any deviation from this pattern must be syntactically marked. A similar argument holds for the main-subordinate relation. When these same Scots children first use subordinate clauses, they almost always place the subordinate clause after the main clause (see also Davis, 1937; and Heider and Heider, 1940). This ordering is a reasonable choice, for in it the fixed event becomes the event first mentioned—the theme of the sentence or what the speaker is talking about—while the subordinated event is mentioned second to indicate that it "modifies" the theme.

The marking of the main-subordinate relation has further justification in its formal linguistic analysis. Lees (1961) suggests that the subordinate clause is imbedded in kernel strings or sentences in place of time adverbials (such as *then*). The clause *after he ate*, according to this view, replaces the word *then* in (the underlying structure of) the sentence *He left then* to produce the complex embedded sentence *He left after he ate*. Halliday (1967*b*), however, points out that when a speaker places *then* at the beginning of a sentence, as in *Then he left*, he is marking *then* as the theme of the sentence. In *He left then*, on the other hand, *he* is the unmarked theme, for the subject of the verb is the unmarked theme in English. Similarly, we argue that *After he ate he left* is marked and *He left after he ate* unmarked. When an English speaker wants to make the subordinated event itself the theme of his sentence, he marks the sentence syntactically by inverting the main-subordinate clause order.

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