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PRONOUN RESOLUTION IN TWO-CLAUSE SENTENCES

City University of New York PH.D. 1986

PRONOUN RESOLUTION IN TWO-CLAUSE SENTENCES

by

ALISON MATTHEWS

A dissertation submitted to the Graduate Faculty in Psychology in partial fulfillment of the requirements for the degree of Doctor of Philosophy, The City University of New York.

1986

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Abstract

PRONOUN RESOLUTION IN TWO-CLAUSE SENTENCES

by

Alison Matthews

Advisor: Professor Martin Chodorow

This dissertation examines the resolution of anaphoric pronoun references in two-clause sentences with the pronoun in the second clause and potential antecedents in the first. Evidence suggests that pronoun resolution involves a search of short-term memory. Experiments were performed to evaluate the predictions of linear, hierarchical, and parallel function searches in a word-by-word reading comprehension task. The results of Experiment 1 showed that when gender cues are present, pronoun coreference is resolved more quickly than when the cues are absent and in their absence, there were strong effects of left-right position of the antecedent on comprehension time. Experiment 2 varied the linear position and syntactic level of embedding of the antecedents in order to test the linear and hierarchical search models. Results were most consistent with a left-to-right, top-down breadth-first search such as that proposed by Hobbs (1978).

Main/subordinate clause order had no effect. Experiment 3 tested the predictions of the parallel function model using pronouns that had the same grammatical role as the contextually appropriate antecedent or a different grammatical role. Results indicated no significant effect of parallel function, although the positional differences found in Experiments 1 and 2 were once again obtained. The failure to find an effect of pronoun position suggests that the search may begin at the topmost node of the preceding clause rather than at the pronoun, requiring a modification of Hobbs' model. Experiment 4 examined the psychological mechanism underlying the search for antecedents. Work by Holmes and Forster (1979) and Mehler et al (1978) indicate that the memory strength of adjectives and adverbs in a sentence may be related to their position and level of embedding. Experiment 4 used a rapid serial visual presentation task to measure memory for nouns as a function of these variables. Results for nouns showed significant effects of position and level on probability of recall. This suggests that the left-to-right, top-down breadth-first search order may simply reflect the memory strength of the noun phrases which are potential antecedents for an anaphoric pronoun.

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INTRODUCTION

1: Pronouns

According to the Pocket Oxford Dictionary (Sykes, 1978), a pronoun is a word which is used "instead of a noun to designate (without naming) a person or thing already mentioned or known from context". This definition has in it two components that are of interest: 1) a pronoun replaces a noun and 2) a pronoun refers to something already mentioned or known from context. A linguist would argue that a pronoun does not replace a noun; it replaces a noun phrase (NP) or some other constituent, such as a verb phrase (VP) or a clause and would better be referred to as a ProFORM.

For example, consider the following sentences adapted from Radford (1981). (Ungrammatical sentences are marked with an asterisk.)

(1) I LIKE THE WOMAN.
(2) I LIKE HER.
(3) *I LIKE THE HER.

In (2), the word 'her' replaces the entire noun phrase 'the woman. Readers comprehend this substitution and accept it as grammatical. However, in (3), the word 'her' replaces the noun 'woman'. Such replacements are not considered grammatical. A pronoun can replace a NP, as in (2), where 'her' replaces 'the woman' but not just a noun, as in (3).

Pronouns can, and usually do, refer to some other previously mentioned or inferred concept. Consider the sentences: Keith drank a lot and drove. It was a rash

thing to do. 'It' has no explicit antecedent, however the scenario is understood conceptually, i.e. drunken driving is a rash thing to do (Sanford, Garrod, Lucas, and Henderson, 1983). Pronouns that refer back to some previously mentioned or inferred concept are called 'anaphoric'. Those that refer to something that will be mentioned or inferred later on in a sentence or a text are called 'cataphoric', as in sentences (4 and 5).

(4) AFTER HE ARRIVED, FRED SHOOK HANDS.

(5) WHEN SHE BROKE THE TRICYCLE,
THE MOTHER GAVE THE GIRL A NEW ONE.

Halliday and Hassan (1979) note that pronouns are necessary for text cohesion, that a text is a kind of fabric in which pronouns play an integral part in maintaining the connectedness of a passage. A sentence is a special type of text. It is the smallest unit that can be termed a text, and, unlike larger texts, it has a definite structure that follows grammatical rules. As far as this paper is concerned, I will use the word 'pronoun' to refer to a ProFORM, and I will only consider explicit pronoun referencing within the bounds of one sentence.

There is a large body of research in psycholinguistics and computational linguistics that deals with pronoun resolution in discourse. The present work is more restricted in scope as it only deals with cases of reference occurring in single sentences. Of course, a general theory of text processing will have to include, as a special case, intrasentential reference. The

relationship between this work and the work on discourse will be discussed in the last section.

Intrasentential pronoun referencing has several constraints. One constraint is based on the gender and number of the pronoun and its antecedent. When the constraint holds, the sentence is unambiguous. For instance in the sentence:

(6) WHEN THE BOY SAW THE GIRL, SHE SMILED.

'she' logically refers to 'the girl' because 'she' must refer to a feminine, singular NP, and 'the girl' is the only nonpronominal feminine, singular NP in the sentence. In other cases, there is only one noun phrase that can be referred to, as in (7):

(7) WHEN THE BOY TRIED TO SWIM, HE SANK.

Of course, in (6) and (7), the pronouns could logically refer to individuals mentioned in a previous sentence or found elsewhere in context, but as noted above, such cases will not be considered here.

Pronoun resolution is often not constrained in the same way as in (6) and (7). For example, in (8):

(8) AFTER THE BARTENDER SERVED THE PATRON'S DRINK,
a. HE LEFT A BIG TIP.
b. HE GOT A BIG TIP.

'he' matches the gender and number of both 'the bartender' and 'the patron'. The constraint uses the semantic content of the sentence to resolve gender ambiguities. The aim of the present work is to evaluate six different approaches to intra-sentential coreference, all based on the notion that

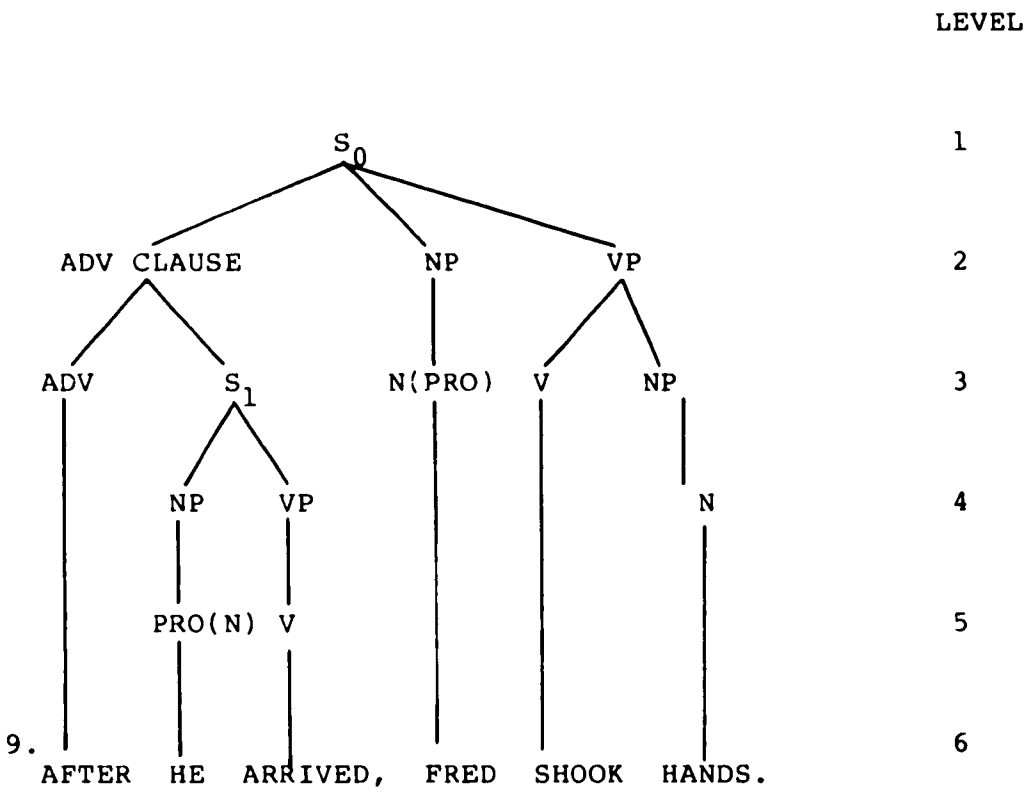
a search for possible antecedents is part of the process of resolving anaphoric coreference. Before discussing the background for each approach, I will discuss some of the linguistic background on the theoretical nature of the grammatical constraints on pronoun resolution.

2: The Role of Syntactic Structure

Structural linguists have used the theoretical grammatical structure of the sentence to determine the interrelationships among its various constituents. (A constituent is an intuitive structural unit of a phrase or sentence. For example in (4), see Figure 1, 'shook hands' is a constituent of the phrase 'Fred shook hands', but 'arrived, Fred' is not.) With respect to pronominalization, the emphasis in transformational generative grammar has been on the rules that restrict coreference.

One early account of the restrictions on coreference comes from Langacker (1969). According to his examination of the structure of sentences, he proposed a constraint based on the notions 'precedence' and 'command'. Any node A precedes another node B if it comes before B in the sentence, while any "Node A 'commands' another node B if neither A nor B dominates the other and the S-node that most immediately dominates A also dominates B" (p.169). The command relation is illustrated in Figure 2. Langacker's constraint is that 'a pronoun cannot precede and command its antecedent'. The restriction (see Figures 1

FIGURE 1
Structural diagram of sentences (9) and (10)



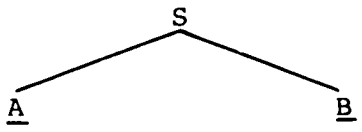
Using Langacker's (1969) model:

B precedes A and A commands B

FIGURE 2

Langacker's (1969) command relations

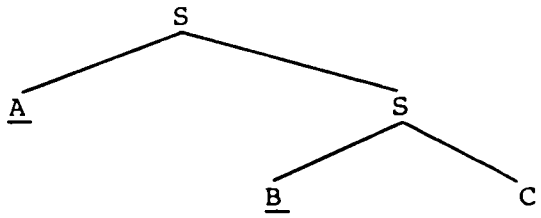
a)



A commands B

B commands A

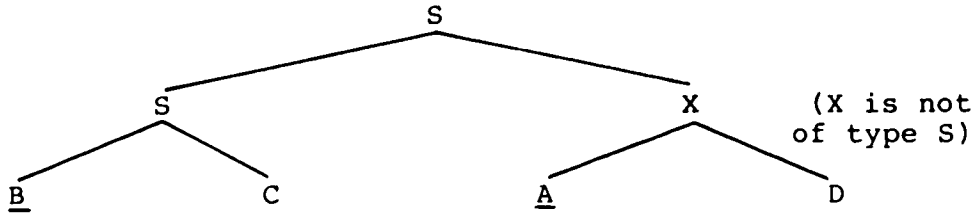
b)



A commands B

B does not command A

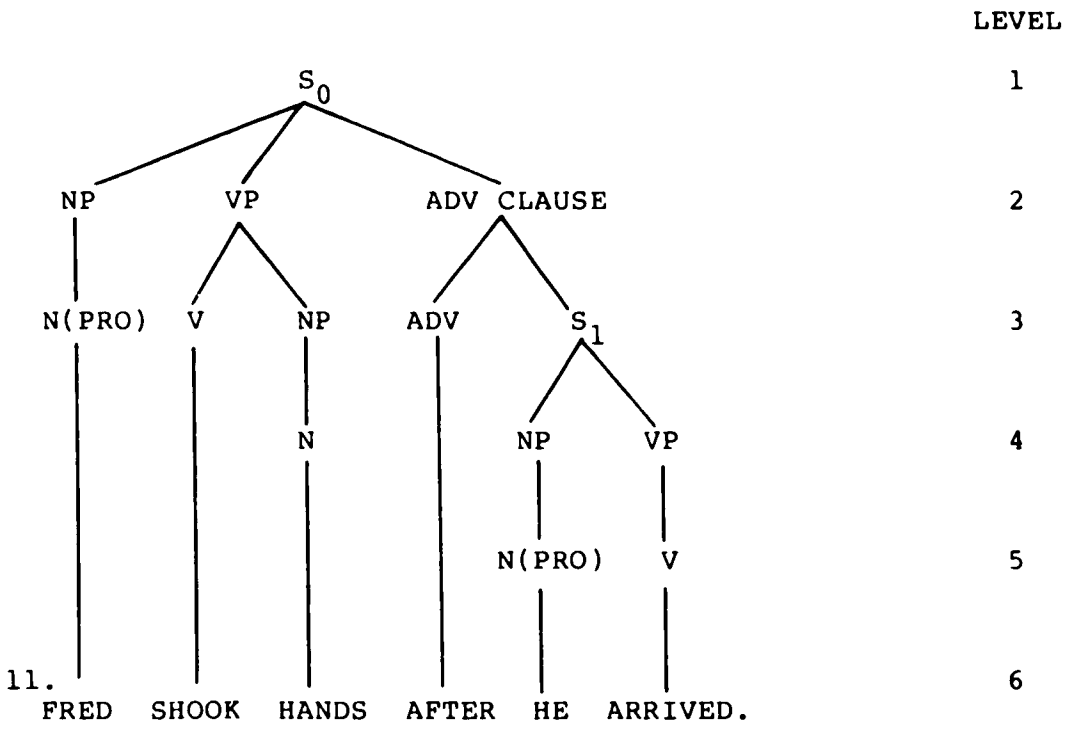
c)



A commands B

B does not command A

FIGURE 3
Structural diagram of sentences (11) and (12)



11. FRED SHOOK HANDS AFTER HE ARRIVED.

12. *HE SHOOK HANDS AFTER FRED ARRIVED.
A B

Using Langacker's (1969) model:

A precedes B and A commands B but if A is a pronoun coreference is not allowed.

Using Reinhart's (1981) model:

A c-commands B

and 3) correctly predicts that 'he' may refer to 'Fred' in sentences (9)-(11), but not in (12).

(9) AFTER HE ARRIVED, FRED SHOOK HANDS.

(10) AFTER FRED ARRIVED, HE SHOOK HANDS.

(11) FRED SHOOK HANDS, AFTER HE ARRIVED.

(12) *HE SHOOK HANDS, AFTER FRED ARRIVED.

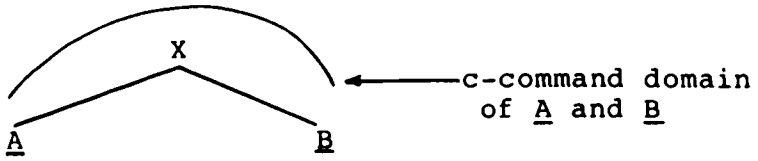
In (9), 'he' precedes 'Fred', but 'he' does not command 'Fred' because the S-node that most immediately dominates 'he' does not dominate 'Fred' (See Figure 1). In (10), 'he' commands 'Fred' but does not precede 'Fred'. In (11), 'he' neither precedes nor commands 'Fred' (See Figure 3). In (12), 'he' both precedes and commands 'Fred', and here coreference is blocked.

Reinhart (1981) has challenged Langacker's precede and command constraint and has presented a revised version that does not include precedence as one of its conditions. She uses a different type of command called c(onstituent)-command. A simple version of the definition of c-command is "Node A c(onstituent)-commands node B if and only if the branching node most immediately dominating A also dominates B" (p.612). The c-command relation is illustrated in Figure 4. The restriction for pronominalization is that "a given noun phrase cannot be interpreted as coreferential with a distinct nonpronoun in its c-command domain" (p.617), with domain defined as those branching nodes c-commanded by node A regardless of their linear order (see Figure 4). In other words, a pronoun

FIGURE 4

Reinhart's (1981) c-command relations

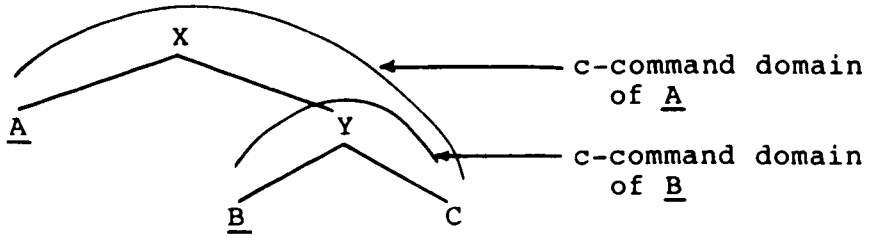
a)



A c-commands B

B c-commands A

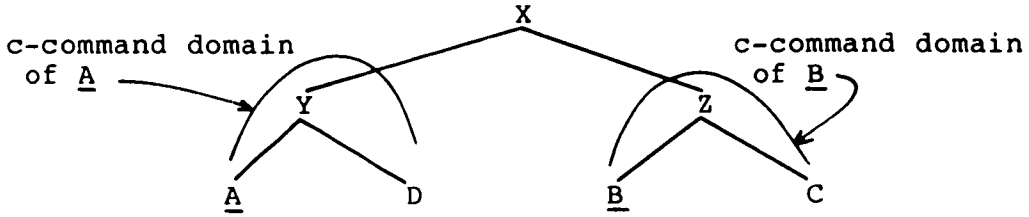
b)



A c-commands B

B does not c-command A

c)



A does not c-command B

B does not c-command A

cannot c-command its antecedent. This principle follows from a more general principle of binding theory (Chomsky 1981, 1982) that names must be free in all environments.

The c-command constraint is able to account for the coreference relations in (9)-(12) without using precedence because the structure of sentences with fronted adverbial clauses is taken by Reinhart to be different from the structure that was assumed by Langacker (compare Figure 2 to Figure 5).

The differences between these two linguistic accounts are not crucial to the experiments discussed in this paper because the linguistic theories seek to determine the constraints on coreference while the work outlined here seeks to determine how a coreferent is assigned when more than one syntactically possible antecedent is available. For example, in (8), repeated below, either theory would permit 'he' to refer to 'the bartender' or 'the patron'.

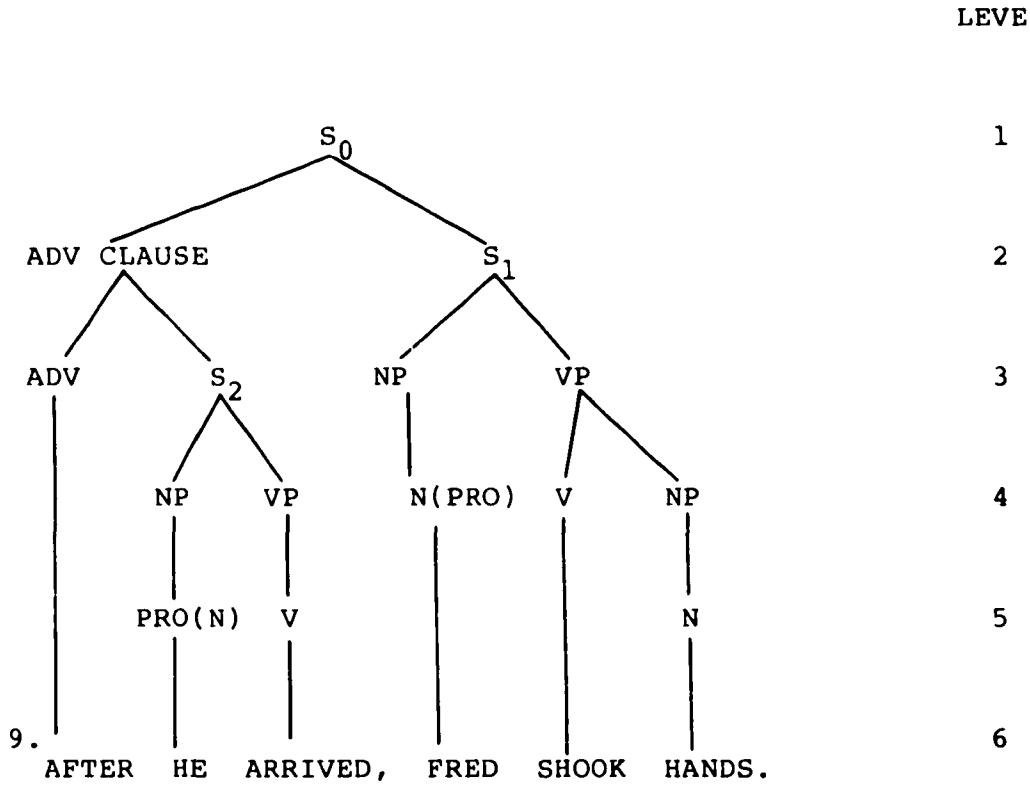
(8) AFTER THE BARTENDER SERVED THE PATRON'S DRINK,
a. HE LEFT A BIG TIP.
b. HE GOT A BIG TIP.

The linguistic theories do however provide a useful insight into structural dimensions that may be important in resolving ambiguities of pronoun reference, specifically, the linear structure of the sentence (precedence) and its hierarchical structure (dominance).

3: Importance of Short-term Memory

One approach to the study of pronoun resolution considers the psychological location of the processing of

FIGURE 5
Structural diagram of sentences (9) and (10).



Using Reinhart's (1981) model:

A c-commands B

pronoun reference. There is ample evidence to suggest that the contents of a prior clause is held in short-term memory (STM) during auditory presentation. Sachs (1967) and Jarvella (1971) found that subjects had verbatim memory for an immediately prior clause and that this memory could easily be disrupted by presenting distractor material. Some recent work by Glanzer, Fischer, and Dorfman (1984) demonstrates STM storage of immediately prior material when the input is visual. Of particular interest is their finding regarding STM and pronoun resolution: Reading times are longer for sentences containing anaphoric pronouns when STM for their antecedents has been disrupted by a distractor task. This supports the conclusion that the preceding clause is normally in STM during pronoun resolution and is available there in a verbatim form.

The work that demonstrates an initial surface structure representation of the sentence also points to the rapid loss of that structure as it is replaced by a more abstract, integrative conceptual representation. This subsequent representation is generally faithful to the meaning of the sentence but does not contain the surface structure as shown in tests of recognition memory (Sachs, 1967; Cairns and Jablon, 1976) and in recall (Jarvella, 1971). Even the lexical items are less accessible (Jenkins and Strange, 1977; Caplan, 1972). Another characteristic of the loss of structural information is the integrative quality of the conceptual representation. It contains

inferences, (Offir, 1973; Bransford, Barclay, and Franks, 1972; Harris, 1974) and related propositions dealing with the same topic (Bransford and Franks, 1971).

Retricting the scope of the present work to immediate decisions about intrasentential reference has the advantage of providing a more circumscribed field in which to test hypotheses that deal with psychological and syntactic processes. The disadvantage is that the findings may not generalize beyond STM and those representations that are dependent upon it, such as surface structure.

4: Search Strategies

A second approach to the study of pronoun resolution is concerned with how the search for antecedents proceeds. It is generally assumed that a search for an antecedent in unambiguous sentences will be different from that for an ambiguous sentence. Erhlich (1980) found that the response time to choose a preferred referent in a button release task was significantly shorter in sentences with gender cues than in sentences without gender cues. Sentences were of the type illustrated by (13) and (13A) below: NP_1+V+NP_2+conj+PRO+VP. Subjects had to decide whether the pronoun referred to NP_1 or NP_2 given the context of the sentence. An example sentence might be (13) and (13A):

(13) JOHN BLAMED JOE BECAUSE HE SPILLED THE COFFEE.

(state preferred choice: 'John' or 'Joe')

(13A) JOHN BLAMED SUE BECAUSE SHE SPILLED THE COFFEE.

(state preferred choice: 'John' or 'Sue')

The results suggest that when subjects are given gender cues as above, they assign the referent before completing the detailed analysis of the sentence. This conclusion is supported by the fact that in the gender cued sentences the reaction times were shorter than in the non-cued ones. Also, the effects of the other independent variables (verb and conjunction type) were attenuated in cued sentences.

However, when there are no gender cues, reference assignment must wait until the sentence is semantically or pragmatically disambiguated. Part of the delay most likely represents the ongoing search process for the antecedents. It is not known whether the rapid processing in the cued case reflects the same search path or if the antecedent is found by different means in these sentences.

There are three major kinds of search strategies based on the organization of the words in the sentence. 1. The sentence is considered as a linear string without taking its hierarchical (dominance) structure into account. 2. The search path reflects both linear and hierarchical structures of the sentence. 3. The grammatical role of the pronoun and its antecedent is used as the starting point for the search. These three will be considered in the remainder of this section. No matter how the search proceeds, its final output must conform to the constraints outlined by Langacker (1969) and Reinhardt (1981). For instance, in the sentence *Near Dan, he saw a snake., (Langacker, 1969), 'he' can not refer to 'Dan'.

a. Linear Searches

Consistent with a linear search model, Corbett and Chang (1983) show that in a post-sentence probe recognition task with sentences containing anaphoric pronouns, subjects take less time to respond to a probe which refers to a NP that occurred earlier in the sentence than to one that occurred later. For example, in sentences such as: Bonnie passed the basketball to Claire and she sank a jump shot, response times to the post sentence probe 'Bonnie' are consistently faster than to the probe 'Claire'. This suggests that the search for a prior occurrence of a post-sentence probe progresses from left-to-right or from early-to-late.

Evidence for the opposite, i.e. right-to-left, search order comes from the work of Springston (1975). With one antecedent in the same clause as the pronoun and the other in the preceding clause, there was a significant advantage for the more recent antecedent. The results lend themselves to other interpretations based on clausal structure. Further support for the right-to-left model comes from Clark and Sengul (1979), who measured reading comprehension time for short paragraphs containing several possible antecedents at different locations. Comprehension time was fastest when the antecedent of a pronoun or a definite noun phrase was found in the immediately prior clause. Comprehension times were slower when the antecedent was two clauses away and slowest when it was

three clauses prior. Considered in light of Springston's results, this work suggests a serial look-back by clauses, with the most recent clause first.

The findings of Springston and of Clark and Sengul are not necessarily inconsistent with those of Corbett and Chang (1983). The latter used materials in which the antecedents were in the same clause while the best evidence for the right-to-left model comes from experiments in which the antecedents are in separate clauses. It is therefore, possible that readers start searching in the most recent clause before proceeding to the next previous one (hence right-to-left by clauses), but within each clause the search is from left-to-right. Searches across clauses and sentences will be discussed in light of work on discourse processing in the final section.

If, on the other hand, this right-to-left search applies to pronoun resolution within a clause, then the search will start at the right-most (last) word of the clause and proceed back word-by-word to the left. Here, the prediction is that the search for later antecedents will require less time for processing than earlier ones. The left-to-right and the right-to-left searches have generally been considered self-terminating in the sense that the search stops once an acceptable antecedent is found.

A third linear search possibility is based on Sternberg's (1967) finding that the short-term memory

search of random item lists is a serial and exhaustive one; that is, the search continues until it exhausts the available list, not until the first appropriate match is found. If the list strategy is applied to sentence processing (and it is clear that sentences are not lists), this model would predict that the search time for syntactically possible antecedents would not vary as a function of their location in the sentence (early or late), but pronoun resolution time should vary as a function of the number of words in the sentence.

The work cited above supporting the left-to-right and right-to-left models is inconsistent with Sternberg's exhaustive serial search and, in addition, the studies mentioned above show no indication that sentence length affects pronoun resolution time. As a general rule, sentences with five words should take less time to process than those with fifteen. However, there are more complications in the processing of a fifteen word sentence other than the mere number of words. In fact, Chang (1980) did find an effect of serial position on word-by-word reading times, but this had no effect on subsequent probe response times. It is, of course, unclear whether pronoun resolution and the search for an antecedent of a post-sentence probe involve the same search processes.

b. Hierarchical Searches

Indirect evidence for a hierarchical component of the search has been provided by Holmes and Forster (1972) and

Mehler, Segui, Pittet, and Barriere (1978). Holmes and Forster (1972) used a rapid serial visual presentation (RSVP) task where words of sentences are presented in rapid (41.8 msec per word) succession. They note that this technique is useful for obtaining accurate perceptual data with normal, uncontrived, sentence materials. Subjects were asked to read sentences, and after each one they were instructed to recall the words in the correct order. The results showed a 87.5% recall for nouns and 80.5% recall for verbs. There was a significant drop in the percent recalled for adjectives and adverbs, 68.5%. In their materials, the adjectives and adverbs modified the nouns and verbs, which served as NP and VP heads respectively. The results thus suggest that higher levels (heads of phrases) are more prominent than lower levels. This may be because the higher levels are accessed more easily.

Further support for the notion that levels of embedding are related to accessibility comes from the work of Mehler, Segui, Pittet, and Barriere (1978), who examined recall of French sentences in RSVP as a function of word classification. They varied position of an adjective and its level of embedding by constructing sentences with modifying adjectives either preceding or following a head noun in a NP and sentences with the same adjective used in a predicate adjective construction, i.e. as head of an adjective phrase. For example, in the sentences on the next page, the adjective is underlined.

(a) Les laboureurs ont trouve des grosses souris dans le grenier.
(The farm workers found the big rats in the barn.)

(b) Les laboureurs ont trouve des chauves-souris dans le grenier.
(The farm workers found the bald mice in the barn.)

(c) Le doctuer a besoin de sang frais pour cette operation.
(The doctor needed fresh blood for that operation.)

(d) Le doctuer a besoin de sang-froid pour cette operation.
(The doctor needed self-control (cold blood) for that operation.)

(e) Sur les plages le sable est chaud toute la journee.
(At the beach the sand is warm all day long.)

In (a) and (b), the adjective precedes the noun, while in (c) and (d), it follows. In (b) and (d) the adjective is part of a compound NP while in (a) and (c) it simply modifies the noun. In (e), the adjective is the phrasal head of the predicate phrase.

The results indicated that, irrespective of the order of the adjective and noun in the NP, subjects reported the presence of the noun twice as often as the adjective. However, when the adjective was a phrasal head as in the predicate adjective construction, it was recalled as well as noun and verb phrasal heads.

Mehler (1978) et al. propose the view that readers process a sentence on the basis of partial information. They suggest that the 'potential' role of the adjective seems to control whether the item is recalled. That is, the adjective as a modifier is not preserved as well as the other items that occupy the subject, object, and verb

functions. However, when the adjective is the phrasal head following a static verb, its potential function is that of attribute and therefore is more salient for recall.

The data from Holmes and Forster, and Mehler et al. suggests that the function of the elements within a sentence controls the degree to which it is recalled. The relationship of the elements parallels the surface structure of the sentence. Items that are least embedded are more often recalled than those that are more deeply embedded.

These findings of a differential probability of recall based on depth of embedding suggest that the syntactic structure of the sentence may itself serve as a guide for the antecedent search. Based on the sentence's surface syntactic structure, at least two different paths can be considered. One is the breadth-first path in which the search travels top-down (higher to lower nodes) and left-to-right (earlier to later nodes), accessing all nodes from left to right before descending to the next level (Figure 6A). The other is the depth-first path in which the search accesses all the nodes from top to bottom at one linear position before proceeding to the next position (Figure 6B).

In Figures 6A and 6B, note that each search path starts at the topmost node and in general moves downward and to the left. In the breadth-first search, Figure 6A, all the nodes on the same level and to the right of a given

FIGURE 6A

Breadth-first path

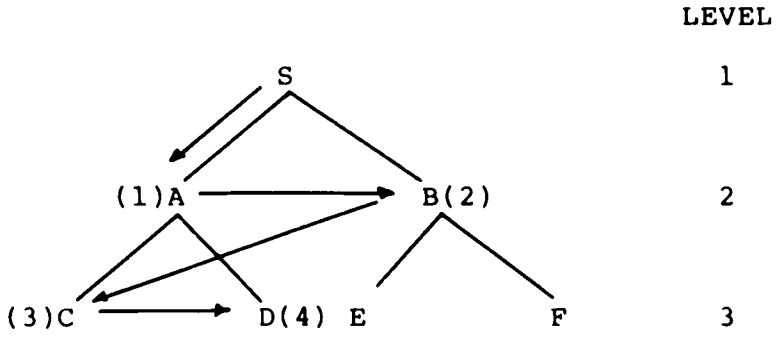
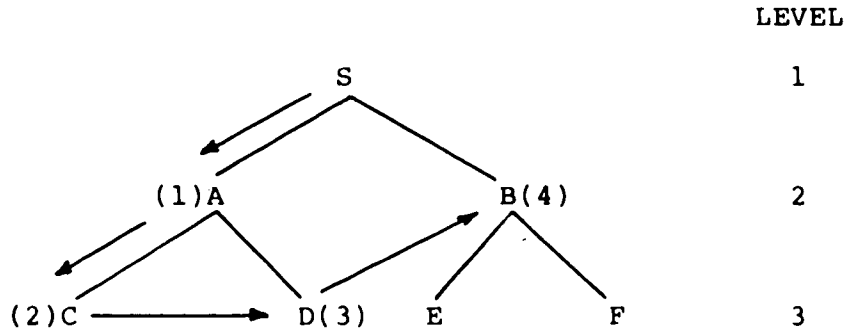


FIGURE 6B

Depth-first path.

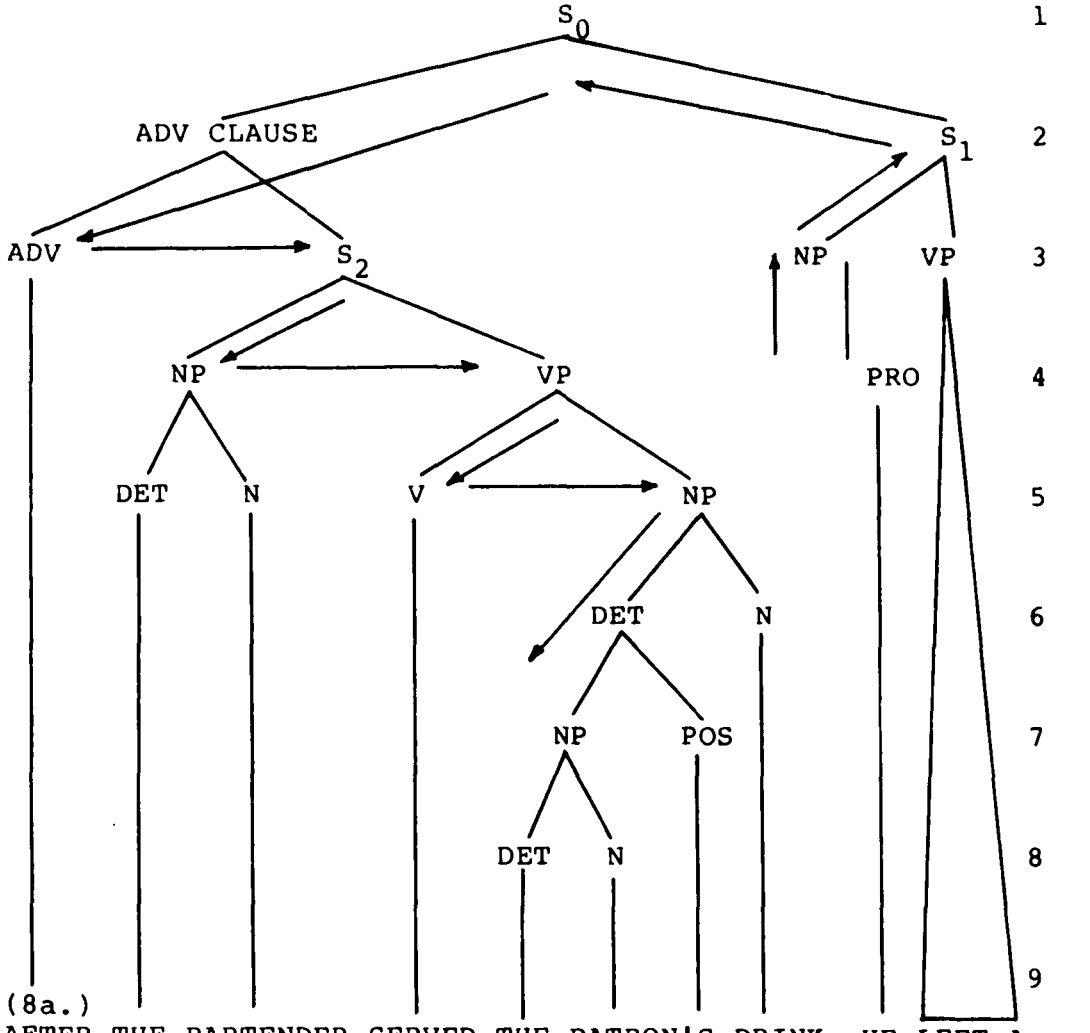


node A are visited before A's descendants, while in the depth-first search, Figure 6B, all the descendants of a given node A are visited before nodes on the same level and to the right of A.

Hobbs (1978) proposed a search for pronoun antecedents that incorporates the breadth-first scan through the structure of the sentence. For example, in sentence (8), (Figure 7), the pronoun is in the second clause. For such a case, the search as proposed by Hobbs takes place in the following manner: ascend to the S node that dominates the pronoun and search along all branches below that S node and to the left of the pronoun. If there are no branches below the S node and to the left of the pronoun (as in the case of the example in (8)) then ascend to the next S node and repeat the process. In Figure 7, "ADV CLAUSE" is the only node immediately below S_0 that is to the left of the pronoun. Since this is not an NP node, the search continues by descending again along the left-most branch to "ADV", which is not an NP. To the right of "ADV" is the S_2 node that dominates the first clause. Descend along its left-most branch to the next level in the tree. Within that level, of the branches dominated by the S_2 node, test for plausibility each syntactically possible antecedent NP encountered from left to right. If no antecedent is found, return to the left-most node and descend along its left-most branch to the next level, and proceed left-to-right. Continue this process until a contextually

FIGURE 7

Structural diagram of sentence (8)



appropriate antecedent is located.

In sentence (8), the selection of a "contextually appropriate" antecedent is determined largely by the semantic context provided in the second clause, but the procedure predicts that the shallowest, left-most antecedent ('the bartender') will be found and evaluated for its appropriateness first and that the deepest, right-most antecedent ('the patron') will be found and evaluated last. In general, for two nodes on the same level N, the node to the left will require less time than the one on the right, and any node on level N will require less time than any node on level N+1.

In contrast to the breadth-first search, the depth-first hypothesis predicts that antecedents on the left will always require less search time than ones on the right. As such, this pathway is very similar in its predictions to those of the linear left-to-right search. The difference from the linear model is that depth of embedding is considered in the depth-first model. The prediction is that at a given word position (e.g. the third word in the sentence), a shallow antecedent will require less time than a more deeply embedded one. For example, in sentence (8), repeated here:

(8)AFTER THE BARTENDER SERVED THE PATRON'S DRINK,
HE GOT A BIG TIP.
HE LEFT A BIG TIP.

and in sentence (8A), on the next page:

8A) AFTER THE PATRON'S DRINK WAS SERVED BY THE BARTENDER,
HE GOT A BIG TIP.
HE LEFT A BIG TIP.

The third word of each, 'bartender' and 'patron', is located at a different level in the structure of the sentence. 'The bartender' is located one node below S_2 and 'the patron' is three nodes below S_2. According to the depth-first model, 'the bartender' will be accessed before 'the patron'.

The left-to-right top-down, breadth-first model was developed by Hobbs in the context of computational linguistics and computer-based language understanding systems. He reports the results of a test of his algorithm on one hundred consecutive examples of pronouns found in three published sources: a college text, a novel, and a news magazine. In 88% of the cases, the first antecedent (with appropriate gender and number) which the search algorithm encountered was the contextually appropriate antecedent. These materials had undoubtedly undergone careful writing and editing before publication. Perhaps the writer and editor implicitly rely on knowledge of the reader's search algorithms for their editorial judgments.

c. Searches Based on Parallel Function

Aside from the breadth-first and depth-first models, a third approach related to the detailed structural analysis presented above is the Parallel Function hypothesis. It is concerned with the grammatical roles performed by the pronoun and its potential antecedents. Sheldon (1974)

examined children's acquisition of coreference for relative pronouns and their antecedents. She found that when the relative pronoun and its antecedent served the same grammatical role (i.e. had a parallel function), resolution time was faster than when the coreferents had non-parallel grammatical function. She proposed a line of research that would test the applicability of parallel function in the resolution of reference for pronouns in general. Predictions from Sheldon's work involve the cases where a pronoun and its antecedent are the subjects or the objects of their respective clauses. Specifically, the prediction is that resolution time will be faster when pronoun and antecedent have parallel functions than when one is a subject and the other is an object.

Although the Parallel Function hypothesis uses the term 'function', the notion here seems to be based on purely syntactic specifications of subject and object rather than on more broadly functional criteria. Of course, the hypothesis might be construed to take as parallel any two NPs which function as the agents (or patients) of their respective clauses. If it is the deep structure of the sentence that is available in STM, then the surface object of an active sentence and the surface subject of a passive sentence could have parallel functional roles.

Thus, there are two ways to consider the Parallel Function hypothesis based on the type of structure (surface

or deep) of the sentence. One view could be called Surface Parallel Function, in which the search begins in the antecedent's clause at the point in the surface tree that corresponds to the location of the pronoun in its own clause. In the other view, Deep Parallel Function, the search begins at the location of the deep functional role which is parallel to that of the pronoun.

In summary then, in either interpretation of the Parallel Function hypothesis, the parallel grammatical function of the pronoun and its antecedent is predicted to facilitate the search.

The predictions drawn from each of the three major strategies, linear, hierarchical, and parallel function are summarized in Table 1. The experiments described in the next section were designed to clarify the search process by testing these predictions. Before discussing the experiments, the broader perspective of automony in language processing must be addressed.

5: Language Comprehension and Autonomy Theory

While the thesis does not address these issues directly, it is of theoretical interest to note that there is an important current debate in the psycholinguistic literature concerning the modular versus global nature of language comprehension processes. Forster (1979) proposed a language processing system that consists of a set of autonomous subsystems whose functions are strictly constrained. In this model, sentences are put into a

TABLE 1

Summary Table of Predictions for the Relative Speed of Search for an Appropriate Antecedent

Type of Search Model	Prediction for Relative Comprehension Time
A. Linear	
1. Left-to-Right	1. Left < Right
2. Right-to-Left	2. Right < Left
3. Serial Exhaustive	3. Left = Right
B. Structural (top-down)	
1. Left-to-Right, Depth-first	1a. Left < Right
	b. Shallow < Deep Left Left
	c. Shallow < Deep Right Right
	d. Shallow > Deep Right Left
	e. Shallow < Deep Left Right
2. Left-to-Right, Breadth-first	2a. Shallow < Deep
	b. Shallow < Deep Left Left
	c. Shallow < Deep Right Right
	*d. Shallow < Deep Right Left
	e. Shallow < Deep Left Right
C. Parallel Function	Parallel Non-Parallel

* This prediction distinguishes the breadth-first model from the linear left-to-right model and from the depth-first model.

lexical processor which has access to phonological knowledge which identifies the lexical items in a sentence. The resulting string of words is sent to a syntactic processor which has access to lexical syntactic information only (e.g. parts of speech). Its purpose is to construct a syntactic description of the sentence. The output of the syntactic processor is sent to a message processor for formulation of the semantic and conceptual representation of the sentence. In this most tightly constrained model, there are no interactions between the subsystems; each is independent and there are no backward or interactive influences on the ongoing interpretation of the sentence.

An opposing point of view has been proposed by Marslen-Wilson and his co-workers (1978, 1978). They maintain that both syntactic and semantic interpretations of the sentence are formulated word by word as it is heard or read, and the formulations use all the available syntactic and semantic information. Autonomy of syntactic processing is rejected in favor of the notion that there is no distinct syntactic level of analysis. Instead, the view is that the semantic and syntactic analyses are integrated concurrently. As a model, it is less constrained than the autonomy model, for it permits interactions among any of the component processes in language comprehension.

In Forster's autonomy model, the resolution of any ambiguities of reference takes place in the message processor. At this point, syntactic, semantic, and

pragmatic information are all available and, in principle, could be brought to bear in any number of ways. They might interact or remain relatively independent. By contrast, in the Marslen-Wilson interactive model, there is no independent syntactic level, so it would be difficult to imagine a search for antecedents that was guided by surface syntax. All of the pronoun reference search models discussed earlier assume that some aspect of surface syntax, for example, linear location, depth of embedding, or grammatical function, guides the search. In these search models, once an antecedent is found, the role of context is to form the basis for judging whether it is contextually appropriate.

For example, in sentences such as (8) and (8A), if the search is pragmatically guided, then 'got a tip' would lead directly to 'the bartender' wherever 'the bartender' happened to be located in the structure of the first clause. If, on the other hand, syntax ordered the search, then the time to access 'the bartender' would be different as a function of the location of the antecedent. (See Table 1 for a summary of the search predictions for the relative times to access and judge a referent.)

The assumption underlying the experiments discussed in the next section is that the language processing system more closely resembles Forster's autonomy model than Marslen-Wilson's interactive one. Predictions from the latter could be expected to place a strong emphasis on the

role of context in the second clause (e.g. 'got a big tip' or 'left a big tip'). If there were to be any comprehension time differences at all, they would correspond to the nature of this biasing context. For example, all sentences biased toward 'the bartender' might be faster than those biased toward 'the patron' because the context of 'got a big tip' might provide a stronger link to 'the bartender' than 'left a big tip' does to 'the patron'. However, if there is a syntactic representation that is independent of the semantic one then it is possible that reading time differences will reflect syntactic structure even though the decision about the antecedent's appropriateness is a semantic or pragmatic one.

In the next section, three major experiments will be discussed that were designed to address the search predictions noted earlier and in Table 1. Experiment 1 tests the effects of gender cues and linear location of the antecedent on sentence comprehension time. Experiment 2 has two parts. Experiment 2A tests for the effects of the level of embedding and location of the more plausible antecedent in sentences containing two syntactically possible ones. Experiment 2B replicates the previous one with an additional factor testing for the effects of clause order on sentence comprehension time. Experiment 3 also has two parts. The first, Experiment 3A, tests for the effects of parallel function in shallow active sentences with two syntactically possible antecedents. The second,

Experiment 3B, uses a more complete design testing again for the effects of parallel function of the pronoun and its semantically preferred antecedent on sentence comprehension time.

EXPERIMENTS 1 - 3

1: Features Common to the Experiments

First, before discussing any particular experiment, I will give a detailed description of the factors that were common to all. The individual experiments will then be described in detail where there are differences from the general plan.

a. Materials

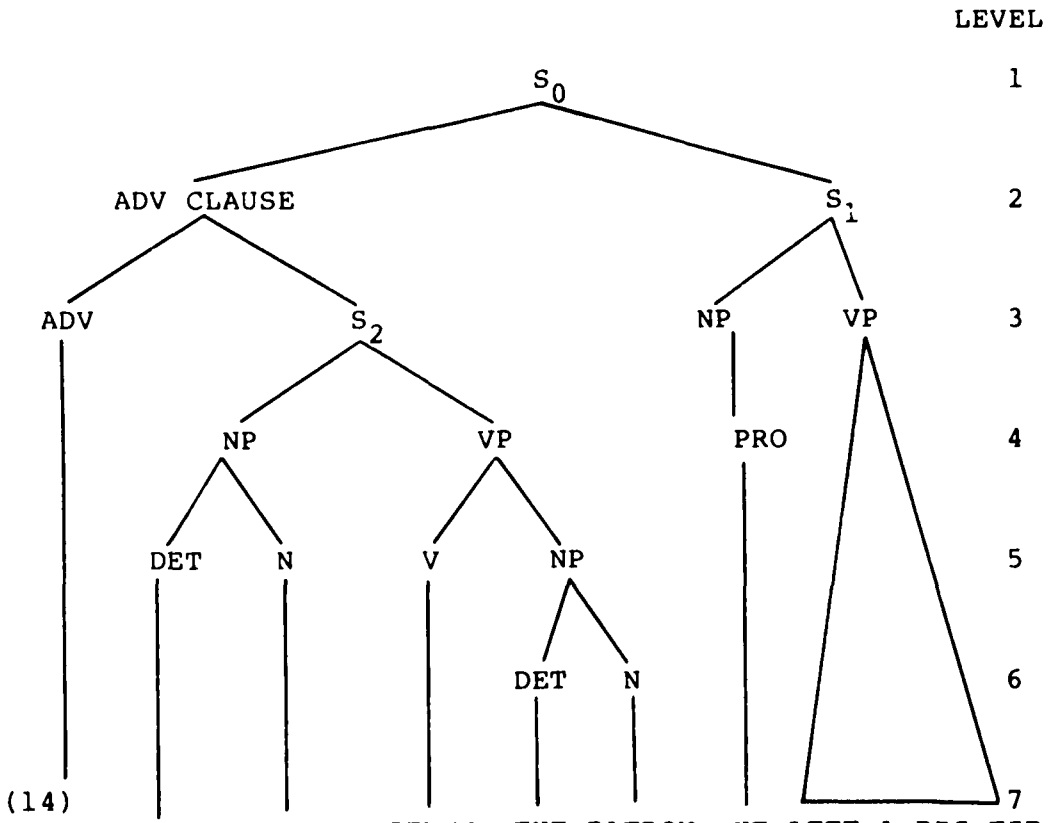
All of the experimental materials were two-clause sentences having the general structure: Subordinate-Conj+NP_1+V+NP_2, PRO+VP. The materials for the experiment were constructed so that the pronoun provided either ambiguous or unambiguous gender cues for the resolution of pronoun reference in the sentence. All sentences contained a minimum of NP embedding. That is, in the first clause, the subject NP was one level below the dominating S_2 node and the object NP was two levels below the S_2 node. For example, sentence (14):

(14) AFTER THE BARTENDER SERVED THE PATRON,
  (a) HE GOT A BIG TIP.
  (b) HE LEFT A BIG TIP.

in Figure 8 shows 'the bartender' and 'the patron' under the least amount of embedding (i.e. one and two nodes under S_2, respectively). (Contrast this with Figure 7 where 'the patron' is four nodes under S_2.) The pronoun can refer to either the first (early) or second (late) NP in the first clause. In ambiguous materials such as sentences (14) and (16), the second clause was contextually biased toward one

FIGURE 8

Structural diagram of sentence (14)



(14)
AFTER THE BARTENDER SERVED THE PATRON, HE LEFT A BIG TIP.

AFTER THE BARTENDER SERVED THE PATRON, HE GOT A BIG TIP.

or the other antecedent even though the pronoun itself matched both antecedents in number and gender. In the case of unambiguous materials such as (15), the pronoun designated the preferred antecedent through gender cues. For each sentence, there were two versions, one in which the pronoun referred to NP_1 and one in which it referred to NP_2. For example, sentence (15) below is an unambiguous sentence with two versions shown.

(15) WHEN FREDDY SAW THE PROM QUEEN,
(NP1) (NP2)
(a) HE WAS AMAZED.(Freddy)
(b) SHE WAS SMILING.(the Prom Queen)

Sentence (16) is an example of an ambiguous sentence. It also has two versions:

(16) AFTER THE PRISONER BRIBED THE COP,
(NP1) (NP2)
(a) HE WAS RELEASED IMMEDIATELY.(the prisoner)
(b) HE POCKETED THE MONEY.(the cop)

Sentences were constucted in sentence frames that contained all versions of a sentence. The number of versions for a sentence depended on the number of variables a particular experiment was manipulating. Filler sentences were interspersed among the experimental sentences in order to reduce practice effects and anticipation. The order of presentation of the sentences was the same for all subjects of an experiment. The version that a subject saw of any one sentence frame was varied systematically so that all subjects saw an equal number of the various types of the experimental sentences.

All of the experimental materials can be found in the

Appendix.

b. Subjects

Experimentally naive Hunter College students whose native language was American English were subjects in the experiments. They volunteered their participation knowing that the experiment required some knowledge of the typewriter keyboard. Each subject participated in only one experiment.

c. Procedure

Subjects sat in front of a microcomputer. The experimenter read aloud the following instructions:

> "This is an experiment on reading comprehension and memory. You will be reading sentences on the screen one word at a time. By pressing the key marked "enter", you will cause the first word of a sentence to appear in the small window on the screen. With the next press, the second word will appear and take the old word's place, and so on. Please read as quickly as you can, keeping in mind there will be a question at the end of each sentence. The last word of the sentence ends with a period. Your next press of the "enter" key will cause the question to be displayed. Before you press "enter" to display the question, make sure you understand the sentence."

When the subjects finished reading the questions, they were instructed to type the answer at the computer keyboard andthen to press "enter" for the next sentence. There were about five seconds in between sentences.

In this technique, the time between key presses represents the reading time for each consecutive word. The reading time for the last word also represents comprehension time for the sentence.

The experiment took from 15 to 60 minutes depending on

how quickly the subject could read and type. Subjects were tested one at a time.

While it is true that word-by-word reading as described here differs from the normal mode of reading, evidence indicates that it is not as different as one might suppose. Aaronson and Scarborough (1976) used this task in their studies on reading comprehension and recall. The analyses of their data showed that subjects' reading times were similar to natural moderately fast reading speeds of about 100-200 msecs per word. Patberg and Yonas (1978) found that although skilled readers demonstrated a slower reading speed in the word-by-word reading task, their comprehension was unaffected when compared to their normal reading of a text. Less skilled readers showed no decrement in either speed or comprehension. Rayner and McConkie (1977) found that the perceptual span for normal reading was no more than 1.5 to 2 words, not much greater than that imposed upon the reader in the word-by-word task.

d. Criteria for Accepting Data

The analyses that were performed dealt only with the reading-comprehension time at the end of the sentence when this time was less than four seconds. This cutoff point was established to eliminate highly skewed reading times. Other deletions were made on the basis of the answers to the comprehension question at the end of the sentence. For example, here are the comprehension questions for sentence (16), repeated on the next page:

(16) AFTER THE PRISONER BRIBED THE COP,
(a) HE WAS RELEASED IMMEDIATELY.
question: WHO WAS RELEASED? (the prisoner)
(b) HE POCKETED THE MONEY.
question: WHO POCKETED THE MONEY? (the cop)

The second clause was intended to bias the reader toward a particular antecedent, but it was not always effective in doing so. Generally, subjects made two kinds of errors by: (i) failing to respond or giving an irrelevant response, or (ii) choosing the shallow and/or early NP when the bias of the second clause was toward the later and/or deeper NP. The statistical analyses of the experiments did not include data from those trials on which the intended antecdent was not chosen by the subject. Thus, the results only reflect cases in which the intended effect of context is shown in the subject's answer to the comprehension question. The data for a sentence was deleted if all subjects chose the nonintended NP. (These sentences were considered to be insufficiently biased.) The number of subjects and sentences affected by these procedures is noted in each experiment, which includes an indication of the type of error (i or ii).

The data was analyzed twice by analysis of variance, once using subjects as the repeated measure and once again using sentences as the repeated measure. These analyses allow generalizations across subjects and also across materials (Clark 1973). If only subjects were used to generate the statistical error term, then a few aberrant sentences could have a large effect on the outcome of an

experiment. By using both analyses, atypical scores by subjects or sentences are not likely to mislead interpretations of the data. The means for each condition in the tables reported here represents the average of the means of both the subject and the sentence analyses.

As noted earlier, these features of materials, subjects, procedure, and data analysis were common to all the experiments. The sections below will present those aspects which are unique to the individual experiments.

2: Experiment 1

Experiment 1 was designed to test for differences, if any, in the processing of pronoun resolution when using ambiguous and unambiguous materials.

a: Subjects, Materials, and Design

Twenty students participated in Experiment 1. Two groups of twenty-four sentence frames were constructed. Each sentence frame had two versions. A sentence frame was syntactically unambiguous (15) or ambiguous (16), and the pronoun in the second clause referred to either the first antecedent (15a and 16a) or second antecdent (15b and 16b). Each subject read ambiguous and unambiguous sentences with NP_1 and NP_2 antecedents, but each subject saw only one version of a given sentence frame. The experimental sentences were randomly interspersed among 24 filler sentences.

Two ANOVAs were performed on the data from Experiment 1. For the subject analysis, the design was a two-way

factorial with 20 subjects (as the repeated measure) crossed with two levels of ambiguity (ambiguous and unambiguous) and two levels of antecedent location (early and late). For the sentence analysis, the design nested 24 sentences (the repeated measure) in two levels of ambiguity crossed with two levels of location. Deletions accounted for 7% of the 960 possible responses.

b. Results

On the basis of Erhlich's (1980) findings, I expected that the reading times for unambiguous sentences would be shorter overall than those for the ambiguous sentences. Further, based on the predictions of the various search models for ambiguous materials, it was expected that there would be significant differences in the sentence-final comprehension times depending on the location of the contextually appropriate antecedent. This was not expected for the unambiguous materials.

In Table 2, the means of the reading comprehension times for the ambiguous sentences showed that, as predicted, ambiguous sentences did require significantly more time than the unambiguous sentences in both the subject and sentence analyses, $F(1,19)=9.76$, $p<.01$, $MSe = 47481$, and $F(1,46)=4.66$, $p<.05$, $MSe = 147326$, respectively. The main effect for location was marginally significant at about $p=.06$ for each analysis, with the early location requiring less time than the later one. The interaction of the ambiguity and location factors showed that for the

TABLE 2

Experiment 1
Means for Reading Comprehension Time
in milliseconds

Main Effects:

Ambiguity:	Unambiguous	Ambiguous	**
	829	990	
Location:	Early	Late	-
	855	965	

Interaction:

Ambiguity X Location: *

	Early Location	Late Location
Unambiguous	837	822
Ambiguous	873	1108

unambiguous sentences, about the same amount of time was needed to choose an early antecedent as to choose a later one, but for the ambiguous sentences the early location was significantly faster than the later one in the sentence analysis, ($F(1,46)=5.98$, $p<.05$, $MSe = 90532$). This difference was not significant for the subject analysis, $p=.11$, but the means were in the same direction. In sum, the search is faster with unambiguous gender cues than without, and in ambiguous sentences, there is some evidence that the search proceeds from left tc right.

3: Experiment 2

Experiment 2 consists of two parts which test syntactically ambiguous sentences for the effects of location and level of embedding of the more plausible referent (2A and 2B), and for the effects of clause order (2B).

a. Experiment 2A: Subjects and Materials

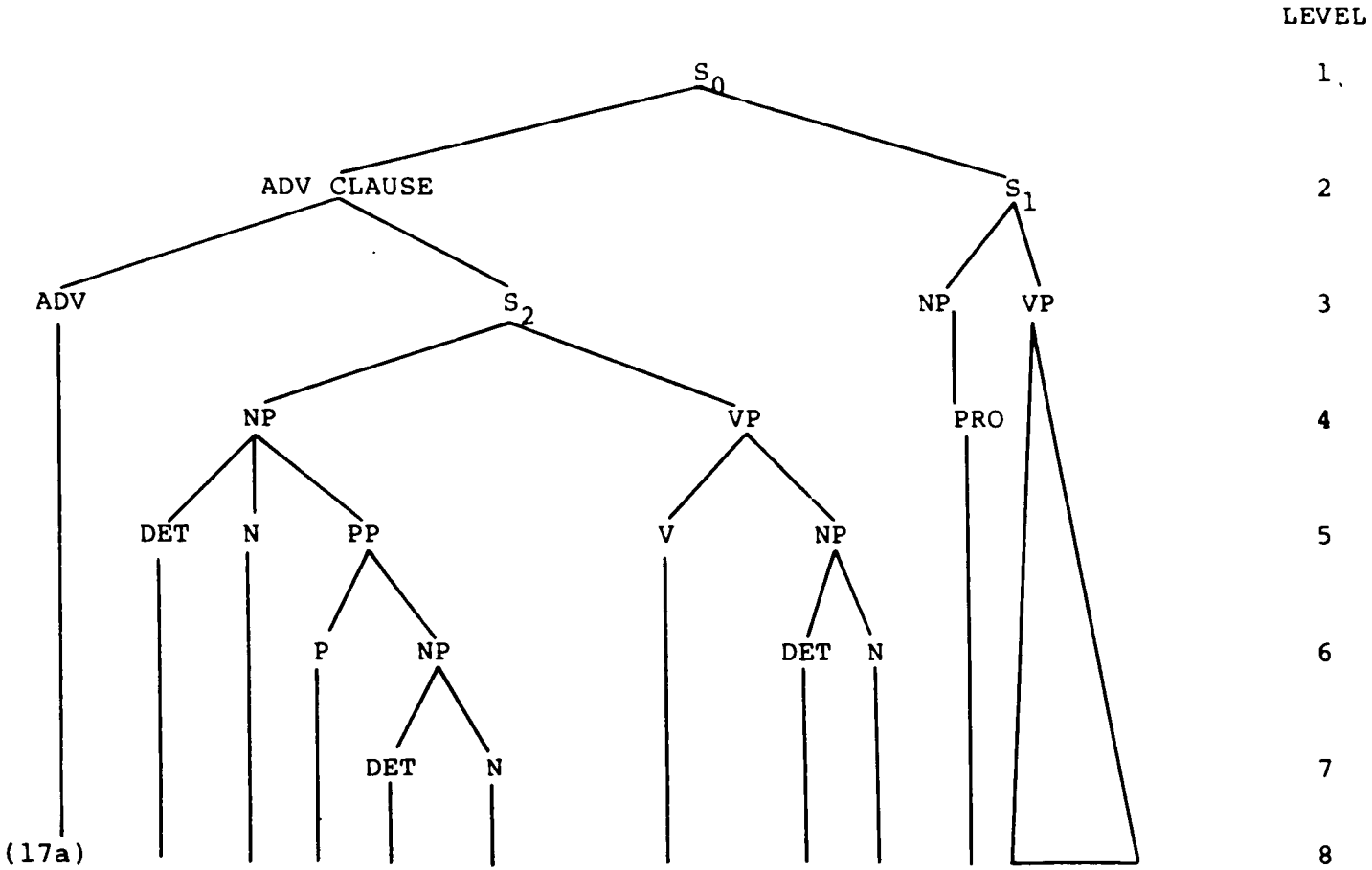
Thirty-two subjects participated in Experiment 2A. In Experiment 2A, experimental materials were constructed in which the degree of embedding of possible antecedents was either shallow or deep and their location was either early or late in the first clause. Example (8), repeated here, and illustrated in Figure 7, shows deep embedding late and shallow embedding early in the first clause.

(8) AFTER THE BARTENDER SERVED THE PATRON'S DRINK,
    (a) HE GOT A BIG TIP.
    (b) HE LEFT A BIG TIP.

In contrast, sentence (17), illustrated in Figure 9, shows deep embedding early and shallow embedding late in the

FIGURE 9

Structural diagram of sentence (17)



(17a)
BECAUSE THE OWNER OF THE RESTAURANT PREPARED THE FOOD, IT WAS ALWAYS CROWDED.
(17b)
BECAUSE THE OWNER OF THE RESTAURANT PREPARED THE FOOD, IT WAS ALWAYS DELICIOUS.

first clause.

(17) BECAUSE THE OWNER OF THE RESTAURANT PREPARED THE FOOD,
(a) IT WAS ALWAYS CROWDED.
(b) IT WAS ALWAYS DELICIOUS.

In each sentence there are two noun phrases in the first clause with the same number and gender as the pronoun subject of the second clause.

Twenty-four sentences with the first clause in the active voice were constructed from a master list of 24 sentence frames. Twelve of these had deeper NP embedding in the subject of the first clause, as in example sentence (17), hence appearing early within the first clause. The other 12 sentences had deeper NP embedding in the object of the first clause, as in example sentence (8), therefore appearing late within that clause. These two sentence types will be referred to as the subject-type (17) and object-type (8), respectively. In both sentence types, the embedding could take the form of either a possessive modifier or a prepositional phrase.

Corresponding to each active first clause, there was a passive version in which the location of the more deeply embedded antecedent was changed from early to late or late to early. The purpose of the passive version was to change the locations of the antecedents without altering the semantic content of the sentence. For example, in sentence (8A), the deeper NP embedding is now early in the first clause.

(8A) AFTER THE PATRON'S DRINK WAS SERVED BY THE BARTENDER,
(a) HE GOT A BIG TIP.
(b) HE LEFT A BIG TIP.

In sentence (17A), the deeper NP embedding is late in the first clause.

(17A) BECAUSE THE FOOD WAS PREPARED BY THE OWNER OF THE RESTAURANT,
(a) IT WAS ALWAYS CROWDED.
(b) IT WAS ALWAYS DELICIOUS.

The pronoun subject of the second clause could refer to either the first or second possible antecedent. The content of the second clause biased readers toward one or the other NP. In (8) and (8A), 'left a big tip' biases the reader toward 'the patron', while 'got a big tip' biases the reader toward 'the bartender'.

In summary, for Experiment 2A, there were 24 sentence frames, four versions in each frame: The pronoun referred to (i) the subject NP (8a and 17Ab), (ii) the NP embedded in the subject of the first clause (8Ab and 17a), (iii) the object NP (17b and 8Aa), (iv) the NP embedded in the object of the first clause (8b and 17Aa). Actually, in 8Aa and 17Aa, the antecedent is the object of a preposition. The experimental sentence frames were randomly interspersed among 48 other filler sentences. Subjects saw an equal number of examples of the four versions, but each subject saw only one version of any one sentence frame.

b. Experiment 2B: Subjects and Materials

Thirty-two subjects participated in Experiment 2B. Heretofore, all first clauses were subordinate to the second clause. Since this might be a factor influencing the process of pronoun coreference, the above experiment

was replicated with the additional factor of clause order. In Experiment 2B, the same materials were used as for Experiment 2A with alterations made in the subordinate conjunction to maintain overall sentence meaning. Instead of having four versions of each sentence frame, there were now eight: four original with subordinate-main clause order and four additional with main-subordinate clause order. Sentence (17) would now be read as (17B):

(17B) THE OWNER OF THE RESTAURANT PREPARED THE FOOD,
(a) SO IT WAS ALWAYS CROWDED.
(b) SO IT WAS ALWAYS DELICIOUS.

c. Experiments 2A and 2B: Design and Results

Experiment 2A had a 4-way design for the subject analysis: 32 subjects (as the repeated measure) were crossed with two locations of antecedent, two levels of embedding, and two sentence types. For the sentence analysis, 24 sentences were nested within two sentence types and crossed with two locations of antecedent and two levels of embedding. Experiment 2B had the same design as 2A with the additional factor of two levels of clause order for each of the analyses. Of the 768 possible responses in Experiment 2A, 14% were deleted. No subjects or sentences were deleted. In Experiment 2B, no subjects but six sentences were deleted. Of the 768 possible responses, 9% were deleted.

The predictions were that the main effects of location and of embedding would be significant, but that sentence type and clause order would not have an effect. No

interactions were expected. It was also predicted that the early location would be resolved significantly faster than the later location (as in Experiment 1), and that the shallow embedding would be resolved significantly faster than the deeper embedding. This latter expectation is consistent with the hierarchical search models that involve a left-to-right and top-down scan, "top-down" referring to the accessing of the higher, more prominent, nodes before the lower, less prominent, ones.

Results for Experiments 2A and 2B are shown in Table 3. For Experiment 2A, the main effect for location was significant for the subject and sentence analyses ($F(1,31) = 10.12$, $p<.01$, $MSe = 850571$ and $F(1,23) = 8.08$, $p<.01$, $MSe = 301331$, respectively) with the early location faster than the later one. This suggests that the antecedent search is from left to right. As expected, the type of sentence had little impact on search time. A significant effect was obtained in the sentence analysis for embedding ($F(1,22) = 4.91$, $p<.05$, $MSe = 170068$) with the shallower location faster than the deeper one. The effect was marginal in the subject analysis, $p=.08$. Of interest is the significant interaction in the subject and sentence analyses between embedding and sentence type ($F(1,31) = 7.67$, $p<.01$, $MSe = 556541$ and $F(1,23) = 8.61$, $p<.01$, $MSe = 179435$ respectively). The pattern indicates that there was an effect of embedding on search time in the subject-type sentences but not in the object-type. This may be due to

TABLE 3

Experiment 2
Means for Reading Comprehension Time
in milliseconds

Main Effects:			
Location:	Early	Late	**
2A	1074	1453	
2B	1082	1280	
Embedding:	Shallow	Deep	**
2A	1161	1369	
2B	997	1364	
Sentence-Type:	Subject	Object	-
2A	1264	1264	
2B	1260	1101	
Clause Order:	Sub-Main	Main-Sub	-
2B	1158	1203	
Interaction:			
Sentence Type X Embedding:			**
	Shallow Embedding	Deep Embedding	
Subject-type			
2A	1027	1503	
2B	976	1545	
Object-type			
2A	1294	1239	
2B	1019	1184	

the fact that the difference between levels of deep and shallow embedding was greater in the subject-type sentences than in the object-type sentences, as can be seen in Table 4. Shallow antecedents in subject-type sentences were on average 1.5 levels below S_2 and the deep antecedents were 4 levels below S_2. This compares with 2 and 3.5 levels for shallow and deep antecedents in the object-type sentences.

Table 4 also shows another unexpected finding: the passive early location is much faster than would be predicted simply on the basis of level and location. In active sentences, the early shallow location on level 1 requires an average of 1022 milliseconds to comprehend while the same location in a passive sentence takes only 793 msecs. For passive and active sentences, level 3 requires an average of 1508 msecs, however an antecedent located on level 3 in a passive early location takes 1000 msecs. This observation suggests that there is something special about passive sentences. When the antecedent is early in the passive sentence, independent evidence by Kail (1979) in a paradigm similar to that of Carammazza et al (1977, 1979), has shown that subjects overwhelmingly prefer the subject of the sentence as the referent for the pronoun in the second clause. This even seems to override the semantics of implicit causality of the main verb as described by Caramazza (1977, 1979).

Experiment 2B had similar results, which are also presented in Table 3. The main effect for location was

TABLE 4

Levels of Embedding in Subject-type and Object-type Sentences

	Level of Embedding	RT in msec.
Subject-type Sentence		
(A)		
WHEN THE OWNER OF THE RESTAURANT		
PREPARED THE FOOD,		
(deep early)IT WAS ALWAYS CROWDED.	3	1465
(shallow late)IT WAS ALWAYS DELICIOUS.	2	1266
(B)		
WHEN THE FOOD WAS PREPARED		
BY THE OWNER OF THE RESTAURANT,		
(shallow early)IT WAS ALWAYS DELICIOUS.	1	793
(deep late)IT WAS ALWAYS CROWDED.	5	1541
Object-type Sentence		
(C)		
AFTER THE BARTENDER PREPARED		
THE PATRON'S DRINK,		
(shallow early)HE GOT A BIG TIP.	1	1022
(deep late)HE LEFT A BIG TIP.	4	1461
(D)		
AFTER THE PATRON'S DRINK		
WAS PREPARED BY THE BARTENDER,		
(deep early)HE LEFT A BIG TIP.	3	1002
(shallow late)HE GOT A BIG TIP.	3	1551

significant for the subject analysis ($F(1,30) = 6.86$, $p<.05$), MSe = 365805. The early location required less time than the later one. This effect was marginal, $p=.08$, in the sentence analysis. Embedding showed only marginal effects in the sentence analysis, $p=.06$ and no effect in the subject analysis. Sentence type again showed no significant effects as was the case in Experiment 2A. The interaction of sentence type and embedding was significant in both the subject and sentence analyses ($F(1,30) = 6.24$, $p<.05$, MSe = 420048 and $F(1,16) = 8.26$, $p<.05$, MSe = 146132 respectively) with the subject-type sentence showing the effects of early and deep embedding similar to those of Experiment 2A. The order of the clauses did not make any difference in reading comprehension time. An effect would have been expected if the position of the dominant clause had an effect on the search process.

d. Testing the Models

A multiple regression analysis was performed on the data of Experiment 2A to test the predictions of the serial exhaustive search model with several variables used to predict reading comprehension time. They were: location of the appropriate antecedent measured in number of words from the beginning of the first clause (ranging from 2 to 12 words), level of embedding (ranging from 1 to 5), total number of words in the first clause (ranging from 5 to 12 words) and sentence type. Over all, 47% of the variance

was accounted for by the location and embedding. Sentence type and total number of words each accounted for about 1% of the variance. The exhaustive search model predicts a significant correlation between the number of words in the first clause and reading comprehension time. This was not the case. Both location and level of embedding were significantly correlated ($p<.05$) with reading comprehension time ($r=.56$ and $.36$ respectively). These results suggest that the hierarchical top-down left-to-right models provide a more accurate account of the search path than the right-to-left or serial exhaustive ones. However, as noted above, the account does not predict all the results, most notably, the faster than expected comprehension times for early antecedents in passive sentences.

Because of the confounding of location and depth of embedding in a right-branching language such as English, it is difficult to determine conclusively if the order of the search is a left-right scan at each level, starting with the most shallow level and proceeding to deeper ones, when no acceptable antecedent is found (i.e. whether it is breadth-first, or is, instead, depth-first). As noted above, this breadth-first approach (left-to-right and top-down), has been proposed by Hobbs (1978) as a useful procedure for computer resolution of pronoun reference.

Although not conclusive, the results of 2A and 2B suggest that Hobbs' proposal may be correct. In Table 4, the later antecedent in (B), (C), and (D) is as deeply or

more deeply embedded than the earlier one, and therefore longer reading times for the later antecedents are predicted by both the depth-first model and the breadth-first model. However, in (A), the earlier antecedent is more deeply embedded than the later one. Here, a breadth-first model would predict a longer search time for the early antecedent as compared to the late antecedent, while the depth-first model would predict a shorter search time for the early antecedent. An ANOVA was performed on the response times to the earlier antecedent as a function of the right-left difference in level. The analysis showed that reading-comprehension times for sentences with a -1 level difference, as in (A), are significantly slower ($F(3,44) = 3.51$, $p<.05$) than those with a greater than zero difference. These results support the breadth-first model.

4: Experiment 3

In the experiments just described, the pronoun was always in a subject role, i.e. the subject of the second clause. The materials for the next two experiments used sentences with the pronoun in two possible locations, the usual subject location and an additional object location. The additional factor of pronoun location in the subject or object of the second clause allowed testing of the Parallel Function hypothesis proposed by Sheldon (1974). In the Parallel Function model of pronoun resolution, comprehension times are predicted to be shorter in cases

where the pronoun and its antecedent occupy parallel grammatical roles (in surface or deep structure) than in cases where they occupy non-parallel roles.

Experiment 3 was divided into two parts. Experiment 3A used materials with only active first clauses. It was designed to examine the Parallel Function model in cases where its predictions are the clearest, that is, in sentences without 'by' phrases that complicate the interpretation of the grammatical roles played by the NPs in the sentence. Experiment 3B used a fully crossed design that included both an active and a passive version of the first clause that allowed two sets of predictions, one based on the surface structure of the sentence and the other based on the deep structure. The use of active first clauses in Experiment 3A does not differentiate between the surface and deep structure of a sentence.

a. Experiment 3A: Subjects, Materials, and Design

Thiry-two subjects participated in Experiment 3A. For each subject, there were eight practice sentences, 60 filler and 12 experimental sentences. In the materials for Experiment 3A, a contextually appropriate antecedent was located either early or late within the first clause, and the pronoun was either the grammatical subject or object of the second clause. In each sentence there were two nouns in the first clause with the same number and gender as the pronoun in the second clause. The pronoun was biased toward one or the other of these noun antecedents,

depending on the context of the second clause.

The master list had 12 sentence frames. Each frame had four versions, one each in which (a) the pronoun subject referred to the NP subject of the first clause, (b) the pronoun object referred to the NP subject of the first clause, (c) the pronoun subject referred to the NP object of the first clause, (d) and the pronoun object referred to the NP object of the first clause. The structure of these materials reflects both a minimum amount of embedding and a condition where the parallel and non-parallel grammatical functions are directly comparable. For example, in (18):

(18) AFTER THE FATHER HIT THE BOY,
    (a) AN ONLOOKER REPORTED HIM TO THE POLICE.(the father)
    (b) THE MOTHER COMFORTED HIM WITH A HUG.(the boy)
    (c) HE APOLOGIZED FOR THE VERY SEVERE BLOW.(the father)
    (d) HE CRIED OUT IN PAIN FOR HELP.(the boy)

'him' is the grammatical object and 'he' is the grammatical subject of the second clause. Sentence (18a) represents true non-parallel roles in that the object of the second clause refers to the subject of the first, while sentence (18b) represents true parallel roles in that the object of the second clause refers to the object of the first.

Experiment 3A had a three-way design. In the subject analysis, 32 subjects (as the repeated measure) were crossed with two locations of antecedent, early and late, and two levels of function, parallel and non-parallel. For the sentence analysis, 12 sentences were crossed with two locations of antecedent and two levels of function. Of the 394 possible responses 8.8% were deleted. One sentence

frame was deleted.

b. Experiment 3A: Results

The prediction for the analysis of variance was that the main effects for location and function would be significant. No interactions were expected. It was also predicted that the early location would be faster than the later one as in the previous experiments, and that parallel function would be faster than non-parallel function.

In Table 5, the location of the antecedent shows a significant main effect in the subject analysis ($F(1,31) = 4.50$, $p<.05$), MSe = 598175.0 and in the sentence analysis ($F(1,10) = 10.50$, $p<.01$, MSe = 154843.0) with the early position faster than the later location. This suggests that the order of the search is from left-to-right. Contrary to the predictions, the means show that non-parallel function is slightly faster than parallel function, but the difference is not significant. This suggests that parallel function is not a significant factor in ordering the search for pronoun referents nor for making an appropriate evaluation of possible antecedents. As expected, there were no significant interactions.

c. Experiment 3B: Subjects, Materials, and Design

In Experiment 3A, four different second clause contexts were used to bias the reader toward the subject or object antecedent in parallel and non-parallel cases. It might be argued that a better control would involve using a single context for each lexical antecedent (e.g. 'the

TABLE 5

Experiment 3A
Means for Reading Comprehension Time
in milliseconds

Main Effects:

Location:	Early	Late	*
	855	1192	
Function:	Parallel	Non-Parallel	-
	1072	974	

father' and 'the boy') and a syntactic manipulation to set up parallel and non-parallel conditions. This was the purpose of conducting Experiment 3B.

Thirty-two subjects participated in the experiment. For each subject, there were eight practice sentences, 48 filler and 24 experimental sentences. The materials were similar to those used in Experiment 3A with one additional condition: the passive voice was used to switch the relative locations of the subject and the object NPs of the first and second clauses while maintaining the context of the sentence. For example, sentence (18) was modified to (18A).

(18) AFTER THE FATHER HIT THE BOY,
(18A) AFTER THE BOY WAS HIT BY THE FATHER,
a)HE WAS REPORTED TO THE POLICE BY AN ONLOOKER.(the father)
b)AN ONLOOKER REPORTED HIM TO THE POLICE.(the father)
c)HE WAS COMFORTED WITH A HUG BY THE MOTHER.(the boy)
d)THE MOTHER COMFORTED HIM WITH A HUG.(the boy)

'He' in (a) and 'him' in (b) refer to NP1 in (18) and to the object of the preposition in (18A). 'He' in (c) and 'him' in (d) refer to NP_2 in (18) and to NP_1 in (18A).

In this experiment, true parallel function refers to those cases where the pronoun and its antecedent occupy corresponding locations in the syntactical structure of their respective clauses, e.g. (18a). True non-parallel function refers to the comparable cases where the corresponding locations (subject, direct object) are interchanged, e.g. (18b). I will use the general term of non-parallel function to refer to any other case, e.g. (18Aa).

The master list had 24 sentence frames. Each frame had eight versions: two in which the pronoun subject of the second clause referred to the NP subject of the first clause (18a and 18Ac); two in which the pronoun object of the second clause referred to the NP subject of the first clause (18b and 18Ad); two in which the pronoun subject of the second clause referred to an NP object in the first clause (18c and 18Aa); and two in which the pronoun object of the second clause referred to an NP object in the first clause (18d and 18Ab). Sentences 18a, 18d, and 18Ac show true parallel function of pronoun and antecedent, and sentences 18b, 18c,and 18Ad represent the comparable true non-parallel function. It should be noted that sentences 18Aa and 18Ab do not clearly fit into either category since 'father' is the object of a preposition and not a direct object in both sentences. Although they are not fully comparable to the other cases of parallel and non-parallel function, 18Aa and 18Ab were included in the statistical analyses of the data for design purposes.

The use of the active and passive voice in the first clause served to interchange the relative locations of the antecedents from early to late and late to early in the clause. The use of the active and passive voice in the second clause served to vary the grammatical function of the pronoun from direct object in the active version to surface structure subject in the passive version.

Experiment 3B had a four-way design. For the subject

analysis, 28 subjects (as the repeated measure) were crossed with two positions of antecedent (early and late), two first clause types (active and passive), and two levels of function (parallel and non-parallel). For the sentence analysis, 24 sentences were crossed with two positions of antecedent, two first clause types, and two levels of function. 16% of the total of 768 responses were deleted. Four subjects' data were deleted. As described above in Experiment 3B, one sentence was deleted because all subjects chose the non-intended antecedent in at least one cell of the design.

d. Experiment 3B: Results

The prediction for the analysis of variance was that, again, there would be a main effect of location with the early location faster than the later one. In contrast to the findings of 3A, it was predicted that the main effect of function would be significant because of better control for the biasing context in the current experiment.

In Table 6, the position of the antecedent shows a significant main effect in the subject analysis ($F(1,27) = 4.83$, $p<.05$, $MSe = 703296.4$) and a marginal effect in the sentence analysis ($F(1,22) = 4.17$, $p<.10$, $MSe = 492686$) with the early location faster than the later location. This suggests, again, that the order of the search is from left-to-right. Once again, the main effect for parallel function was not obtained.

There is, as noted above, a problem with some of the

TABLE 6

Experiment 3B
Means for Reading Comprehension Time
in milliseconds

Main Effects:

Location:	Early	Late	*
	1037	1265	
Function:	Parallel	Non-Parallel	-
	1117	1185	

Rank ordering of the comprehension times of the true parallel and non-parallel items.

Example Sentence	Reading Time	Surface Structure Analyses	Deep Structure Analyses
18a	1010	Subject Parallel	Subject Non-Parallel
18b	1010	Subject Non-Parallel	Subject Non-Parallel
18Ac	1012	Subject Parallel	object Parallel
18Ad	1028	Subject Non-Parallel	Object Parallel
18d	1159	Object Parallel	Object Parallel
18Ab	1247	++	Subject Non-Parallel
18c	1296	Object Non-Parallel	Object Parallel
18Aa	1432	++	Subject Non-Parallel

++ Not true parallel and non-parallel function.

sentence materials, i.e. 18Aa and 18Ab where the parallel-object designation is not completely accurate. If only the means are considered in which there is true parallel function and comparable true non-parallel function and these means are put into rank order (as at the bottom of Table 6), the Parallel Function Hypothesis can be examined more clearly. However, the ranking still fails to confirm the hypothesis. One observation that can be made of the ranking of the reading times is that when the reference is to the subject of the first clause, less time is required to find the correct antecedent than when the reference is to the object.

The preceding discussion considers only the surface structure of the sentence in designating parallel and non-parallel roles, and this Surface Parallel Function Hypothesis has clearly not been confirmed. The related alternative hypothesis is Deep Parallel Function. In this interpretation, sentences 18c, 18d, 18Ac, and 18Ad would be examples of true parallel function, while 18a, 18b, 18Aa, and 18Ab would be examples of true non-parallel function. In Table 6, the labels corresponding to deep roles show that the predictions of this hypothesis are also unsupported. Confirmation of the Deep Parallel Function Hypothesis would require that all the sentences with true parallel function be faster than those with true non-parallel function.

5: Summary of Results of Experiments 1-3

Thus far, the evidence from experiments 1 and 2 is consistent with the model proposed by Hobbs for a breadth-first, left- to-right, hierarchical search. However, Experiments 3A and 3B provide an opportunity for testing another aspect of the model not previously covered. According to this search algorithm, described earlier, the search path must ascend from the pronoun to the topmost S node before the preceding subordinate clause can be searched. This means that a longer path must be followed when the pronoun is in the object location than when it is in the subject location. (Compare Figures 10A and 10B.) If the ascent to the topmost S is part of the search for coreferents, then the location of the pronoun can be expected to affect comprehension time. The data from 3A and 3B do not support this notion. There are no significant differences in the comprehension times for sentences with pronouns in either location.

The Hobbs model does a good job of predicting comprehension times when the variables of location and depth of antecedents are manipulated in the first clause. The failure to find an effect of pronoun location might mean that the search is a clausal one and that after the reader fails to find a syntactically possible antecedent in the second clause (coreference between subject and object is syntactically blocked), the search goes directly to the previous clause.

FIGURE 10A

Structural diagram of sentence (18a)

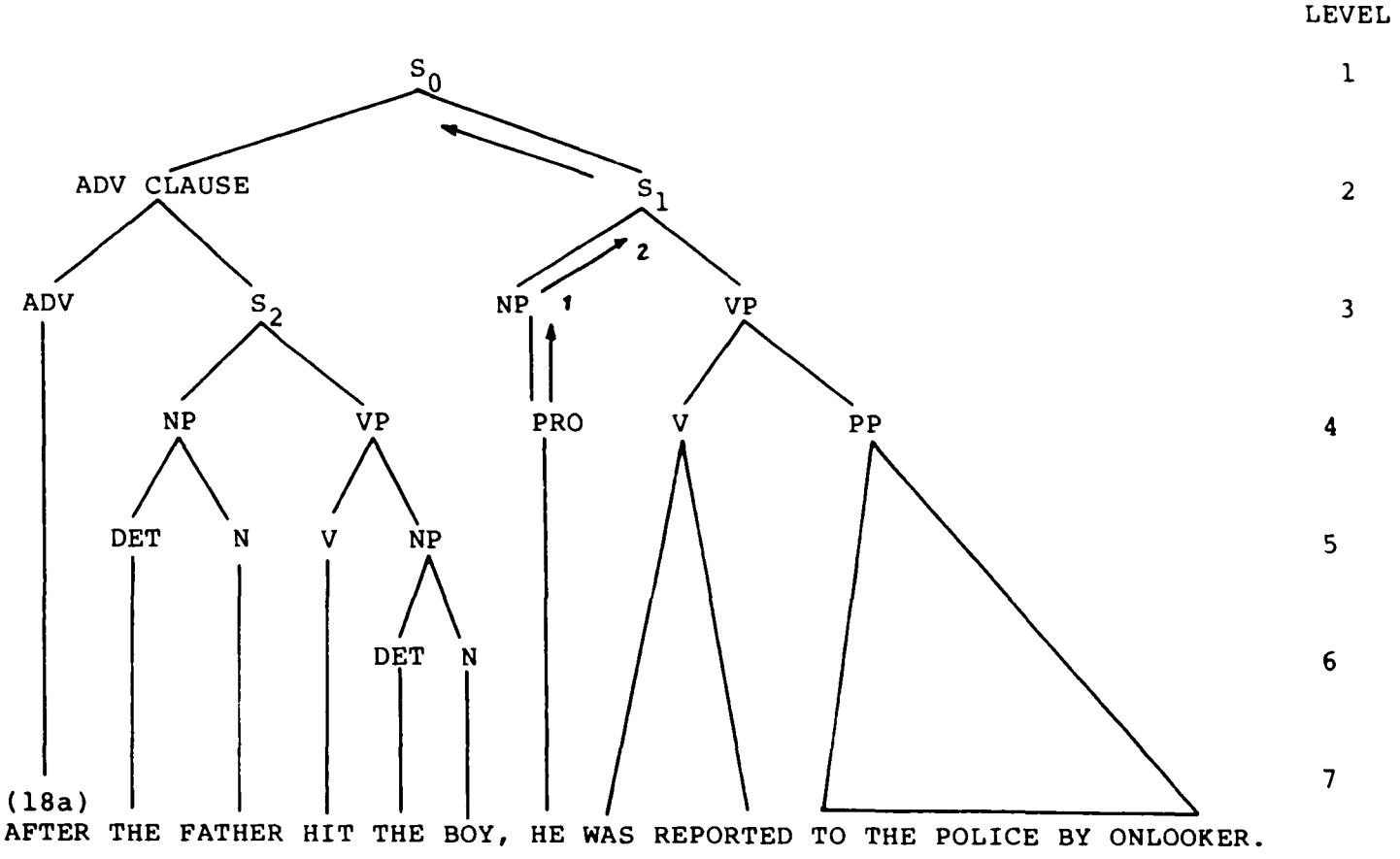
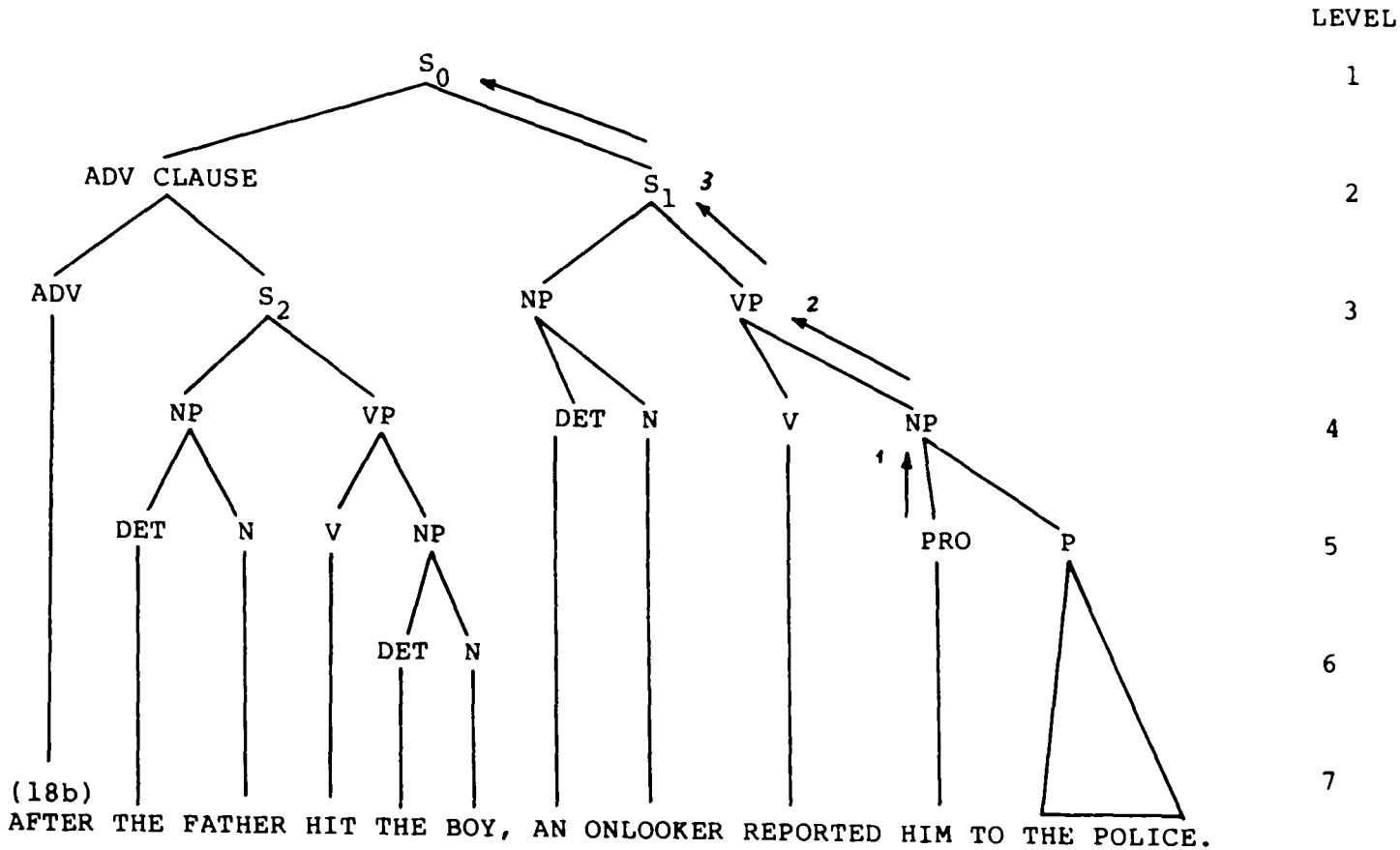


FIGURE 10B

Structural diagram of sentence (18b)



DISCUSSION AND CONCLUSIONS

1: The Proposed Search Model

The pattern of results in the five experiments (1-3B) suggests that in the absence of unambiguous gender cues, there is a clausal left-to-right top-down breadth-first search of the first clause for an appropriate antecedent of an anaphoric pronoun. These results support a search model that is a variation of the algorithm proposed by Hobbs (1978). The choice of an antecedent for the pronoun is governed by the linguistic constraints on pronominal reference, and, within those constraints, the semantics and pragmatics of the sentence, but the time required to make that choice is governed by the surface structure of the preceding clause. This model differs from Hobbs' proposal because the data from Experiments 3A and 3B show no effect on comprehension time of pronoun's location within its clause. I will refer to this as the clausal breadth-first model.

2: A Memory Strength Account of the Search Order

A point that must be addressed, however, is the parsimony of having such an elaborate search procedure just for pronoun resolution. Is the search special for this one purpose or is it a by-product of a more general phenomenon such as memory strength or level of activation? The work by Holmes and Forster (1972) showed differential levels of recall in rapid serial visual presentation (RSVP) based on part of speech. Mehler et al. (1978) showed that, for

adjectives, it was the structural role as head of phrase or as embedded modifier that determines the accuracy of recall of adjectives. Forster (1970) and Mehler et al. (1978) have argued that in a RSVP task, with words appearing for such brief exposures, recall is in large part related to the processing load at the time of the input of the word.

The proposed search model here might reflect the strength of the memory for the NPs in the sentences without relating necessarily to the pronoun resolution process per se. This means that, in selecting candidate pronouns, the reader first selects the strongest, then the next strongest, and so on until a suitable antecedent is located. The memory strength for the items reflects the structure of the sentence and thus, the apparent search path may just involve a ranking of the various weighted constituents with the 'heaviest' being the most available.

a. Experiment 4

This notion of memory strength is predicated on the idea that while all items are in STM, they may have different degrees of accessibility. Experiment 4 was designed to test memory for NPs using the same materials as those used in Experiment 2. This allowed a comparison with comprehension time results. A RSVP task, similar to that of Holmes and Forster, was used to test for recall of the NPs of each sentence.

b. Subjects, Materials, and Procedure

Thirty-two subjects participated in the study. The

materials were exactly the same as those for Experiment 2A. Since the RSVP technique used in this study is new to the experiments presented in this paper, I will give a detailed review of the procedures. A moderately fast (100 msec per word) RSVP rate was used in this experiment. The sentences were displayed on a microcomputer monitor one word at a time. The experimenter read aloud the following instructions:

> "This is an experiment about perception and sentence memory. You will see sentences presented one word at a time on the screen in front of you. Each word will appear in the center of a small window that will be shown on the screen. As each word appears, it will erase the preceding word. You will have to watch very carefully in order to see all the words. When the sentence is completed, you will be asked to repeat as much of it as you can aloud. After saying the sentence, press the <ENTER> key to continue. After a short pause, the next sentence will be presented.
>
> "In order to acquaint you with the task, we will start with several practice sentences. Each one will begin with the word 'Ready' at the center of the window. If you have any questions, please ask the experimenter before going on."

Verbatim recall responses were recorded on tape and were then scored for the presence of two NPs, one shallow and one embedded NP. For example, in (8), 'the bartender' is the shallow NP and 'the patron' is the deep one. The dependent measure was percent recall for these NPs.

In Experiments 1 - 3B, the reading comprehension time was used as a measure of the search time required to find the contextually appropriate antecedent. However, the RSVP data provide information about both the appropriate and the inappropriate antecedent because the subject is asked to

recall the entire sentence. This provides the opportunity to measure memory for a NP whether or not it is the appropriate referent. If memory strength is independent of the search process, then the factors of location and embedding will not interact with the contextual approporiateness of the antecedent. For example, the propability of recalling 'the patron' in (8) will not be affected by the difference in the second clause context, 'left/got a big tip'. In one case, 'the patron' is the approporiate antecedent and in the other it is the inappropriate one. If, on the other hand, recall is affected by the NP's status as an appropriate referent for the pronoun, then the results may be due to the search process itself. In other words, memory for a NP may be strengthened by virtue of its being referred to by a pronoun. If this were the case, then memory strength would be the result of the search rather than a guiding factor.

c. Design and Results

The data for the subjects was analyzed in an ANOVA with a 3-way factorial design. In the subject analysis, 32 subjects (as the repeated measure) were crossed with two NP locations (early and late within the first clause), two levels of embedding (shallow and deep), and two reference possibilities (appropriate and inappropriate). The ANOVA for the sentence analysis crossed 24 sentences with two NP locations, two levels of embedding, and two reference possibilities.

In Table 7, the means show a significant effect in the sentence and subject analyses for location, ($F(1,23) = 17.23$, $p<.01$, $MSe = 2.18$ and $F(1,31) = 32.38$, $p<.01$, $MSe = .028$ respectively) with the early location recalled more often than the later one. There was also a significant effect in both analyses for embedding ($F(1,23) = 5.85$, $p<.05$, $MSe = 3.99$ and $F(1,31) = 26.39$, $p<.01$, $MSe = .025$, respectively) with the shallow NP recalled more often than the deep one. The latter result is in accordance with Holmes and Forster's (1972) findings and those of Mehler et al. (1978). Appropriateness of the NP seemed to make no difference in the probability of its recall, nor did this factor interact location and embedding. This result suggests that the effects of location and embedding on memory are determined on-line or at least before coreference is established. In fact, the recall task did not require subjects to state which antecedent the pronoun referred to, and in many cases the pronoun was not even recalled.

3: Extensions of the Clausal Breadth-First Model

It makes no difference for the predictions of the clausal breadth-first model whether the reader uses the structure of the sentence or the memory strength of the NPs to determine the order in which antecedents are evaluated. In either case, the model seems to be well supported by the data from Experiments 1 - 3B, but it is unclear to what extent the results can be generalized to other cases of

TABLE 7

Experiment 4
Average number of items recalled
of a total of eight

Main Effects:			
Position:	Early	Late	**
	5.58	4.73	
Embedding:	Shallow	Deep	**
	5.51	4.80	
Reference:	Appropriate	Inappropriate	-
	5.10	5.21	

pronoun resolution.

In all five experiments it was assumed that the search for the antecedent took place in STM while surface structure representation was still available. The materials consisted of only two-clause anaphoric sentences with the pronoun in the second clause. With one exception, all the materials were syntactically, but not semantically, ambiguous. These restrictions on the materials were imposed by design to limit their scope for the purposes of testing the various search hypotheses. However, once evidence for a hypothesis, the clausal breadth-first model, is demonstrated, it is important to discover the extent to which it will generalize. There are several ways to extend the range of this work to other cases of pronoun resolution both in single sentences and in multiple sentences, i.e. discourse.

a. Single Sentences: Anaphora

In unambiguous, gender cued, sentences, it would be of interest to know if there is a clausal breadth-first search for the syntactically appropriate antecedent. The results of Experiment 1 do not suggest such a search. However, if less global measures than the sentence-final comprehension time were used, then one might get differential results depending on the location and the depth of embedding of the antecedent. One such measure might be the on-line reading time at the pronoun or verb of the second clause.

Using other sentence constructions e.g. coordinate

conjunctions, that permit anaphoric reference, it is possible to test for evidence of a search across different structures. In fact, Corbett and Chang (1983) used such materials in their work and found consistently faster probe recognition times for early antecedents of the pronoun than for late ones. This suggests that the results of Experiments 1 - 3B will generalize to coordinate constructions.

The conclusion drawn by Corbett and Chang from their data is at odds with the predictions of the clausal breadth-first search model as outlined in this paper. In particular, they have concluded that all syntactically possible antecedents of an anaphoric pronoun are accessed in the resolution process. After this initial multiple access of all possible antecedents, a choice is made on the basis of pragmatic and semantic considerations. This model was preferred to an alternative hypothesis which proposed a single direct access of the correct antecedent based on the semantics of the sentence. Their conclusion rests on the difference in recognition times for a probe word following a sentence containing a pronoun and one containing a repeated proper name. For example, in

(19) BOB THREW A CUSTARD PIE AT VINCE BUT
  (a) HE MISSED.
  (b) BOB MISSED.

recognition times for the post-sentence probe 'Vince' are faster for (19a) than for (19b) suggesting that even an inappropriate candidate is accessed. The hierarchical

search model would predict that 'Vince' need not be accessed by the search if 'Bob' is judged to be appropriate. In all the other materials that Corbett and Chang used, the inappropriate antecedent was found in the subject of the first clause (therefore early), and in such cases the hierarchical model would also predict that both antecedents will be accessed. The hierarchical search predicts the order in which the potential antecedents will be accessed, in this case 'Bob' before 'Vince'. In fact, the largest differences in recognition times in their data represent the difference between early and late locations regardless of whether the name occupying the location is the appropriate antecedent.

The clausal breadth-first model predicts the outcome of the Corbett and Chang experiments and is, in fact, more in keeping with the actual results of their work. The proposed search model predicts access of the candidates in the order of the structure of the clause, each evaluated for plausiblity before accessing the next. Corbett and Chang's conclusion of multiple access does not address the anomalies of their data. The probe recognition time for the pronoun condition where the non-antecedent is in the subject location was faster than that for the antecedent in the object location as in (20a).

(20) BONNIE PASSED THE BASKETBALL TO CLAIRE AND
  (a) SHE SANK A JUMPSHOT.
  (b) CLAIRE SANK A JUMPSHOT.

In other words, recognition time for 'Bonnie' after (20a)

was faster than for 'Claire'. They explained this result by attributing it to parallel function. From the data of Experiments 3A and 3B described here, that explanation can not be considered credible since there is no evidence that parallel function has an effect on ordering the search for plausible antecedents. Instead, a more consistent interpretation of Cobett and Chang's results involves a search that at least progresses from left to right. The top-down aspect of the search proposal can not be addressed using their materials.

b. Single Sentences: Cataphora

Another logical extension of the clausal breadth-first search model still within the framework of a single sentence involves the cataphoric pronoun. In the case of cataphoric coreference, the pronoun is encountered prior to its antecedent, as in example (5) repeated here:

(5) WHEN SHE BROKE THE TRICYCLE,
THE MOTHER GAVE THE GIRL A NEW ONE.

The process of resolving the reference in such materials may be different from that used for anaphoric pronouns. There are at least two alternate hypotheses: Either the connection between the pronoun and its referent is held in abeyance until the entire second clause is read, or the first NP encountered, 'the mother', is considered to be the referent until proven inconsistent with the context of the second clause. The first hypothesis entails a memory load that may be considerable, and the second contains the possibility of making the wrong choice and necessitating a

correction process. There is some support for the latter hypothesis.

Cowart and Cairns (in press) used cataphoric pronouns in their experiments. Although they did not address the issue of multiple antecedents and the search for the correct one, it is, however, of interest to note their procedures, results, and interpretations. They examined the relationship between 'reference processing' and the operations of syntactic and message processors in Forster's model. More specifically, their work is directed toward testing whether semantic/pragmatic information is used in syntactic processing as suggested by Tyler and Marslen-Wilson (1977).

Tyler and Marslen-Wilson presented sentences containing structurally ambiguous VERBing NOUNs such as 'flying kites' and preceded them with a context clause that biased subjects toward either a plural NP interpretation or a singular, gerundive interpretation of the phrase. For example, the sentence fragment 'If you know how to handle sudden gusts of wind, flying kites ...', biases the reader to a singular interpretation of 'flying kites' while 'As they glide gracefully over the city, flying kites ...', biases the reader to a plural NP interpretation. Tyler and Marslen-Wilson concluded that the bias of the first clause affects the syntactic parsing of 'flying kites' in the second clause and therefore is support for the interactive levels model.

Cowart and Cairns have provided another interpretation of these results, by showing that the bias toward the plural NP interpretation is due to the presence of the pronoun 'they' in the first clause. They refer to this as the Pronoun Bias Effect (PBE). One of the most interesting properties of the PBE is that it obeys syntactic constraints on coreference but is insensitive to semantic and pragmatic context. For example, the fragment 'Whenever they lecture during the procedure, charming babies ...' shows the PBE even though subjects' general knowledge would lead them to reject 'charming babies' as the antecedent for 'they'. On the other hand, the fragment 'If they want to believe that visiting uncles ...' does not show the PBE and, in fact, here the pronoun can not refer to 'visiting uncles' on syntactic grounds (cf Langacker and Reinhart in INTRODUCTION).

Cowart and Cairns have shown that a search for a referent can proceed without the use of semantic and pragmatic context though, of course, subjects must ultimately use this context in order to reject the connection between 'they' and 'charming babies'. In this respect, these results are consistent with the proposed interpretation of the experiments discussed in this paper, i.e. a structurally determined search finds candidates that are then evaluated on the basis of context.

c. Intersentential Pronominal Reference: the Search for Antecedents in Discourse

Another aspect of this work is in the way in which pronoun resolution in a single sentence relates to pronoun reference within a text or discourse. In her dissertation, Guindon (1984) concluded that antecedents of pronouns are accessed according to either their topicality or recency. In a text of five sentences, coreference for a pronoun in the fifth sentence was resolved more quickly when either its antecedent was recent (in the fourth sentence) or it was the topic of the passage than when the antecedent was not the topic or was located farther (one to three sentences) away from the pronoun.

Guindon (1985) used the concept of focusing (Grosz 1977) as an extension of the concept of 'topic' to predict the ease with which the antecedent for a pronoun can be referenced. Guindon defines focusing as the "process of selecting a subset of the discourse items and making them highly available for future computations". While not predicting the order of search within the sentence or between sentences, Guindon predicts that if a pronoun refers to the topic of a passage or if it refers to the most recently mentioned NP, coreferencing is easier and faster. On the other hand, if the pronoun refers to items that are not in "focus", i.e. neither the topic nor the recent items, then coreferencing requires more time.

Another approach to the intersentential aspect of

pronominal coreference in discourse is described by Clark and Sengul (1979). It involves a strategy to identify Old- or Given-information in memory so that New-information can be included and the memory revised. Given-information is defined as the information the listener is expected to know already and New-information as that which the listener is not expected to know already (Haviland and Clark, 1974). Clark and Sengul (1979) apply the Given-New strategy to pronouns as follows: listeners are assumed to treat pronouns as Given-information and to search their memory for a plausible referent. When the referent is identified, the New-information is attached to it. Their results suggest that the more relevant and recent the referent, the less time is necessary to access the memory and link the New-information to it.

The limitations of Given-New and of Focus make it difficult to describe the process of pronoun resolution in conditions that are not optimal, e.g. other than topical. Clearly, readers are able to find an appropriate coreference even under the adverse conditions of embedding.

The following is a summary of the predictions extrapolated from the discourse hypotheses for the time required to choose an appropriate pronominal antecedent. Focus predicts that the topic (subject NP) and/or most recent NP (object NP) would require the least amount of time. References to embedded NPs would require more time. The Given/New strategy predicts that the subject NP of an

active sentence would require the least amount of time and makes no predictions for object or embedded NPs. These approaches are not specific enough to account for the pattern of results obtained in the Experiments 1 - 4, but in all fairness, it should be noted they were not designed to handle intrasentential coreference.

How general is the clausal breadth-first search? It can be seen to operate in an immediately prior clause as shown in these experiments, but is it also used to search clauses that are no longer in STM, i.e. clauses found earlier in the discourse? To test the limits of this type of search, the materials of Experiments 2A and 2B might be converted into a series of short sentences such as examples (21) and (22).

(21) SAM'S NAUGHTY DAUGHTER KICKED THE POSTMAN.
ANGRILY HE THREATENED TO SUE.

(22) THE BARTENDER SERVED THE PATRON'S DRINK.
SEVERAL HOURS PASSED.
FINALLY HE LEFT A BIG TIP.

In (21) the antecedents are in the prior clause, but this clause is separated from the pronoun by a sentence boundary. In (22) the antecedents are two sentences before the pronoun. Will the comprehension times for the sentence containing the pronoun show the same effects of the antecedents' linear location and depth of embedding that were found in the intrasentential materials? Based on prior work, it seems unlikely that the surface structure of the first sentence in a three, four, or five sentence paragraph is available by the time a pronoun is encountered

in the last sentence. If different search strategies are at work in discourse processing, then it should be possible to find the point at which the hierarchical model no longer predicts resolution time. From this point on, factors such as focus (topic and recency) and given/new can be expected to predominate.

4: General Implications for Psycholinguistic Theory

There are three reasons why the results reported in Experiments 1 - 4 are of broader significance. First, they provide a clear view of at least one way in which syntax and semantics are used in language comprehension. Second, they can be clearly placed in the temporal sequence of sentence processing. Third, they offer an explanation of a psycholinguistic process through the action of a more fundamental psychological mechanism.

a. The debate between the autonomous and interactive theories of sentence processing is fundamentally a debate about the ways in which syntax and semantics are permitted to interact. The results of the experiments reported here provide a more detailed view of the way in which syntactic and semantic information can be used. With regard to pronoun resolution, the autonomy debate has been cast in terms of two alternative models by Corbett and Chang (1983). In one model, multiple-access, all potential antecedents are accessed in memory when a pronoun is encountered, and only later is the selection of the appropriate one made on the basis of context. This

represents the autonomous position. In the other model, unique-access, the effect of context guides the choice in such a way that only the appropriate antecedent is accessed. This represents the interactive position. However, these two models do not exhaust the logical possibilities for representing the theoretical positions. In fact, a different account, the one proposed here, does a better job of explaining the data, not only in Experiments 1 - 4 but also in Corbett and Chang's work, as noted earlier. The value of the present work is that it gives us a better way of characterizing the independence of syntax.

b. The search process that is the subject of study in Experiments 1 - 3B can be relatively well fixed within the temporal sequence of sentence processing. Because the surface structure of the second clause (active vs passive) did not affect the time course of pronoun resolution in Experiment 3B, the search can be assumed to take place after the syntactic processing of that clause. Furthermore, because the selection of the correct antecedent depends upon semantic analysis, it is also reasonable to assume that the effects demonstrated here either follow or occur during semantic processing. However, the fact that the particular biasing context (left/got a big tip) did not affect the resolution times suggests that the search comes after the semantic analysis of the second clause.

If, as I have argued here, pronoun resolution occurs

after both the syntactic and the semantic analyses are completed, then it is a very late event in the course of sentence processing. As noted in the Introduction, at such a late stage, either the autonomous model or the interactive one could accommodate a finding of interaction between syntactic and semantic information. It is therefore, all the more remarkable that the results point to no interaction.

c. There are at least two ways of viewing the clausal breadth-first search, one as a kind of 'walk' along the branches of a surface structure tree, and the other, as a retrieval of items based on their short-term memory strength. The first view seems more compatible with a computational approach such as Hobbs' (1978), but from a psychological perspective it seems less attractive. Perhaps memory strength is just the psychological mechanism which mediates the psycholinguistic process of searching for an antecedent.

This would not be the first time a psycholinguistic phenomenon has been explained in terms of a more general cognitive one. For example, the psycholinguistic phenomenon of subjective click movement can be accounted for by attributing it to the structural integrity of the clause as a unit in perception (Fodor and Bever, 1965; Fodor, Bever, and Garrett 1974), or to the variation in attention during sentence processing (Bever and Hurtig, 1975; Abrams and Bever, 1969). The latter account appeals

to a more basic psychological mechanism to explain the data, and in a similar way the memory strength account of the results in Experiments 1 - 3B ties pronoun resolution to more general psychological memory phenomena.

Of course, explaining a psycholinguistic effect in terms of the variation in attention or memory strength simply pushes the question one step further back: Why does attention or memory strength vary as a function of syntactic structure? Bever and his colleagues attribute fluctuations in attention to the parsing strategy that listeners use in analyzing clauses. Mehler er al. (1978) also view the differences in memory strength for adjectives as a consequence of parsing, in particular attributing it to differences in the reader's expectation of the syntactic role the adjective will play. Experiment 4 suggests that memory strength for NPs also may vary according to their location in the hierarchical structure of the sentence and that this effect is not specifically tied to pronoun resolution. Once we have a theory of parsing that explains why late embedded NPs are recalled less often than shallow early ones, we will have a more satisfactory explanation for the search order. Until then, our accounts must remain descriptive.

5: Conclusions

Comprehension time is faster in the presence of gender cues for pronoun resolution than in their absence, a finding that is consistent with that of Ehrlich (1980). In

the gender cued case there is no difference in sentence-final reading comprehension time as a function of linear location of the antecedent.

When there are multiple possible antecedents comprehension time is shorter for earlier antecedents than for later ones, and for shallower antecedents than for deeper ones. Comprehension time is slower for a more deeply embedded early antecedent than for a less deeply embedded late antecedent, in accordance with the prediction of a breadth-first model such as that of Hobbs (1978). There is no evidence that comprehension time is affected by the order of clauses, subordinate/main or main/subordinate.

All other things being equal, comprehension time is faster for antecedents that are subjects of passive sentences, as suggested by the work of Kail (1979). Comprehension time is unaffected by the location of the pronoun, suggesting a clausal search that differs from Hobbs' (1978) proposal.

Comprehension time is unaffected by the particular biasing context of the second clause and by the role of the pronoun in surface or deep structure. This latter finding disconfirms the predictions of the parallel function hypotheses.

Memory for NPs in a serial visual presentation paradigm shows effects of linear location and depth of embedding, suggesting that the search path may be a reflection of memory strength.

APPENDIX

Sentences for Experiment 1

SINCE THE WOMAN DELIGHTED THE KING, SHE WAS EMPLOYED IMMEDIATELY.

SINCE THE WOMAN DELIGHTED THE KING, HE REQUESTED CONSTANT ATTENDANCE.

AFTER THE FATHER HIT THE GIRL, HE APOLOGIZED FOR THE BLOW.

AFTER THE FATHER HIT THE GIRL, SHE RAN AWAY FROM HOME.

EVENTHOUGH TOM BUMPED MARY, HE REFUSED TO ADMIT IT.

EVENTHOUGH TOM BUMPED MARY, SHE PRETENDED IT DIDN'T HURT.

BEFORE SUZY APPROACHED THE CHAIRMAN, SHE FELT VERY NERVOUS.

BEFORE SUZY APPROACHED THE CHAIRMAN, HE ADJOURNED THE MEETING.

AFTER THE BOXER SLAPPED THE WIFE, HE WON THE CHAMPIONSHIP BOUT.

AFTER THE BOXER SLAPPED THE WIFE, SHE SUED FOR DIVORCE IMMEDIATELY.

WHEN THE WOMAN TELEPHONED THE DOCTOR, SHE FELT MUCH BETTER.

WHEN THE WOMAN TELEPHONED THE DOCTOR, HE PRESCRIBED SOME MEDICINE.

JUST AS THE REPORTER SPOTTED THE PRINCESS, HE TOOK SOME QUICK PHOTOGRAPHS.

JUST AS THE REPORTER SPOTTED THE PRINCESS, SHE GOT IN THE LIMOSINE.

WHEN THE WOMAN CRITICIZED MICHAEL, SHE TRIED TO BE CONSTRUCTIVE.

WHEN THE WOMAN CRITICIZED MICHAEL, HE PRETENDED NOT TO

CARE.

BEFORE THE DEAN SUSPENDED THE SCHOOL NURSE, HE LOOKED FOR A SUBSTITUTE.

BEFORE THE DEAN SUSPENDED THE SCHOOL NURSE, SHE LOOKED FOR ANOTHER JOB.

AFTER THE MOTHER SCOLDED THE SON, SHE PUNISHED THE REST OF THE CHILDREN.

AFTER THE MOTHER SCOLDED THE SON, HE SLAMMED THE KITCHEN DOOR VERY ANGRILY.

AFTER THE PROFESSOR PRAISED THE STUDENT, HE DECIDED TO WAIVE THE LAST EXAM.

AFTER THE PROFESSOR PRAISED THE STUDENT, SHE DECIDED NOT TO STUDY ANY MORE.

WHEN SALLY KICKED THE POSTMAN, SHE EXPECTED SOME KIND OF RETALIATION.

WHEN SALLY KICKED THE POSTMAN, HE REFUSED TO DELIVER THE MAIL.

UNTIL THE LAWYER DEFENDED THE WOMAN, HE WOULDN'T ACCEPT ANY RETAINER.

UNTIL THE LAWYER DEFENDED THE WOMAN, SHE WAS OUT ON BAIL.

SINCE THE PARTNER TRIPPED THE PRIMA DONA, HE HAD TO MAKE A PUBLIC APOLOGY.

SINCE THE PARTNER TRIPPED THE PRIMA DONA, SHE COULD NOT PERFORM ON OPENING NIGHT.

AFTER THE POLICEMAN ARRESTED THE GIRL, HE WROTE DOWN THE CHARGES AT THE POLICE STATION.

AFTER THE POLICEMAN ARRESTED THE GIRL, SHE WAS ALLOWED TO

MAKE ONE TELEPHONE CALL.

WHEN THE MODEL PRESENTED THE PRODUCT, SHE CONVINCED PEOPLE TO BUY THE BRAND.

WHEN THE MODEL PRESENTED THE PRODUCT, IT SEEMED TO BE AN EXCELLENT BUY.

ALTHOUGH THE LADY PAID THE BOY, SHE WAS DISSATISFIED WITH THE QUALITY OF WORK.

ALTHOUGH THE LADY PAID THE BOY, HE WANTED TO BET A BETTER JOB ELSEWHERE.

EVENTHOUGH A DOCTOR HELPS PATIENTS, HE SOMETIMES MAKES MISTAKES.

EVENTHOUGH A DOCTOR HELPS PATIENTS, THEY OFTEN DON'T PAY.

SHORTLY AFTER THE WAITRESS RECOGNIZED THE SUSPECT, SHE DECIDED TO RETRACT THE TESTIMONY.

SHORTLY AFTER THE WAITRESS RECOGNIZED THE SUSPECT, HE WAS CONVICTED OF THE CRIME.

EVENTHOUGH THE NURSEMAID CHASED THE NAUGHTY BOY, SHE COULD NOT CATCH UP.

EVENTHOUGH THE NURSEMAID CHASED THE NAUGHTY BOY, HE WAS ABLE TO ESCAPE.

WHILE THE SECRETARY FEARED THE BOSS, SHE WOULDN'T ASK FOR A RAISE.

WHILE THE SECRETARY FEARED THE BOSS, HE COULD KEEP THE WAGES LOW.

EVENTHOUGH THE PRISONERS ANGERED THE WARDEN, THEY WERE NOT PUNISHED SEVERELY.

EVENTHOUGH THE PRISONERS ANGERED THE WARDEN, HE DECIDED NOT

TO PROSECUTE.

AFTER THE PRIEST PREPARED THE GIRL FOR CONFIRMATION, HE SAID THE CONFIRMATION MASS.

AFTER THE PRIEST PREPARED THE GIRL FOR CONFIRMATION, SHE WAS GIVEN CONFIRMATION CANDELS.

WHEN FREDDY SAW THE PROM QUEEN, HE BOWED LOW IN AMAZEMENT.

WHEN FREDDY SAW THE PROM QUEEN, SHE SMILED BENEVOLENTLY TO ALL.

AFTER THE HOTEL MANAGER REGISTERED THE TOURIST, HE DECIDED TO RAISE THE RATES.

AFTER THE HOTEL MANAGER REGISTERED THE TOURIST, HE DECIDED TO TAKE SOME PICTURES.

AFTER THE SPORTSCASTER INTRODUCED THE GOLFER, HE WATCHED THE GAME.

AFTER THE SPORTSCASTER INTRODUCED THE GOLFER, HE TEED OFF GRACEFULLY.

WHEN THE GIRL HIT THE OLD WOMAN, SHE RAN AWAY.

WHEN THE GIRL HIT THE OLD WOMAN, SHE FELL DOWM.

AFTER THE PRISONER BRIBED THE COP, HE WAS RELEASED QUIETLY.

AFTER THE PRISONER BRIBED THE COP, HE POCKETED THE MONEY.

WHEN THE DENTIST FRIGHTENED THE TODDLER, HE TRIED TO BE CONSOLING.

WHEN THE DENTIST FRIGHTENED THE TODDLER, HE SCREAMED LOUDLY FROM TERROR.

BECAUSE THE AUTHOR SLANDERED THE CORPORATE EXECUTIVE, HE WAS FINED HEAVILY.

BECAUSE THE AUTHOR SLANDERED THE CORPORATE EXECUTIVE, HE

WAS AWARDED DAMAGES.

AFTER THE BUS CRUSHED THE BICYCLE, IT CONTINUED ALONG THE ROUTE.

AFTER THE BUS CRUSHED THE BICYCLE, IT WAS A TOTAL WRECK.

WHEN BOB SAW THE MOVIE STAR, HE ASKED FOR AN AUTOGRAPH.

WHEN BOB SAW THE MOVIE STAR, HE WAS GREETING THE FANS.

BECAUSE THE GUARDS ANNOYED THE STUDENTS, THEY WERE ASSIGNED ANOTHER SECTOR.

BECAUSE THE GUARDS ANNOYED THE STUDENTS, THEY STUDIED MORE AT HOME.

AFTER THE DEMONSTRATOR INSULTED THE VISITING OFFICIAL, HE WAS CRITICIZED PUBLICLY.

AFTER THE DEMONSTRATOR INSULTED THE VISITING OFFICIAL, HE CANCELED ALL MEETINGS.

WHEN THE CARELESS MAID TRIPPED THE LADY, SHE REFUSED TO APOLOGIZE.

WHEN THE CARELESS MAID TRIPPED THE LADY, SHE SPRAINED AN ANKLE.

BEFORE PETER PAID THE MECHANIC, HE TEST DROVE THE CAR.

BEFORE PETER PAID THE MECHANIC, HE SUBMITTED A REVISED BILL.

BECAUSE THE PATIENT SAW THE DOCTOR, HE RECEIVED PROMPT TREATMENT.

BECAUSE THE PATIENT SAW THE DOCTOR, HE PRESCRIBED MEDICATION.

AFTER THE BARBER NICKED THE LITTLE BOY, HE APOLOGIZED FOR THE MISTAKE.

AFTER THE BARBER NICKED THE LITTLE BOY, HE ASKED FOR A BANDAID.

AFTER THE RINGMASTER VISITED THE ACROBAT IN THE HOSPITAL, HE RETURNED TO THE CIRCUS TENT.

AFTER THE RINGMASTER VISITED THE ACROBAT IN THE HOSPITAL, HE FELL ASLEEP ON THE COMFORTABLE BED.

BECAUSE THE PASSENGER HIT THE TRAIN CONDUCTOR, HE WAS ARRESTED AT THE NEXT STATION.

BECAUSE THE PASSENGER HIT THE TRAIN CONDUCTOR, HE REFUSED TO OPEN THE CAR DOORS.

WHEN THE BARTENDER WARNED THE CUSTOMER ABOUT THE HIGH PRICES, HE WAS FIRED WITHOUT WARNING.

WHEN THE BARTENDER WARNED THE CUSTOMER ABOUT THE HIGH PRICES, HE DECIDED TO DRINK ELSEWHERE.

BECAUSE THE CLIENT IRRITATED THE DETECTIVE, HE OFFERED MORE MONEY FOR THE JOB.

BECAUSE THE CLIENT IRRITATED THE DETECTIVE, HE SIMPLY DECIDED TO DROP THE CASE.

AFTER THE TAXI DRIVER LOCATED THE LOST BOY, HE WAS GIVEN A REWARD.

AFTER THE TAXI DRIVER LOCATED THE LOST BOY, HE WAS SENT HOME IMMEDIATELY.

BECAUSE THE NEWSBOY CHEATED THE CUSTOMER, HE WAS FIRED THAT DAY.

BECAUSE THE NEWSBOY CHEATED THE CUSTOMER, HE CANCELED THE NEWSPAPER SUBSCRIPTION.

AFTER THE TENANTS BOTHERED THE NEIGHBORS, THEY WERE EVICTED

FROM THE APARTMENT.

AFTER THE TENANTS BOTHERED THE NEIGHBORS, THEY CALLED THE POLICE EVERY DAY.

WHILE THE MOTHER DRESSED THE LITTLE GIRL, SHE LISTENED TO THE NEWS.

WHILE THE MOTHER DRESSED THE LITTLE GIRL, SHE TRIED TO PLAY HOUSE.

AFTER THE BLACK CAR RAN OVER THE POTHOLE, IT WAS FITTED WITH ANOTHER AXLE.

AFTER THE BLACK CAR RAN OVER THE POTHOLE, IT WAS FILLED WITH SOME ASPHALT.

BECAUSE THE SALESLADY ENCOURAGED THE WOMAN, SHE SOLD THE WHOLE BEDROOM SET.

BECAUSE THE SALESLADY ENCOURAGED THE WOMAN, SHE BOUGHT THE WHOLE BEDROOM SET.

Sentences for Experiment 2A and Experiment 4

WHEN SAM'S LITTLE DAUGHTER KICKED THE POSTMAN, HE THREATENED TO SUE.

WHEN SAM'S LITTLE DAUGHTER KICKED THE POSTMAN, HE APOLOGIZED VERY QUICKLY.

WHEN THE POSTMAN WAS KICKED BY SAM'S LITTLE DAUGHTER, HE THREATENED TO SUE.

WHEN THE POSTMAN WAS KICKED BY SAM'S LITTLE DAUGHTER, HE APOLOGIZED VERY QUICKLY.

BECAUSE FRED DISCOVERED THE COMBINATION TO JOHN'S LOCK, HE WAS ABLE TO OPEN IT.

BECAUSE FRED DISCOVERED THE COMBINATION TO JOHN'S LOCK, HE HAD TO HAVE IT CHANGED.

BECAUSE THE COMBINATION TO JOHN'S LOCK WAS DISCOVERED BY FRED, HE WAS ABLE TO OPEN IT.

BECAUSE THE COMBINATION TO JOHN'S LOCK WAS DISCOVERED BY FRED, HE HAD TO HAVE IT CHANGED.

JUST AS THE MAN WITH THE TELESCOPE SPOTTED THE PLANE, IT DISAPPEARED BEHIND SOME CLOUDS.

JUST AS THE MAN WITH THE TELESCOPE SPOTTED THE PLANE, IT FELL FROM HIS HAND.

JUST AS THE PLANE WAS SPOTTED BY THE MAN WITH THE TELESCOPE, IT DISAPPEARED BEHIND SOME CLOUDS.

JUST AS THE PLANE WAS SPOTTED BY THE MAN WITH THE TELESCOPE, IT FELL FROM HIS HAND.

BECAUSE THE INSTRUCTOR MISPLACED THE STUDENT'S EXAM, SHE HAD TO GIVE A MAKE-UP.

BECAUSE THE INSTRUCTOR MISPLACED THE STUDENT'S EXAM, SHE HAD TO TAKE A MAKE-UP.

BECAUSE THE STUDENT'S EXAM WAS MISPLACED BY THE INSTRUCTOR, SHE HAD TO GIVE A MAKE-UP.

BECAUSE THE STUDENT'S EXAM WAS MISPLACED BY THE INSTRUCTOR, SHE HAD TO TAKE A MAKE-UP.

AS THE DRIVER OF THE TRUCK UNLOADED THE CEMENT, IT FLOWED OVER THE CURB.

AS THE DRIVER OF THE TRUCK UNLOADED THE CEMENT, IT SLIPPED INTO FIRST GEAR.

AS THE CEMENT WAS UNLOADED BY THE DRIVER OF THE TRUCK, IT FLOWED OVER THE CURB.

AS THE CEMENT WAS UNLOADED BY THE DRIVER OF THE TRUCK, IT SLIPPED INTO FIRST GEAR.

ALTHOUGH THE NURSE ADMINISTERED THE WOMAN'S DRUG, SHE ONLY GAVE HALF THE USUAL AMOUNT.

ALTHOUGH THE NURSE ADMINISTERED THE WOMAN'S DRUG, SHE FELT HARDLY ANY EFFECT FROM IT.

ALTHOUGH THE WOMAN'S DRUG WAS ADMINISTERED BY THE NURSE, SHE ONLY GAVE HALF THE USUAL AMOUNT.

ALTHOUGH THE WOMAN'S DRUG WAS ADMINISTERED BY THE NURSE, SHE FELT HARDLY ANY EFFECT FROM IT.

BECAUSE THE OWNER OF THE RESTAURANT PREPARED THE FOOD, IT WAS ALWAYS DELICIOUS.

BECAUSE THE OWNER OF THE RESTAURANT PREPARED THE FOOD, IT WAS ALWAYS CROWDED.

BECAUSE THE FOOD WAS PREPARED BY THE OWNER OF THE

RESTAURANT, IT WAS ALWAYS DELICIOUS.

BECAUSE THE FOOD WAS PREPARED BY THE OWNER OF THE RESTAURANT, IT WAS ALWAYS CROWDED.

UNTIL THE LAWYERS DEFENDED THE CLIENTS' LAWSUIT, THEY WERE NOT PAID.

UNTIL THE LAWYERS DEFENDED THE CLIENTS' LAWSUIT, THEY DID NOT PAY.

UNTIL THE CLIENTS' LAWSUIT WAS DEFENDED BY THE LAWYERS, THEY WERE NOT PAID.

UNTIL THE CLIENTS' LAWSUIT WAS DEFENDED BY THE LAWYERS, THEY DID NOT PAY.

SINCE THE WOMAN'S JEWELRY DELIGHTED THE QUEEN, SHE DECIDED TO BUY IT.

SINCE THE WOMAN'S JEWELRY DELIGHTED THE QUEEN, SHE AGREED TO SELL IT.

SINCE THE QUEEN WAS DELIGHTED BY THE WOMAN'S JEWELRY, SHE DECIDED TO BUY IT.

SINCE THE QUEEN WAS DELIGHTED BY THE WOMAN'S JEWELRY, SHE AGREED TO SELL IT.

ALTHOUGH THE GUARDIAN PAID THE BOY'S TUITION, HE RECEIVED ANOTHER BILL.

ALTHOUGH THE GUARDIAN PAID THE BOY'S TUITION, HE WAS SENT HOME.

ALTHOUGH THE BOY'S TUITION WAS PAID BY THE GUARDIAN, HE RECEIVED ANOTHER BILL.

ALTHOUGH THE BOY'S TUITION WAS PAID BY THE GUARDIAN, HE WAS SENT HOME.

WHEN THE CHIEF OF THE FOREST RANGERS PLANTED TREES, THEY ALWAYS GREW WELL.

WHEN THE CHIEF OF THE FOREST RANGERS PLANTED TREES, THEY WERE ALL AMAZED.

WHEN TREES WERE PLANTED BY THE CHIEF OF THE FOREST RANGERS, THEY ALWAYS GREW WELL.

WHEN TREES WERE PLANTED BY THE CHIEF OF THE FOREST RANGERS, THEY WERE ALL AMAZED.

WHEN THE COMMERCIAL PRESENTED MISLEADING CLAIMS ABOUT THE PRODUCT, IT WAS TAKEN OFF THE AIR.

WHEN THE COMMERCIAL PRESENTED MISLEADING CLAIMS ABOUT THE PRODUCT, IT WAS TAKEN OFF GROCERY SHELVES.

WHEN MISLEADING CLIAMS ABOUT THE PRODUCT WERE PRESENTED BY THE COMMERCIAL, IT WAS TAKEN OFF THE AIR.

WHEN MISLEADING CLAIMS ABOUT THE PRODUCT WERE PRESENTED BY THE COMMERCIAL, IT WAS TAKEN OFF GROCERY SHELVES.

SHORTLY AFTER THE COMPANY'S MANAGER RENTED THE NEW OFFICE, IT WAS REMODELED.

SHORTLY AFTER THE COMPANY'S MANAGER RENTED THE NEW OFFICE, IT WENT BANKRUPT.

SHORTLY AFTER THE NEW OFFICE WAS RENTED BY THE COMPANY'S MANAGER, IT WAS REMODELED.

SHORTLY AFTER THE NEW OFFICE WAS RENTED BY THE COMPANY'S MANAGER, IT WENT BANKRUPT.

WHEN THE DEAN SUSPENDED THE COACH'S BEST PLAYERS, HE OUTRAGED ALL OF THE FANS.

WHEN THE DEAN SUSPENDED THE COACH'S BEST PLAYERS, HE COULD

NOT WIN THE GAME.

WHEN THE COACH'S BEST PLAYERS WERE SUSPENDED BY THE DEAN, HE OUTRAGED ALL OF THE FANS.

WHEN THE COACH'S BEST PLAYERS WERE SUSPENDED BY THE DEAN, HE COULD NOT WIN THE GAME.

AFTER THE BOY'S BASEBALL HIT THE FATHER, HE WAS ANGRY.

AFTER THE BOY'S BASEBALL HIT THE FATHER, HE RAN AWAY.

AFTER THE FATHER WAS HIT BY THE BOY'S BASEBALL, HE WAS ANGRY.

AFTER THE FATHER WAS HIT BY THE BOY'S BASEBALL, HE RAN AWAY.

SINCE THE UNDERSTUDY BROKE THE BALLERINA'S TOESHOE, SHE WAS FIRED RIGHT AWAY.

SINCE THE UNDERSTUDY BROKE THE BALLERINA'S TOESHOE, SHE WAS UNABLE TO PERFORM.

SINCE THE BALLERINA'S TOESHOE WAS BROKEN BY THE UNDERSTUDY, SHE WAS FIRED RIGHT AWAY.

SINCE THE BALLERINA'S TOESHOE WAS BROKEN BY THE UNDERSTUDY, SHE WAS UNABLE TO PERFORM.

AFTER TIM'S GRANDPARENTS GAVE THE BOY A TREAT, HE GAVE IT AWAY.

AFTER TIM'S GRANDPARENTS GAVE THE BOY A TREAT, HE WANTED ONE ALSO.

AFTER THE BOY WAS GIVEN A TREAT BY TIM'S GRANDPARENTS, HE GAVE IT AWAY.

AFTER THE BOY WAS GIVEN A TREAT BY TIM'S GRANDPARENTS, HE WANTED ONE ALSO.

BEFORE THE REPAIRMNEN FIXED THE SMITHS' HOUSE, THEY WORKED ON THE HOUSE NEXT DOOR.

BEFORE THE REPAIRMEN FIXED THE SIMTHS' HOUSE, THEY HAD TO LIVE WITH BROKEN STEPS.

BEFORE THE SMITHS' HOUSE WAS FIXED BY THE REPAIRMEN, THEY WORKED ON THE HOUSE NEXT DOOR.

BEFORE THE SMITHS' HOUSE WAS FIXED BY THE REPAIRMEN, THEY HAD TO LIVE WITH BROKEN STEPS.

EVEN THOUGH THE MEDICINE IN DRUGSTORES HELPS PATIENTS, THEY VERY OFTEN CAN'T AFFORD IT.

EVEN THOUGH THE MEDICINE IN DRUGSTORES HELPS PATIENTS, THEY DON'T CARRY ENOUGH OF IT.

EVEN THOUGH PATIENTS ARE HELPED BY THE MEDICINE IN DRUGSTORES, THEY VERY OFTEN CAN'T AFFORD IT.

EVEN THOUGH PATIENTS ARE HELPED BY THE MEDICINE IN DRUGSTORES, THEY DON'T CARRY ENOUGH OF IT.

WHEN THE POLICEMAN ARRESTED THE BOY'S MOTHER, HE SENT HER TO PRISON.

WHEN THE POLICEMAN ARRESTED THE BOY'S MOTHER, HE COMPLAINED TO HIS FATHER.

WHEN THE BOY'S MOTHER WAS ARRESTED BY THE POLICEMAN, HE SENT HER TO PRISON.

WHEN THE BOY'S MOTHER WAS ARRESTED BY THE POLICEMAN, HE COMPLAINED TO HIS FATHER.

EVEN THOUGH TOM'S TRUCK BUMPED CHRISTOPHER, HE WAS NOT HURT.

EVEN THOUGH TOM'S TRUCK BUMPED CHRISTOPHER, HE DID NOT

STOP.

EVEN THOUGH CHRISTOPHER WAS BUMPED BY TOM'S TRUCK, HE WAS NOT HURT.

EVEN THOUGH CHRISTOPHER WAS BUMPED BY TOM'S TRUCK, HE DID NOT STOP.

WHEN THE WOMAN CRITICIZED NELLY'S BOSS, SHE WAS VERY MISTAKEN.

WHEN THE WOMAN CRITICIZED NELLY'S BOSS, SHE DIDN'T BELIEVE IT.

WHEN NELLY'S BOSS WAS CRITICIZED BY THE WOMAN, SHE WAS VERY MISTAKEN.

WHEN NELLY'S BOSS WAS CRITICIZED BY THE WOMAN, SHE DIDN'T BELIEVE IT.

WHEN MARY'S UNCLE HUGGED FRAN, SHE WARMLY RETURNED HIS EMBRACE.

WHEN MARY'S UNCLE HUGGED FRAN, SHE WAS OUT OF TOWN.

WHEN FRAN WAS HUGGED BY MARY'S UNCLE, SHE WARMLY RETURNED HIS EMBRACE.

WHEN FRAN WAS HUGGED BY MARY'S UNCLE, SHE WAS OUT OF TOWN.

AFTER THE BARTENDER SERVED THE PATRON'S DRINK, HE GOT A BIG TIP.

AFTER THE BARTENDER SERVED THE PATRON'S DRINK, HE LEFT A BIG TIP.

AFTER THE PATRON'S DRINK WAS SERVED BY THE BARTENDER, HE GOT A BIG TIP.

AFTER THE PATRON'S DRINK WAS SERVED BY THE BARTENDER, HE LEFT A BIG TIP.

Sentences for Experiment 2B:

Subordinate/Main

BECAUSE SAM'S LITTLE DAUGHTER KICKED THE POSTMAN, HE THREATENED TO SUE.

BECAUSE SAM'S LITTLE DAUGHTER KICKED THE POSTMAN, HE APOLOGIZED VERY QUICKLY.

BECAUSE THE POSTMAN WAS KICKED BY SAM'S LITTLE DAUGHTER, HE THREATENED TO SUE.

BECAUSE THE POSTMAN WAS KICKED BY SAM'S LITTLE DAUGHTER, HE APOLOGIZED VERY QUICKLY.

BECAUSE FRED DISCOVERED THE COMBINATION TO JOHN'S LOCK, HE WAS ABLE TO OPEN IT.

BECAUSE FRED DISCOVERED THE COMBINATION TO JOHN'S LOCK, HE HAD TO HAVE IT CHANGED.

BECAUSE THE COMBINATION TO JOHN'S LOCK WAS DISCOVERED BY FRED, HE WAS ABLE TO OPEN IT.

BECAUSE THE COMBINATION TO JOHN'S LOCK WAS DISCOVERED BY FRED, HE HAD TO HAVE IT CHANGED.

AFTER THE MAN WITH THE TELESCOPE SPOTTED THE PLANE, IT DISAPPEARED BEHIND SOME CLOUDS.

AFTER THE MAN WITH THE TELESCOPE SPOTTED THE PLANE, IT FELL FROM HIS HAND.

AFTER THE PLANE WAS SPOTTED BY THE MAN WITH THE TELESCOPE, IT DISAPPEARED BEHIND SOME CLOUDS.

AFTER THE PLANE WAS SPOTTED BY THE MAN WITH THE TELESCOPE, IT FELL FROM HIS HAND.

BECAUSE THE INSTRUCTOR MISPLACED THE STUDENT'S EXAM, SHE

HAD TO GIVE A MAKE-UP.

BECAUSE THE INSTRUCTOR MISPLACED THE STUDENT'S EXAM, SHE HAD TO TAKE A MAKE-UP.

BECAUSE THE STUDENT'S EXAM WAS MISPLACED BY THE INSTRUCTOR, SHE HAD TO GIVE A MAKE-UP.

BECAUSE THE STUDENT'S EXAM WAS MISPLACED BY THE INSTRUCTOR, SHE HAD TO TAKE A MAKE-UP.

WHILE THE DRIVER OF THE TRUCK UNLOADED THE CEMENT, IT FLOWED OVER THE CURB.

WHILE THE DRIVER OF THE TRUCK UNLOADED THE CEMENT, IT SLIPPED INTO FIRST GEAR.

WHILE THE CEMENT WWHILE UNLOADED BY THE DRIVER OF THE TRUCK, IT FLOWED OVER THE CURB.

WHILE THE CEMENT WAS UNLOADED BY THE DRIVER OF THE TRUCK, IT SLIPPED INTO FIRST GEAR.

ALTHOUGH THE NURSE ADMINISTERED THE WOMAN'S DRUG, SHE ONLY GAVE HALF THE USUAL AMOUNT.

ALTHOUGH THE NURSE ADMINISTERED THE WOMAN'S DRUG, SHE FELT HARDLY ANY EFFECT FROM IT.

ALTHOUGH THE WOMAN'S DRUG WAS ADMINISTERED BY THE NURSE, SHE ONLY GAVE HALF THE USUAL AMOUNT.

ALTHOUGH THE WOMAN'S DRUG WAS ADMINISTERED BY THE NURSE, SHE FELT HARDLY ANY EFFECT FROM IT.

BECAUSE THE OWNER OF THE RESTAURANT PREPARED THE FOOD, IT WAS ALWAYS DELICIOUS.

BECAUSE THE OWNER OF THE RESTAURANT PREPARED THE FOOD, IT WAS ALWAYS CROWDED.

BECAUSE THE FOOD WAS PREPARED BY THE OWNER OF THE RESTAURANT, IT WAS ALWAYS DELICIOUS.

BECAUSE THE FOOD WAS PREPARED BY THE OWNER OF THE RESTAURANT, IT WAS ALWAYS CROWDED.

AFTER THE LAWYERS DEFENDED THE CLIENTS' LAWSUIT, THEY WERE PAID.

AFTER THE LAWYERS DEFENDED THE CLIENTS' LAWSUIT, THEY PAID CASH.

AFTER THE CLIENTS' LAWSUIT WAS DEFENDED BY THE LAWYERS, THEY WERE PAID.

AFTER THE CLIENTS' LAWSUIT WAS DEFENDED BY THE LAWYERS, THEY PAID CASH.

BECAUSE THE WOMAN'S JEWELRY DELIGHTED THE QUEEN, SHE DECIDED TO BUY IT.

BECAUSE THE WOMAN'S JEWELRY DELIGHTED THE QUEEN, SHE AGREED TO SELL IT.

BECAUSE THE QUEEN WAS DELIGHTED BY THE WOMAN'S JEWELRY, SHE DECIDED TO BUY IT.

BECAUSE THE QUEEN WAS DELIGHTED BY THE WOMAN'S JEWELRY, SHE AGREED TO SELL IT.

AFTER THE GUARDIAN PAID THE BOY'S TUITION, HE RECEIVED ANOTHER BILL.

AFTER THE GUARDIAN PAID THE BOY'S TUITION. HE WAS SENT HOME.

AFTER THE BOY'S TUITION WAS PAID BY THE GUARDIAN, HE RECEIVED ANOTHER BILL.

AFTER THE BOY'S TUITION WAS PAID BY THE GUARDIAN, HE WAS

SENT HOME.

BECAUSE THE CHIEF OF THE FOREST RANGERS PLANTED TREES, THEY ALWAYS GREW WELL.

BECAUSE THE CHIEF OF THE FOREST RANGERS PLANTED TREES, THEY WERE ALL AMAZED.

BECAUSE TREES WERE PLANTED BY THE CHIEF OF THE FOREST RANGERS, THEY ALWAYS GREW WELL.

BECAUSE TREES WERE PLANTED BY THE CHIEF OF THE FOREST RANGERS, THEY WERE ALL AMAZED.

AFTER THE COMMERCIAL PRESENTED MISLEADING CLAIMS ABOUT THE PRODUCT, IT WAS TAKEN OFF THE AIR.

AFTER THE COMMERCIAL PRESENTED MISLEADING CLAIMS ABOUT THE PRODUCT, IT WAS TAKEN OFF GROCERY SHELVES.

AFTER MISLEADING CLIAMS ABOUT THE PRODUCT WERE PRESENTED BY THE COMMERCIAL, IT WAS TAKEN OFF THE AIR.

AFTER MISLEADING CLAIMS ABOUT THE PRODUCT WERE PRESENTED BY THE COMMERCIAL, IT WAS TAKEN OFF GROCERY SHELVES.

AFTER THE COMPANY'S MANAGER RENTED THE NEW OFFICE, IT WAS REMODELED.

AFTER THE COMPANY'S MANAGER RENTED THE NEW OFFICE, IT WENT BANKRUPT.

AFTER THE NEW OFFICE WAS RENTED BY THE COMPANY'S MANAGER, IT WAS REMODELED.

AFTER THE NEW OFFICE WAS RENTED BY THE COMPANY'S MANAGER, IT WENT BANKRUPT.

BECAUSE THE DEAN SUSPENDED THE COACH'S BEST PLAYERS, HE OUTRAGED ALL OF THE FANS.

BECAUSE THE DEAN SUSPENDED THE COACH'S BEST PLAYERS, HE COULD NOT WIN THE GAME.

BECAUSE THE COACH'S BEST PLAYERS WERE SUSPENDED BY THE DEAN, HE OUTRAGED ALL OF THE FANS.

BECAUSE THE COACH'S BEST PLAYERS WERE SUSPENDED BY THE DEAN, HE COULD NOT WIN THE GAME.

AFTER THE BOY'S BASEBALL HIT THE FATHER, HE WAS ANGRY.

AFTER THE BOY'S BASEBALL HIT THE FATHER, HE RAN AWAY.

AFTER THE FATHER WAS HIT BY THE BOY'S BASEBALL, HE WAS ANGRY.

AFTER THE FATHER WAS HIT BY THE BOY'S BASEBALL, HE RAN AWAY.

BECAUSE THE UNDERSTUDY BROKE THE BALLERINA'S TOESHOE, SHE WAS FIRED RIGHT AWAY.

BECAUSE THE UNDERSTUDY BROKE THE BALLERINA'S TOESHOE, SHE WAS UNABLE TO PERFORM.

BECAUSE THE BALLERINA'S TOESHOE WAS BROKEN BY THE UNDERSTUDY, SHE WAS FIRED RIGHT AWAY.

BECAUSE THE BALLERINA'S TOESHOE WAS BROKEN BY THE UNDERSTUDY, SHE WAS UNABLE TO PERFORM.

AFTER TIM'S GRANDPARENTS GAVE THE BOY A TREAT, HE GAVE IT AWAY.

AFTER TIM'S GRANDPARENTS GAVE THE BOY A TREAT, HE WANTED ONE ALSO.

AFTER THE BOY WAS GIVEN A TREAT BY TIM'S GRANDPARENTS, HE GAVE IT AWAY.

AFTER THE BOY WAS GIVEN A TREAT BY TIM'S GRANDPARENTS, HE

WANTED ONE ALSO.

BEFORE THE REPAIRMNEN FIXED THE SMITHS' HOUSE, THEY WORKED ON THE HOUSE NEARBY.

BEFORE THE REPAIRMEN FIXED THE SIMTHS' HOUSE, THEY HAD LIVED WITH BROKEN STEPS.

BEFORE THE SMITHS' HOUSE WAS FIXED BY THE REPAIRMEN, THEY WORKED ON THE HOUSE NEARBY.

BEFORE THE SMITHS' HOUSE WAS FIXED BY THE REPAIRMEN, THEY HAD LIVED WITH BROKEN STEPS.

ALTHOUGH THE MEDICINE IN DRUGSTORES HELPS PATIENTS, THEY VERY OFTEN CAN'T AFFORD IT.

ALTHOUGH THE MEDICINE IN DRUGSTORES HELPS PATIENTS, THEY DON'T CARRY ENOUGH OF IT.

ALTHOUGH PATIENTS ARE HELPED BY THE MEDICINE IN DRUGSTORES, THEY VERY OFTEN CAN'T AFFORD IT.

ALTHOUGH PATIENTS ARE HELPED BY THE MEDICINE IN DRUGSTORES, THEY DON'T CARRY ENOUGH OF IT.

AFTER THE POLICEMAN ARRESTED THE BOY'S MOTHER, HE SENT HER TO PRISON.

AFTER THE POLICEMAN ARRESTED THE BOY'S MOTHER, HE COMPLAINED TO HIS FATHER.

AFTER THE EOY'S MOTHER WAS ARRESTED BY THE POLICEMAN, HE SENT HER TO PRISON.

AFTER THE BOY'S MOTHER WAS ARRESTED BY THE POLICEMAN, HE COMPLAINED TO HIS FATHER.

ALTHOUGH TOM'S TRUCK BUMPED CHRISTOPHER, HE WAS NOT HURT.

ALTHOUGH TOM'S TRUCK BUMPED CHRISTOPHER, HE DID NOT STOP.

ALTHOUGH CHRISTOPHER WAS BUMPED BY TOM'S TRUCK, HE WAS NOT HURT.

ALTHOUGH CHRISTOPHER WAS BUMPED BY TOM'S TRUCK, HE DID NOT STOP.

ALTHOUGH THE WOMAN CRITICIZED NELLY'S BOSS, SHE WAS VERY MISTAKEN.

ALTHOUGH THE WOMAN CRITICIZED NELLY'S BOSS, SHE DIDN'T BELIEVE IT.

ALTHOUGH NELLY'S BOSS WAS CRITICIZED BY THE WOMAN, SHE WAS VERY MISTAKEN.

ALTHOUGH NELLY'S BOSS WAS CRITICIZED BY THE WOMAN, SHE DIDN'T BELIEVE IT.

WHILE MARY'S UNCLE HUGGED FRAN, SHE WARMLY RETURNED HIS EMBRACE.

WHILE MARY'S UNCLE HUGGED FRAN, SHE WAS OUT OF TOWN.

WHILE FRAN WAS HUGGED BY MARY'S UNCLE, SHE WARMLY RETURNED HIS EMBRACE.

WHILE FRAN WAS HUGGED BY MARY'S UNCLE, SHE WAS OUT OF TOWN.

AFTER THE BARTENDER SERVED THE PATRON'S DRINK, HE GOT A BIG TIP.

AFTER THE BARTENDER SERVED THE PATRON'S DRINK, HE LEFT A BIG TIP.

AFTER THE PATRON'S DRINK WAS SERVED BY THE BARTENDER, HE GOT A BIG TIP.

AFTER THE PATRON'S DRINK WAS SERVED BY THE BARTENDER, HE LEFT A BIG TIP.

Main/Subordinate

SAM'S LITTLE DAUGHTER KICKED THE POSTMAN, SO HE THREATENED TO SUE.

SAM'S LITTLE DAUGHTER KICKED THE POSTMAN, SO HE APOLOGIZED VERY QUICKLY.

THE POSTMAN WAS KICKED BY SAM'S LITTLE DAUGHTER, SO HE THREATENED TO SUE.

THE POSTMAN WAS KICKED BY SAM'S LITTLE DAUGHTER, SO HE APOLOGIZED VERY QUICKLY.

FRED DISCOVERED THE COMBINATION TO JOHN'S LOCK, SO HE WAS ABLE TO OPEN IT.

FRED DISCOVERED THE COMBINATION TO JOHN'S LOCK, SO HE HAD TO HAVE IT CHANGED.

THE COMBINATION TO JOHN'S LOCK WAS DISCOVERED BY FRED, SO HE WAS ABLE TO OPEN IT.

THE COMBINATION TO JOHN'S LOCK WAS DISCOVERED BY FRED, SO HE HAD TO HAVE IT CHANGED.

THE MAN WITH THE TELESCOPE SPOTTED THE PLANE, BEFORE IT DISAPPEARED BEHIND SOME CLOUDS.

THE MAN WITH THE TELESCOPE SPOTTED THE PLANE, BEFORE IT FELL FROM HIS HAND.

THE PLANE WAS SPOTTED BY THE MAN WITH THE TELESCOPE, BEFORE IT DISAPPEARED BEHIND SOME CLOUDS.

THE PLANE WAS SPOTTED BY THE MAN WITH THE TELESCOPE, BEFORE IT FELL FROM HIS HAND.

THE INSTRUCTOR MISPLACED THE STUDENT'S EXAM, SO SHE HAD TO GIVE A MAKE-UP.

THE INSTRUCTOR MISPLACED THE STUDENT'S EXAM, SO SHE HAD TO TAKE A MAKE-UP.

THE STUDENT'S EXAM WAS MISPLACED BY THE INSTRUCTOR, SO SHE HAD TO GIVE A MAKE-UP.

THE STUDENT'S EXAM WAS MISPLACED BY THE INSTRUCTOR, SO SHE HAD TO TAKE A MAKE-UP.

THE DRIVER OF THE TRUCK UNLOADED THE CEMENT, WHILE IT FLOWED OVER THE CURB.

THE DRIVER OF THE TRUCK UNLOADED THE CEMENT, WHILE IT SLIPPED INTO FIRST GEAR.

THE CEMENT WAS UNLOADED BY THE DRIVER OF THE TRUCK, WHILE IT FLOWED OVER THE CURB.

THE CEMENT WAS UNLOADED BY THE DRIVER OF THE TRUCK, WHILE IT SLIPPED INTO FIRST GEAR.

THE NURSE ADMINISTERED THE WOMAN'S DRUG, ALTHOUGH SHE ONLY GAVE HALF THE USUAL AMOUNT.

THE NURSE ADMINISTERED THE WOMAN'S DRUG, ALTHOUGH SHE FELT HARDLY ANY EFFECT FROM IT.

THE WOMAN'S DRUG WAS ADMINISTERED BY THE NURSE, ALTHOUGH SHE ONLY GAVE HALF THE USUAL AMOUNT.

THE WOMAN'S DRUG WAS ADMINISTERED BY THE NURSE, ALTHOUGH SHE FELT HARDLY ANY EFFECT FROM IT.

THE OWNER OF THE RESTAURANT PREPARED THE FOOD, SO IT WAS ALWAYS DELICIOUS.

THE OWNER OF THE RESTAURANT PREPARED THE FOOD, SO IT WAS ALWAYS CROWDED.

THE FOOD WAS PREPARED BY THE OWNER OF THE RESTAURANT, SO IT

WAS ALWAYS DELICIOUS.

THE FOOD WAS PREPARED BY THE OWNER OF THE RESTAURANT, SO IT WAS ALWAYS CROWDED.

THE LAWYERS DEFENDED THE CLIENTS' LAWSUIT, BEFORE THEY WERE PAID.

THE LAWYERS DEFENDED THE CLIENTS' LAWSUIT, BEFORE THEY PAID CASH.

THE CLIENTS' LAWSUIT WAS DEFENDED BY THE LAWYERS, BEFORE THEY WERE PAID.

THE CLIENTS' LAWSUIT WAS DEFENDED BY THE LAWYERS, BEFORE THEY PAID CASH.

THE WOMAN'S JEWELRY DELIGHTED THE QUEEN, SO SHE DECIDED TO BUY IT.

THE WOMAN'S JEWELRY DELIGHTED THE QUEEN, SO SHE AGREED TO SELL IT.

THE QUEEN WAS DELIGHTED BY THE WOMAN'S JEWELRY, SO SHE DECIDED TO BUY IT.

THE QUEEN WAS DELIGHTED BY THE WOMAN'S JEWELRY, SO SHE AGREED TO SELL IT.

THE GUARDIAN PAID THE BOY'S TUITION, BEFORE HE RECEIVED ANOTHER BILL.

THE GUARDIAN PAID THE BOY'S TUITION, BEFORE HE WAS SENT HOME.

THE BOY'S TUITION WAS PAID BY THE GUARDIAN, BEFORE HE RECEIVED ANOTHER BILL.

THE BOY'S TUITION WAS PAID BY THE GUARDIAN, BEFORE HE WAS SENT HOME.

THE CHIEF OF THE FOREST RANGERS PLANTED TREES, SO THEY ALWAYS GREW WELL.

THE CHIEF OF THE FOREST RANGERS PLANTED TREES, SO THEY WERE ALL AMAZED.

THE TREES WERE PLANTED BY THE CHIEF OF THE FOREST RANGERS, SO THEY ALWAYS GREW WELL.

THE TREES WERE PLANTED BY THE CHIEF OF THE FOREST RANGERS, SO THEY WERE ALL AMAZED.

THE COMMERCIAL PRESENTED MISLEADING CLAIMS ABOUT THE PRODUCT, BEFORE IT WAS TAKEN OFF THE AIR.

THE COMMERCIAL PRESENTED MISLEADING CLAIMS ABOUT THE PRODUCT, BEFORE IT WAS TAKEN OFF GROCERY SHELVES.

THE MISLEADING CLAIMS ABOUT THE PRODUCT WERE PRESENTED BY THE COMMERCIAL, BEFORE IT WAS TAKEN OFF THE AIR.

THE MISLEADING CLAIMS ABOUT THE PRODUCT WERE PRESENTED BY THE COMMERCIAL, BEFORE IT WAS TAKEN OFF GROCERY SHELVES.

THE COMPANY'S MANAGER RENTED THE NEW OFFICE, BEFORE IT WAS REMODELED.

THE COMPANY'S MANAGER RENTED THE NEW OFFICE, BEFORE IT WENT BANKRUPT.

THE NEW OFFICE WAS RENTED BY THE COMPANY'S MANAGER, BEFORE IT WAS REMODELED.

THE NEW OFFICE WAS RENTED BY THE COMPANY'S MANAGER, BEFORE IT WENT BANKRUPT.

THE DEAN SUSPENDED THE COACH'S BEST PLAYERS, SO HE OUTRAGED ALL OF THE FANS.

THE DEAN SUSPENDED THE COACH'S BEST PLAYERS, SO HE COULD

NOT WIN THE GAME.

THE COACH'S BEST PLAYERS WERE SUSPENDED BY THE DEAN, SO HE OUTRAGED ALL OF THE FANS.

THE COACH'S BEST PLAYERS WERE SUSPENDED BY THE DEAN, SO HE COULD NOT WIN THE GAME.

THE BOY'S BASEBALL HIT THE FATHER, THEN HE WAS ANGRY.

THE BOY'S BASEBALL HIT THE FATHER, THEN HE RAN AWAY.

THE FATHER WAS HIT BY THE BOY'S BASEBALL, THEN HE WAS ANGRY.

THE FATHER WAS HIT BY THE BOY'S BASEBALL, THEN HE RAN AWAY.

THE UNDERSTUDY BROKE THE BALLERINA'S TOESHOE, SO SHE WAS FIRED RIGHT AWAY.

THE UNDERSTUDY BROKE THE BALLERINA'S TOESHOE, SO SHE WAS UNABLE TO PERFORM.

THE BALLERINA'S TOESHOE WAS BROKEN BY THE UNDERSTUDY, SO SHE WAS FIRED RIGHT AWAY.

THE BALLERINA'S TOESHOE WAS BROKEN BY THE UNDERSTUDY, SO SHE WAS UNABLE TO PERFORM.

TIM'S GRANDPARENTS GAVE THE BOY A TREAT, THEN HE GAVE IT AWAY.

TIM'S GRANDPARENTS GAVE THE BOY A TREAT, THEN HE WANTED ONE ALSO.

THE BOY WAS GIVEN A TREAT BY TIM'S GRANDPARENTS, THEN HE GAVE IT AWAY.

THE BOY WAS GIVEN A TREAT BY TIM'S GRANDPARENTS, THEN HE WANTED ONE ALSO.

THE REPAIRMNEN FIXED THE SMITHS' HOUSE, AFTER THEY WORKED

ON THE HOUSE NEARBY.

THE REPAIRMEN FIXED THE SIMTHS' HOUSE, AFTER THEY HAD LIVED WITH BROKEN STEPS.

THE SMITHS' HOUSE WAS FIXED BY THE REPAIRMEN, AFTER THEY WORKED ON THE HOUSE NEARBY.

THE SMITHS' HOUSE WAS FIXED BY THE REPAIRMEN, AFTER THEY HAD LIVED WITH BROKEN STEPS.

THE MEDICINE IN DRUGSTORES HELPS PATIENTS, ALTHOUGH THEY VERY OFTEN CAN'T AFFORD IT.

THE MEDICINE IN DRUGSTORES HELPS PATIENTS, ALTHOUGH THEY DON'T CARRY ENOUGH OF IT.

PATIENTS ARE HELPED BY THE MEDICINE IN DRUGSTORES, ALTHOUGH THEY VERY OFTEN CAN'T AFFORD IT.

PATIENTS ARE HELPED BY THE MEDICINE IN DRUGSTORES, ALTHOUGH THEY DON'T CARRY ENOUGH OF IT.

THE POLICEMAN ARRESTED THE BOY'S MOTHER, THEN HE SENT HER TO PRISON.

THE POLICEMAN ARRESTED THE BOY'S MOTHER, THEN HE COMPLAINED TO HIS FATHER.

THE BOY'S MOTHER WAS ARRESTED BY THE POLICEMAN, THEN HE SENT HER TO PRISON.

THE BOY'S MOTHER WAS ARRESTED BY THE POLICEMAN, THEN HE COMPLAINED TO HIS FATHER.

TOM'S TRUCK BUMPED CHRISTOPHER, ALTHOUGH HE WAS NOT HURT.

TOM'S TRUCK BUMPED CHRISTOPHER, ALTHOUGH HE DID NOT STOP.

CHRISTOPHER WAS BUMPED BY TOM'S TRUCK, ALTHOUGH HE WAS NOT HURT.

CHRISTOPHER WAS BUMPED BY TOM'S TRUCK, ALTHOUGH HE DID NOT STOP.

THE WOMAN CRITICIZED NELLY'S BOSS, ALTHOUGH SHE WAS VERY MISTAKEN.

THE WOMAN CRITICIZED NELLY'S BOSS, ALTHOUGH SHE DIDN'T BELIEVE IT.

NELLY'S BOSS WAS CRITICIZED BY THE WOMAN, ALTHOUGH SHE WAS VERY MISTAKEN.

NELLY'S BOSS WAS CRITICIZED BY THE WOMAN, ALTHOUGH SHE DIDN'T BELIEVE IT.

MARY'S UNCLE HUGGED FRAN, WHILE SHE WARMLY RETURNED HIS EMBRACE.

MARY'S UNCLE HUGGED FRAN, WHILE SHE WAS OUT OF TOWN.

FRAN WAS HUGGED BY MARY'S UNCLE, WHILE SHE WARMLY RETURNED HIS EMBRACE.

FRAN WAS HUGGED BY MARY'S UNCLE, WHILE SHE WAS OUT OF TOWN.

THE BARTENDER SERVED THE PATRON'S DRINK, BEFORE HE GOT A BIG TIP.

THE BARTENDER SERVED THE PATRON'S DRINK, BEFORE HE LEFT A BIG TIP.

THE PATRON'S DRINK WAS SERVED BY THE BARTENDER, BEFORE HE GOT A BIG TIP.

THE PATRON'S DRINK WAS SERVED BY THE BARTENDER, BEFORE HE LEFT A BIG TIP.

Sentences for Experiment 3A.

AFTER THE FATHER HIT THE BOY, HE CRIED OUT IN PAIN FOR HELP.

AFTER THE FATHER HIT THE BOY, HE APOLOGIZED FOR THE VERY SEVERE BLOW.

AFTER THE FATHER HIT THE BOY, THE MOTHER COMFORTED HIM WITH A HUG.

AFTER THE FATHER HIT THE BOY, AN ONLOOKER REPORTED HIM FOR CHILD ABUSE.

BEFORE SUZY APPROACHED THE CHAIRWOMAN, SHE ADJOURNED THE MEETING AND QUICKLY DISAPPEARED.

BEFORE SUZY APPROACHED THE CHAIRWOMAN, SHE REHEARSED THE REQUEST IN THE HALL.

BEFORE SUZY APPROACHED THE CHAIRWOMAN, THE POLICE ORDERED HER TO DISBAND IMMEDIATELY.

BEFORE SUZY APPROACHED THE CHAIRWOMAN, THE RECEPTIONIST ADVISED HER TO REMAIN SEATED.

WHEN JOHN TELEPHONED THE DOCTOR, HE PRESCRIBED AN OVERNIGHT TREATMENT OF ASPIRINS.

WHEN JOHN TELEPHONED THE DOCTOR, HE COMPLAINED ABOUT A CHRONIC MUSCLE INJURY.

WHEN JOHN TELEPHONED THE DOCTOR, THE RECEPTIONIST TOLD HIM ABOUT THE CALL.

WHEN JOHN TELEPHONED THE DOCTOR, THE NURSE TOLD HIM TO COME FRIDAY.

JUST AS THE REPORTER SPOTTED THE PRESIDENT, HE WAS DRIVEN AWAY IN A LIMOSINE.

JUST AS THE REPORTER SPOTTED THE PRESIDENT, HE DROPPED THE NOTEBOOK IN A PUDDLE.

JUST AS THE REPORTER SPOTTED THE PRESIDENT, THE GUARD DROVE HIM TO THE AIRPORT.

JUST AS THE REPORTER SPOTTED THE PRESIDENT, THE CROWD KEPT HIM FROM ASKING QUESTIONS.

WHEN THE WOMAN CRITICIZED THE NEW GIRL, SHE TRIED TO IGNORE THE NASTY COMMENT.

WHEN THE WOMAN CRITICIZEL THE NEW GIRL, SHE ONLY INTENDED TO BE VERY HELPFUL.

WHEN THE WOMAN CRITICIZED THE NEW GIRL, THE THERAPIST WATCHED HER REACT WITH TEARS.

WHEN THE WOMAN CRITICIZED THE NEW GIRL, THE BOSS ADVISED HER TO BE SILENT.

AFTER THE MOTHER SCOLDED THE DAUGHTER, SHE WALKED AROUND SULKING FOR SEVERAL DAYS.

AFTER THE MOTHER SCOLDED THE DAUGHTER, SHE PUNISHED ALL THE OTHER CHILDREN LATER.

AFTER THE MOTHER SCOLDED THE DAUGHTER, THE FATHER PROTECTED HER FROM FURTHER ANGER.

AFTER THE MOTHER SCOLDED THE DAUGHTER, THE TEACHER COUNSELED HER ON DISCIPLINE METHODS.

AFTER THE PROFESSOR PRAISED THE STUDENT, HE CONTINUED TO DO EVEN BETTER WORK.

AFTER THE PROFESSOR PRAISED THE STUDENT, HE NOTICED OCCASSIONAL CHEATING ON IMPORTANT EXAMS.

AFTER THE PROFESSOR PRAISED THE STUDENT, THE PRINCIPAL

PRESENTED HIM WITH THE SCHOLARSHIP.

AFTER THE PROFESSOR PRAISED THE STUDENT, THE DEAN TEASED HIM ABOUT BEING LENIENT.

AFTER SAM KICKED THE POSTMAN, HE SCREAMED ALOUD FROM SHOCK AND PAIN.

AFTER SAM KICKED THE POSTMAN, HE QUICKLY APOLOGIZED FOR THE ACCIDENTAL BLOW.

AFTER SAM KICKED THE POSTMAN, A BYSTANDER HELPED HIM TO THE DOCTOR.

AFTER SAM KICKED THE POSTMAN, THE MOTHER TOLD HIM TO APOLOGIZE IMMEDIATELY.

BEFORE THE LAWYER DEFENDED THE CLIENT, HE FELT ACCUSED BY THE GENERAL PUBLIC.

BEFORE THE LAWYER DEFENDED THE CLIENT, HE PREPARED THE CASE EVERY AVAILABLE MINUTE.

BEFORE THE LAWYER DEFENDED THE CLIENT, THE JUDGE PUT HIM UNDER HOUSE ARREST.

BEFORE THE LAWYER DEFENDED THE CLIENT, THE JUDGE ASSIGNED HIM TO ANOTHER CASE.

AFTER THE POLICEMAN ARRESTED THE BOY, HE CONFESSED THE TRUTH ABOUT THE CRIME.

AFTER THE POLICEMAN ARRESTED THE BOY, HE FILED A REPORT AT THE STATION.

AFTER THE POLICEMAN ARRESTED THE BOY, THE JUDGE RELEASED HIM WITH A WARNING.

AFTER THE POLICEMAN ARRESTED THE BOY, THE CAPTAIN PRAISED HIM FOR QUICK ACTION.

WHILE THE NURSEMAID HUGGED THE LITTLE GIRL, SHE FELL ASLEEP IN THE ROCKING CHAIR.

WHILE THE NURSEMAID HUGGED THE LITTLE GIRL, SHE CONTINUED TO ROCK THE CHAIR GENTLY.

WHILE THE NURSEMAID HUGGED THE LITTLE GIRL, THE BROTHER READ HER A BEDTIME STORY.

WHILE THE NURSEMAID HUGGED THE LITTLE GIRL, THE MOTHER HANDED HER A CLEAN DIAPER.

AFTER THE PRISONER ANGERED THE WARDEN, HE DECIDED ISOLATION WOULD BE JUST PUNISHMENT.

AFTER THE PRISONER ANGERED THE WARDEN, HE CALMLY RETURNED TO MAKING LICENCE PLATES.

AFTER THE PRISONER ANGERED THE WARDEN, THE SECRETARY WARNED HIM ABOUT A JAILBREAK.

AFTER THE PRISONER ANGERED THE WARDEN, SECURITY OFFICIALS LOCKED HIM IN THE CELL.

Sentences for Experiment 3B

WHEN THE GIRL HIT THE OLD WOMAN, A NEARBY PEDESTRIAN REPORTED HER TO THE POLICE.

WHEN THE GIRL HIT THE OLD WOMAN, A NEARBY PEDESTRIAN CARRIED HER TO THE HOSPITAL.

WHEN THE GIRL HIT THE OLD WOMAN, SHE WAS REPORTED TO THE POLICE BY A NEARBY PEDESTRIAN.

WHEN THE GIRL HIT THE OLD WOMAN, SHE WAS CARRIED TO THE HOSPITAL BY A NEARBY PEDESTRIAN.

WHEN THE OLD WOMAN WAS HIT BY THE GIRL, A NEARBY PEDESTRIAN REPORTED HER TO THE POLICE.

WHEN THE OLD WOMAN WAS HIT BY THE GIRL, A NEARBY PEDESTRIAN CARRIED HER TO THE HOSPITAL.

WHEN THE OLD WOMAN WAS HIT BY THE GIRL, SHE WAS REPORTED TO THE POLICE BY A NEARBY PEDESTRIAN.

WHEN THE OLD WOMAN WAS HIT BY THE GIRL, SHE WAS CARRIED TO THE HOSPITAL BY A NEARBY PEDESTRIAN.

WHEN FRED TRICKED TOM, THE GUARDIAN PUNISHED HIM IMMEDIATELY.

WHEN FRED TRICKED TOM, THE GUARDIAN CONSOLED HIM IMMEDIATELY.

WHEN FRED TRICKED TOM, HE WAS PUNISHED IMMEDIATELY BY THE GUARDIAN.

WHEN FRED TRICKED TOM, HE WAS CONSOLED IMMEDIATELY BY THE GUARDIAN.

WHEN TOM WAS TRICKED BY FRED, THE GUARDIAN PUNISHED HIM IMMEDIATELY.

WHEN TOM WAS TRICKED BY FRED, THE GUARDIAN CONSOLED HIM IMMEDIATELY.

WHEN TOM WAS TRICKED BY FRED, HE WAS PUNISHED IMMEDIATELY BY THE GUARDIAN.

WHEN TOM WAS TRICKED BY FRED, HE WAS CONSOLED IMMEDIATELY BY THE GUARDIAN.

AFTER THE PRISONER HELPED THE COP, THE GOVERNOR GAVE HIM A PARDON.

AFTER THE PRISONER HELPED THE COP, THE GOVERNOR GAVE HIM A RAISE.

AFTER THE PRISONER HELPED THE COP, HE WAS GIVEN A PARDON BY THE GOVERNOR.

AFTER THE PRISONER HELPED THE COP, HE WAS GIVEN A RAISE BY THE GOVERNOR.

AFTER THE COP WAS HELPED BY THE PRISONER, THE GOVERNOR GAVE HIM A PARDON.

AFTER THE COP WAS HELPED BY THE PRISONER, THE GOVERNOR GAVE HIM A RAISE.

AFTER THE COP WAS HELPED BY THE PRISONER, HE WAS GIVEN A PARDON BY THE GOVERNOR.

AFTER THE COP WAS HELPED BY THE PRISONER, HE WAS GIVEN A RAISE BY THE GOVERNOR.

AFTER THE DEMONSTRATOR HIT THE VISITING OFFICIAL, THE MAYOR CRITICIZED HIM STERNLY.

AFTER THE DEMONSTRATOR HIT THE VISITING OFFICIAL, THE MAYOR GREETED HIM WARMLY.

AFTER THE DEMONSTRATOR HIT THE VISITING OFFICIAL, HE WAS

STERNLY CRITICIZED BY THE MAYOR.

AFTER THE DEMONSTRATOR HIT THE VISITING OFFICIAL, HE WAS WARMLY GREETED BY THE MAYOR.

AFTER THE VISITING OFFICIAL WAS HIT BY THE DEMONSTRATOR, THE MAYOR CRITICIZED HIM STERNLY.

AFTER THE VISITING OFFICIAL WAS HIT BY THE DEMONSTRATOR, THE MAYOR GREETED HIM WARMLY.

AFTER THE VISITING OFFICIAL WAS HIT BY THE DEMONSTRATOR, HE WAS STERNLY CRITICIZED BY THE MAYOR.

AFTER THE VISITING OFFICIAL WAS HIT BY THE DEMONSTRATOR, HE WAS WARMLY GREETED BY THE MAYOR.

AFTER THE BLACK CAR RAN OVER THE POTHOLE, THE WORKMAN FITTED IT WITH ANOTHER AXLE.

AFTER THE BLACK CAR RAN OVER THE POTHOLE, THE WORKMAN FILLED IT WITH SOME ASPHALT.

AFTER THE BLACK CAR RAN OVER THE POTHOLE, IT WAS FITTED WITH ANOTHER AXLE BY A WORKMAN.

AFTER THE BLACK CAR RAN OVER THE POTHOLE, IT WAS FILLED WITH SOME ASPHALT BY A WORKMAN.

AFTER THE POTHOLE WAS RUN OVER BY THE BLACK CAR, THE WORKMAN FITTED IT WITH ANOTHER AXLE.

AFTER THE POTHOLE WAS RUN OVER BY THE BLACK CAR, THE WORKMAN FILLED IT WITH SOME ASPHALT.

AFTER THE POTHOLE WAS RUN OVER BY THE BLACK CAR, IT WAS FITTED WITH ANOTHER AXLE BY A WORKMAN.

AFTER THE POTHOLE WAS RUN OVER BY THE BLACK CAR, IT WAS FILLED WITH SOME ASPHALT BY A WORKMAN.

WHEN THE THOUGHTLESS MAID TEASED THE DAUGHTER, THE FATHER DISMISSED HER WITHOUT SEVERANCE PAY.

WHEN THE THOUGHTLESS MAID TEASED THE DAUGHTER, THE FATHER CONSOLED HER WITH A KISS.

WHEN THE THOUGHTLESS MAID TEASED THE DAUGHTER, SHE WAS DISMISSED WITHOUT SEVERANCE PAY BY THE FATHER.

WHEN THE THOUGHTLESS MAID TEASED THE DAUGHTER, SHE WAS CONSOLED BY THE FATHER WITH A KISS.

WHEN THE DAUGHTER WAS TEASED BY THE THOUGHTLESS MAID, THE FATHER DISMISSED HER WITHOUT SEVERANCE PAY.

WHEN THE DAUGHTER WAS TEASED BY THE THOUGHTLESS MAID, THE FATHER CONSOLED HER WITH A KISS.

WHEN THE DAUGHTER WAS TEASED BY THE THOUGHTLESS MAID, SHE WAS DISMISSED WITHOUT SEVERANCE PAY BY THE FATHER.

WHEN THE DAUGHTER WAS TEASED BY THE THOUGHTLESS MAID, SHE WAS CONSOLED BY THE FATHER WITH A KISS.

WHEN THE DENTIST FRIGHTENED THE LITTLE BOY, THE GRANDMOTHER ACCUSED HIM OF HAVING POOR TECHNIQUE.

WHEN THE DENTIST FRIGHTENED THE LITTLE BOY, THE GRANDMOTHER COMFORTED HIM WITH A SHORT STORY.

WHEN THE DENTIST FRIGHTENED THE LITTLE BOY, HE WAS ACCUSED OF HAVING POOR TECHNIQUE BY THE GRANDMOTHER.

WHEN THE DENTIST FRIGHTENED THE LITTLE BOY, HE WAS COMFORTED BY THE GRANDMOTHER WITH A SHORT STORY.

WHEN THE LITTLE BOY WAS FRIGHTENED BY THE DENTIST, THE GRANDMOTHER ACCUSED HIM OF HAVING POOR TECHNIQUE.

WHEN THE LITTLE BOY WAS FRIGHTENED BY THE DENTIST, THE

GRANDMOTHER COMFORTED HIM WITH A SHORT STORY.

WHEN THE LITTLE BOY WAS FRIGHTENED BY THE DENTIST, HE WAS ACCUSED OF HAVING POOR TECHNIQUE BY THE GRANDMOTHER.

WHEN THE LITTLE BOY WAS FRIGHTENED BY THE DENTIST, HE WAS COMFORTED BY THE GRANDMOTHER WITH A SHORT STORY.

AFTER THE MECHANIC CHEATED PETER, THE SERVICE STATION OWNER FIRED HIM FOR DISHONESTY.

AFTER THE MECHANIC CHEATED PETER, THE SERVICE STATION OWNER SENT HIM ANOTHER BILL.

AFTER THE MECHANIC CHEATED PETER, HE WAS FIRED BY THE SERVICE STATION OWNER FOR DISHONESTY.

AFTER THE MECHANIC CHEATED PETER, HE WAS SENT ANOTHER BILL BY THE SERVICE STATION OWNER.

AFTER PETER WAS CHEATED BY THE MECHANIC, THE SERVICE STATION OWNER FIRED HIM FOR DISHONESTY.

AFTER PETER WAS CHEATED BY THE MECHANIC, THE SERVICE STATION OWNER SENT HIM ANOTHER BILL.

AFTER PETER WAS CHEATED BY THE MECHANIC, HE WAS FIRED BY THE SERVICE STATION OWNER FOR DISHONESTY.

AFTER PETER WAS CHEATED BY THE MECHANIC, HE WAS SENT ANOTHER BILL BY THE SERVICE STATION OWNER.

BECAUSE THE AUTHOR LIBELLED THE CORPORATE EXECUTIVE, THE COURT FINED HIM HEAVILY.

BECAUSE THE AUTHOR LIBELLED THE CORPORATE EXECUTIVE, THE COURT AWARDED HIM DAMAGES.

BECAUSE THE AUTHOR LIBELLED THE CORPORATE EXECUTIVE, HE WAS FINED HEAVILY BY THE COURT.

BECAUSE THE AUTHOR LIBELLED THE CORPORATE EXECUTIVE, HE WAS AWARDED DAMAGES BY THE COURT.

BECAUSE THE CORPORATE EXECUTIVE WAS LIBELLED BY THE AUTHOR, THE COURT FINED HIM HEAVILY.

BECAUSE THE CORPORATE EXECUTIVE WAS LIBELLED BY THE AUTHOR, THE COURT AWARDED HIM DAMAGES.

BECAUSE THE CORPORATE EXECUTIVE WAS LIBELLED BY THE AUTHOR, HE WAS FINED HEAVILY BY THE COURT.

BECAUSE THE CORPORATE EXECUTIVE WAS LIBELLED BY THE AUTHOR, HE WAS AWARDED DAMAGES BY THE COURT.

SHORTLY AFTER THE PATIENT WAS VISITED BY THE SENIOR DOCTOR, THE INTERN QUESTIONED HIM ABOUT MEDICAL PROCEDURE.

SHORTLY AFTER THE PATIENT WAS VISITED BY THE SENIOR DOCTOR, THE INTERN EXAMINED HIM IN THE OFFICE.

SHORTLY AFTER THE PATIENT WAS VISITED BY THE SENIOR DOCTOR, HE WAS QUESTIONED ABOUT MEDICAL PROCEDURE BY THE INTERN.

SHORTLY AFTER THE PATIENT WAS VISITED BY THE SENIOR DOCTOR, HE WAS EXAMINED IN THE OFFICE BY THE INTERN.

SHORTLY AFTER THE SENIOR DOCTOR VISITED THE PATIENT, THE INTERN QUESTIONED HIM ABOUT MEDICAL PROCEDURE.

SHORTLY AFTER THE SENIOR DOCTOR VISITED THE PATIENT, THE INTERN EXAMINED HIM IN THE OFFICE.

SHORTLY AFTER THE SENIOR DOCTOR VISITED THE PATIENT, HE WAS QUESTIONED ABOUT MEDICAL PROCEDURE BY THE INTERN.

SHORTLY AFTER THE SENIOR DOCTOR VISITED THE PATIENT, HE WAS EXAMINED IN THE OFFICE BY THE INTERN.

AFTER THE BUS SMASHED THE VOLKSWAGON, THE INSURANCE COMPANY

KEPT IT OUT OF SERVICE.

AFTER THE BUS SMASHED THE VOLKSWAGON, THE INSURANCE COMPANY DECLARED IT A TOTAL WRECK.

AFTER THE BUS SMASHED THE VOLKSWAGON, IT WAS KEPT OUT OF SERVICE BY THE INSURANCE COMPANY.

AFTER THE BUS SMASHED THE VOLKSWAGON, IT WAS DECLARED A TOTAL WRECK BY THE INSURANCE COMPANY.

AFTER THE VOLKSWAGON WAS SMASHED BY THE BUS, THE INSURANCE COMPANY KEPT IT OUT OF SERVICE.

AFTER THE VOLKSWAGON WAS SMASHED BY THE BUS, THE INSURANCE COMPANY DECLARED IT A TOTAL WRECK.

AFTER THE VOLKSWAGON WAS SMASHED BY THE BUS, IT WAS KEPT OUT OF SERVICE BY THE INSURANCE COMPANY.

AFTER THE VOLKSWAGON WAS SMASHED BY THE BUS, IT WAS DECLARED A TOTAL WRECK BY THE INSURANCE COMPANY.

BEFORE THE GROUND CREW LOCATED THE ASTRONAUTS, A SPECTATOR TOLD THEM JUST WHERE TO LOOK.

BEFORE THE GROUND CREW LOCATED THE ASTRONAUTS, A SPECTATOR SAW THEM DESCENDING THROUGH THE CLOUDS.

BEFORE THE GROUND CREW LOCATED THE ASTRONAUTS, THEY WERE TOLD JUST WHERE TO LOOK BY A SPECTATOR.

BEFORE THE GROUND CREW LOCATED THE ASTRONAUTS, THEY WERE SEEN DESCENDING THROUGH THE CLOUDS BY A SPECTATOR.

BEFORE THE ASTRONAUTS WERE LOCATED BY THE GROUND CREW, A SPECTATOR TOLD THEM JUST WHERE TO LOOK.

BEFORE THE ASTRONAUTS WERE LOCATED BY THE GROUND CREW, A SPECTATOR SAW THEM DESCENDING THROUGH THE CLOUDS.

BEFORE THE ASTRONAUTS WERE LOCATED BY THE GROUND CREW, THEY WERE TOLD JUST WHERE TO LOOK BY A SPECTATOR.

BEFORE THE ASTRONAUTS WERE LOCATED BY THE GROUND CREW, THEY WERE SEEN DESCENDING THROUGH THE CLOUDS BY A SPECTATOR.

WHEN BOB SAW THE MOVIE STAR, THE BARRICADE PREVENTED HIM FROM TOUCHING THE ACTOR.

WHEN BOB SAW THE MOVIE STAR, THE BARRICADE KEPT HIM AWAY FROM THE FANS.

WHEN BOB SAW THE MOVIE STAR, HE WAS PREVENTED FROM TOUCHING THE ACTOR BY A BARRICADE.

WHEN BOB SAW THE MOVIE STAR, HE WAS KEPT AWAY FROM THE FANS BY A BARRICADE.

WHEN THE MOVIE STAR WAS SEEN BY BOB, THE BARRICADE PREVENTED HIM FROM TOUCHING THE ACTOR.

WHEN THE MOVIE STAR WAS SEEN BY BOB, THE BARRICADE KEPT HIM AWAY FROM THE FANS.

WHEN THE MOVIE STAR WAS SEEN BY BOB, HE WAS PREVENTED FROM TOUCHING THE ACTOR BY A BARRICADE.

WHEN THE MOVIE STAR WAS SEEN BY BOB, HE WAS KEPT AWAY FROM THE FANS BY A BARRICADE.

AFTER THE MOTOR BOAT DRIVER NEARLY DROWNED THE BOY, THE COASTGUARD ARRESTED HIM IMMEDIATELY.

AFTER THE MOTOR BOAT DRIVER NEARLY DROWNED THE BOY, THE COASTGUARD RESCUED HIM IMMEDIATELY.

AFTER THE MOTOR BOAT DRIVER NEARLY DROWNED THE BOY, HE WAS ARRESTED IMMEDIATELY BY THE COASTGUARD.

AFTER THE MOTOR BOAT DRIVER NEARLY DROWNED THE BOY, HE WAS

RESCUED IMMEDIATELY BY THE COASTGUARD.

AFTER THE BOY WAS NEARLY DROWNED BY THE MOTOR BOAT DRIVER, THE COASTGUARD ARRESTED HIM IMMEDIATELY.

AFTER THE BOY WAS NEARLY DROWNED BY THE MOTOR BOAT DRIVER, THE COASTGUARD RESCUED HIM IMMEDIATELY.

AFTER THE BOY WAS NEARLY DROWNED BY THE MOTOR BOAT DRIVER, HE WAS ARRESTED IMMEDIATELY BY THE COASTGUARD.

AFTER THE BOY WAS NEARLY DROWNED BY THE MOTOR BOAT DRIVER, HE WAS RESCUED IMMEDIATELY BY THE COASTGUARD.

AFTER THE CLEANING WOMAN INSULTED THE WEALTHY LADY, THE PRINCE ESCORTED HER TO THE LIMOSINE.

AFTER THE CLEANING WOMAN INSULTED THE WEALTHY LADY, THE PRINCE ORDERED HER TO MAKE APOLOGIES.

AFTER THE CLEANING WOMAN INSULTED THE WEALTHY LADY, SHE WAS ESCORTED TO THE LIMOSINE BY THE PRINCE.

AFTER THE CLEANING WOMAN INSULTED THE WEALTHY LADY, SHE WAS ORDERED BY THE PRINCE TO MAKE APOLOGIES.

AFTER THE WEALTHY LADY WAS INSULTED BY THE CLEANING WOMAN, THE PRINCE ESCORTED HER TO THE LIMOSINE.

AFTER THE WEALTHY LADY WAS INSULTED BY THE CLEANING WOMAN, THE PRINCE ORDERED HER TO MAKE APOLOGIES.

AFTER THE WEALTHY LADY WAS INSULTED BY THE CLEANING WOMAN, SHE WAS ESCORTED TO THE LIMOSINE BY THE PRINCE.

AFTER THE WEALTHY LADY WAS INSULTED BY THE CLEANING WOMAN, SHE WAS ORDERED BY THE PRINCE TO MAKE APOLOGIES.

AFTER THE BARBER NICKED THE BABY, THE MOTHER CRITICIZED HIM IN VERY STRONG LANGUAGE.

AFTER THE BARBER NICKED THE BABY, THE MOTHER CONSOLED HIM WITH MUCH LOVING ATTENTION.

AFTER THE BARBER NICKED THE BABY, HE WAS CRITICIZED IN VERY STRONG LANGUAGE BY THE MOTHER.

AFTER THE BARBER NICKED THE BABY, HE WAS CONSOLED BY THE MOTHER WITH MUCH LOVING ATTENTION.

AFTER THE BABY WAS NICKED BY THE BARBER, THE MOTHER CRITICIZED HIM IN VERY STRONG LANGUAGE.

AFTER THE BABY WAS NICKED BY THE BARBER, THE MOTHER CONSOLED HIM WITH MUCH LOVING ATTENTION.

AFTER THE BABY WAS NICKED BY THE BARBER, HE WAS CRITICIZED IN VERY STRONG LANGUAGE BY THE MOTHER.

AFTER THE BABY WAS NICKED BY THE BARBER, HE WAS CONSOLED BY THE MOTHER WITH MUCH LOVING ATTENTION.

WHEN THE PHONE OPERATOR REPEATEDLY INTERRUPTED THE SECRETARY, THE MANAGER SCOLDED HER FOR INCONSIDERATE BEHAVIOR.

WHEN THE PHONE OPERATOR REPEATEDLY INTERRUPTED THE SECRETARY, THE MANAGER PERMITTED HER TO CALL AGAIN.

WHEN THE PHONE OPERATOR REREATEDLY INTERRUPTED THE SECRETARY, SHE WAS SCOLDED FOR INCONSIDERATE BEHAVIOR BY THE MANAGER.

WHEN THE PHONE OPERATOR REPEATEDLY INTERRUPTED THE SECRETARY, SHE WAS PERMITTED BY THE MANAGER TO CALL AGAIN.

WHEN THE SECRETARY WAS REPEATEDLY INTERRUPTED BY THE PHONE OPERATOR, THE MANAGER SCOLDED HER FOR INCONSIDERATE BEHAVIOR.

WHEN THE SECRETARY WAS REPEATEDLY INTERRUPTED BY THE PHONE OPERATOR, THE MANAGER PERMITTED HER TO CALL AGAIN.

WHEN THE SECRETARY WAS REREATEDLY INTERRUPTED BY THE PHONE OPERATOR, SHE WAS SCOLDED FOR INCONSIDERATE BEHAVIOR BY THE MANAGER.

WHEN THE SECRETARY WAS REPEATEDLY INTERRUPTED BY THE PHONE OPERATOR, SHE WAS PERMITTED BY THE MANAGER TO CALL AGAIN.

AFTER THE SALESMANAGER PAID THE TECHNICIAN, THE CLERK ASKED HIM FOR A RAISE.

AFTER THE SALESMANAGER PAID THE TECHNICIAN, THE CLERK SHOWED HIM TO THE DOOR.

AFTER THE SALESMANAGER PAID THE TECHNICIAN, HE WAS ASKED FOR A RAISE BY THE CLERK.

AFTER THE SALESMANAGER PAID THE TECHNICIAN, HE WAS SHOWN TO THE DOOR BY THE CLERK.

AFTER THE TECHNICIAN WAS PAID BY THE SALESMANAGER, THE CLERK ASKED HIM FOR A RAISE.

AFTER THE TECHNICIAN WAS PAID BY THE SALESMANAGER, THE CLERK SHOWED HIM TO THE DOOR.

AFTER THE TECHNICIAN WAS PAID BY THE SALESMANAGER, HE WAS ASKED FOR A RAISE BY THE CLERK.

AFTER THE TECHNICIAN WAS PAID BY THE SALESMANAGER, HE WAS SHOWN TO THE DOOR BY THE CLERK.

BEFORE THE NURSE TENDED THE SICK GIRL, THE DOCTOR INFORMED HER OF THE TREATMENT SCHEDULE.

BEFORE THE NURSE TENDED THE SICK GIRL, THE DOCTOR GAVE HER THE PRESCRIBED PAIN MEDICATION.

BEFORE THE NURSE TENDED THE SICK GIRL, SHE WAS INFORMED OF THE TREATMENT SCHEDULE BY THE DOCTOR.

BEFORE THE NURSE TENDED THE SICK GIRL, SHE WAS GIVEN THE PRESCRIBED PAIN MEDICATION BY THE DOCTOR.

BEFORE THE SICK GIRL WAS TENDED BY THE NURSE, THE DOCTOR INFORMED HER OF THE TREATMENT SCHEDULE.

BEFORE THE SICK GIRL WAS TENDED BY THE NURSE, THE DOCTOR GAVE HER THE PRESCRIBED PAIN MEDICATION.

BEFORE THE SICK GIRL WAS TENDED BY THE NURSE, SHE WAS INFORMED OF THE TREATMENT SCHEDULE BY THE DOCTOR.

BEFORE THE SICK GIRL WAS TENDED BY THE NURSE, SHE WAS GIVEN THE PRESCRIBED PAIN MEDICATION BY THE DOCTOR.

AFTER JACK PUNCHED MICHAEL, THE TEACHER DESPISED HIM FOR HAVING BAD BEHAVIOR.

AFTER JACK PUNCHED MICHAEL, THE TEACHER CRITICIZED HIM FOR HAVING ROWDY FRIENDS.

AFTER JACK PUNCHED MICHAEL, HE WAS DESPISED BY THE TEACHER FOR HAVING BAD BEHAVIOR.

AFTER JACK PUNCHED MICHAEL, HE WAS CRITICIZED BY THE TEACHER FOR HAVING ROWDY FRIENDS.

AFTER MICHAEL WAS PUNCHED BY JACK, THE TEACHER DESPISED HIM FOR HAVING BAD BEHAVIOR.

AFTER MICHAEL WAS PUNCHED BY JACK, THE TEACHER CRITICIZED HIM FOR HAVING ROWDY FRIENDS.

AFTER MICHAEL WAS PUNCHED BY JACK, HE WAS DESPISED BY THE TEACHER FOR HAVING BAD BEHAVIOR.

AFTER MICHAEL WAS PUNCHED BY JACK, HE WAS CRITICIZED BY THE

TEACHER FOR HAVING ROWDY FRIENDS.
BECAUSE THE SECURITY GUARDS ANNOYED THE STUDENTS, THE SUPERVISOR ORDERED THEM TO PATROL ANOTHER FLOOR.
BECAUSE THE SECURITY GUARDS ANNOYED THE STUDENTS, THE SUPERVISOR ADVISED THEM TO CLOSE THE DOOR.
BECAUSE THE SECURITY GUARDS ANNOYED THE STUDENTS, THEY WERE ORDERED BY THE SUPERVISOR TO PATROL ANOTHER FLOOR.
BECAUSE THE SECURITY GUARDS ANNOYED THE STUDENTS, THEY WERE ADVISED BY THE SUPERVISOR TO CLOSE THE DOOR.
BECAUSE THE STUDENTS WERE ANNOYED BY THE SECURITY GUARDS, THE SUPERVISOR ORDERED THEM TO PATROL ANOTHER FLOOR.
BECAUSE THE STUDENTS WERE ANNOYED BY THE SECURITY GUARDS, THE SUPERVISOR ADVISED THEM TO CLOSE THE DOOR.
BECAUSE THE STUDENTS WERE ANNOYED BY THE SECURITY GUARDS, THEY WERE ORDERED BY THE SUPERVISOR TO PATROL ANOTHER FLOOR.
BECAUSE THE STUDENTS WERE ANNOYED BY THE SECURITY GUARDS, THEY WERE ADVISED BY THE SUPERVISOR TO CLOSE THE DOOR.
SINCE THE PRINCIPAL SCOLDED THE LITTLE BOY, THE FATHER REPORTED HIM TO THE SCHOOL BOARD.
SINCE THE PRINCIPAL SCOLDED THE LITTLE BOY, THE FATHER BROUGHT HIM TO SCHOOL EVERY DAY.
SINCE THE PRINCIPAL SCOLDED THE LITTLE BOY, HE WAS REPORTED TO THE SCHOOL BOARD BY THE FATHER.
SINCE THE PRINCIPAL SCOLDED THE LITTLE BOY, HE WAS BROUGHT TO SCHOOL EVERY DAY BY THE FATHER.
SINCE THE LITTLE BOY WAS SCOLDED BY THE PRINCIPAL, THE

FATHER REPORTED HIM TO THE SCHOOL BOARD.

SINCE THE LITTLE BOY WAS SCOLDED BY THE PRINCIPAL, THE FATHER BROUGHT HIM TO SCHOOL EVERY DAY.

SINCE THE LITTLE BOY WAS SCOLDED BY THE PRINCIPAL, HE WAS REPORTED TO THE SCHOOL BOARD BY THE FATHER.

SINCE THE LITTLE BOY WAS SCOLDED BY THE PRINCIPAL, HE WAS BROUGHT TO SCHOOL EVERY DAY BY THE FATHER.

WHEN THE BIOLOGIST DECEIVED THE DEAN, THE COLLEGE PRESIDENT CRITICIZED HIM FOR BEING SO TRUSTFUL.

WHEN THE BIOLOGIST DECEIVED THE DEAN, THE COLLEGE PRESIDENT SCORNED HIM FOR BEING SO DISHONEST.

WHEN THE BIOLOGIST DECEIVED THE DEAN, HE WAS CRITICIZED BY THE COLLEGE PRESIDENT FOR BEING SO TRUSTFUL.

WHEN THE BIOLOGIST DECEIVED THE DEAN, HE WAS SCORNED BY THE COLLEGE PRESIDENT FOR BEING SO DISHONEST.

WHEN THE DEAN WAS DECEIVED BY THE BIOLOGIST, THE COLLEGE PRESIDENT CRITICIZED HIM FOR BEING SO TRUSTFUL.

WHEN THE DEAN WAS DECEIVED BY THE BIOLOGIST, THE COLLEGE PRESIDENT SCORNED HIM FOR BEING SO DISHONEST.

WHEN THE DEAN WAS DECEIVED BY THE BIOLOGIST, HE WAS CRITICIZED BY THE COLLEGE PRESIDENT FOR BEING SO TRUSTFUL.

WHEN THE DEAN WAS DECEIVED BY THE BIOLOGIST, HE WAS SCORNED BY THE COLLEGE PRESIDENT FOR BEING SO DISHONEST.

BECAUSE THE NEWSBOY BADLY FRIGHTENED THE CUSTOMER, THE NEWS COMPANY FIRED HIM THE NEXT DAY.

BECAUSE THE NEWSBOY BADLY FRIGHTENED THE CUSTOMER, THE NEWS COMPANY SENT HIM SOME FREE PAPERS.

BECAUSE THE NEWSBOY BADLY FRIGHTENED THE CUSTOMER, HE WAS FIRED THE NEXT DAY BY THE NEWS COMPANY.

BECAUSE THE NEWSBOY BADLY FRIGHTENED THE CUSTOMER, HE WAS SENT SOME FREE PAPERS BY THE NEWS COMPANY.

BECAUSE THE CUSTOMER WAS BADLY FRIGHTENED BY THE NEWSBOY, THE NEWS COMPANY FIRED HIM THE NEXT DAY.

BECAUSE THE CUSTOMER WAS BADLY FRIGHTENED BY THE NEWSBOY, THE NEWS COMPANY SENT HIM SOME FREE PAPERS.

BECAUSE THE CUSTOMER WAS BADLY FRIGHTENED BY THE NEWSBOY, HE WAS FIRED THE NEXT DAY BY THE NEWS COMPANY.

BECAUSE THE CUSTOMER WAS BADLY FRIGHTENED BY THE NEWSBOY, HE WAS SENT SOME FREE PAPERS BY THE NEWS COMPANY.

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