The nature of the search for referents in discourse processing.

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THE NATURE OF THE SEARCH FOR REFERENTS IN DISCOURSE PROCESSING

A Dissertation Presented

By

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IN DISCOURSE PROCESSING

A DISSERTATION PRESENTED

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This dissertation is dedicated to
Robert H. O'Brien
and to the memory of
Mary K. O'Brien
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ABSTRACT

The Nature of the Search for Referents in Discourse Processing
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Kintsch and van Dijk assume that when a reader encounters a reference to a concept no longer available in short-term memory that a search through long-term memory for the original concept is necessary. A series of four experiments are reported that address the nature of this search process. In the first two experiments, subjects read passages that contained two possible referents; one referent appeared early in the passages and the other referent appeared relatively late. Read time differences for the first two experiments demonstrated that late referents are reinstated more quickly than early referents. Several viable search models within the Kintsch and van Dijk framework were considered. However, none of these models was capable of predicting faster access to the late
referent. Following Experiment 2, it was proposed that text is represented as an integrated network and that a backward parallel search model provided that best account of the reinstatement time differences. Experiments 3 and 4 provided further support for these assumptions. The results of these experiments showed that concepts that appeared between a referent and the end of a passage are often considered during the search for a referent. Intervening concepts that are considered are tagged as "not appropriate." This tag produces response competition that slows verification times for statements containing these concepts. The results of all four experiments are discussed in terms of the Kintsch and van Dijk framework.
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CHAPTER I
INTRODUCTION

In the course of reading text, the reader frequently encounters references to concepts introduced earlier, but that are no longer available. Most theorists have argued that to fully comprehend text, readers must be able to find these original concepts in memory and presumably link them to information currently predicated about them (e.g. Kintsch, 1979; Kintsch & van Dijk, 1978). As I will demonstrate in the course of my literature review, the evidence for such a search is weak (Cirilo, 1981; Dell, McKoon, & Ratcliff, 1983; Lesgold, Roth, & Curtis, 1979; McKoon & Ratcliff, 1980). Therefore one purpose of this dissertation will be to demonstrate that readers do in fact retrieve referents from memory. Assuming conditions under which memory is searched for referents, we may ask how that search proceeds. Is the required information directly addressed? Or, is there some hierarchically organized representation that is searched either serially or in parallel?

In order to study such processes, some assumptions need to be made regarding the representation of text in memory and the process whereby such a representation is
created. In the sections that follow, a representation proposed by Kintsch (1974) and a process model developed by Kintsch and van Dijk (1978) will be discussed and supportive data presented. In a final section, recent evidence regarding the search for referents will be presented and evaluated in the context of the Kintsch and van Dijk model.

REPRESENTATION OF MEANING

Propositions

In order to study the complex processes involved in the comprehension of prose, a method for determining the conceptual meaning underlying a text is necessary. There has been general agreement that the representation of meaning is structured (Anderson, 1976; Anderson & Bower, 1973; Fillmore, 1968; Fredericksen, 1975; Grimes, 1975; Kintsch, 1974; Rumelhart, Lindsay, & Norman, 1972; van Dijk, 1977) and that propositions are the units of meaning within that structure. Unfortunately, practical application of propositional theories to prose passages has been difficult with many researchers finding the rules governing application to be both vague and subjective. Kintsch (1974), however, has proposed a theory of
propositional analysis that, although far from complete, has avoided many of these problems and proved moderately successful in application (see Turner & Greene, 1977).

According to Kintsch, the semantic base of a text consists of an ordered list of propositions; each proposition consists of a set of words used to represent underlying concepts. Within each proposition, one word serves as a relation or predicator while the rest serve as arguments of the predicator. Words are chosen to represent entries in the lexicon of semantic memory and are not to be confused with the words themselves. They merely serve as tokens for a particular concept. As a result, it is possible that several different words in the surface structure of a text can be used to represent the same underlying concept. The predicator of a proposition serves to relate several arguments forming a single idea and the lexicon decides which combinations of arguments and predictors are permissible. Consider the following examples of sentences in their surface and propositional form.

The Red Sox won. (WIN, RED SOX)

The Red Sox beat the Yankees. (BEAT, RED SOX, YANKEES)

Note that several conventions have been adopted for representing propositions. First, the predicator and
arguments are written in capital letters to emphasize that they are word concepts rather than individual words. Second, the predicator is written first, followed by the arguments of the proposition. Finally, each word concept is separated by a comma and the entire proposition is enclosed in parentheses. Although the above examples are representations of simple sentences, the model is capable of handling much more complex material (Kintsch, 1974; Turner and Greene, 1977).

There is considerable evidence supporting propositions as a unit of meaning. For example, Kintsch and Keenan (1973) found that reading rate was a monotonically increasing function of the number of propositions being processed irrespective of the number of words. It has also been shown that a particular word is more likely to be recalled if cued by a word from the same proposition (Lesgold, 1972; Wanner, 1975) or if another word from the same proposition has been recalled (Anderson & Bower, 1973). Geotz, Anderson, and Schallert (1981) further demonstrated that one-proposition sentences were more likely to be recalled as a whole than three-proposition sentences, and that fragmentary recall of the three-proposition sentences usually preserved whole propositions (see also Kintsch & Glass, 1974). The most convincing
evidence, however, has been provided by Ratcliff and McKoon (1978). They had subjects study sets of sentences and, in a test phase, found that subjects were quicker to recognize a word presented earlier if it had been primed by a word from the same proposition than if primed by a word from the same sentence but a different proposition.

Text Base

The evidence presented thus far supports the existence of individual propositions. However, propositions are generally not viewed in isolation but instead are combined to form what Kintsch refers to as a text base. A text base is an ordered list of connected propositions that represent the meaning of an entire passage. Within the Kintsch framework, the single most important characteristic of a text base is that it be referentially coherent. Coherence is maintained as long as there is argument overlap among each of the propositions. For example, the two propositions (FALL, CHAIR) and (HEAVY, CHAIR) are considered to be referentially coherent since they both contain the same argument, CHAIR. Unless the context indicates otherwise, it is assumed that whenever two propositions contain the same word concept, they both have the same conceptual referent. Also, all propositions that
contain a repeated argument are subordinate to the proposition that initially introduced the argument. Thus, using the above example, the proposition (HEAVY, CHAIR) would be considered subordinate to the proposition (FALL, CHAIR).

By connecting propositions through argument overlap, and assuming subordination, it is possible to create a memory representation of a text that is hierarchical in nature with all repeated instances of a concept subordinate to the first proposition containing that particular concept. As an example, consider the short text and the list of the propositions derived from that text in Table 1. Figure 1 shows how these propositions are arranged into a coherent text base or graph that represents the underlying structure. There are two major points to be considered regarding this graph. First, since the general theme of the passage is about the Red Sox beating the Yankees, proposition 3 is chosen as the superordinate proposition. All other references to the Red Sox (i.e. propositions 1, 4, and 7) are subordinate to it. The manner in which this superordinate proposition is chosen is not well specified. Second, consider proposition 7 versus propositions 2, 5, and 6. In the surface structure of the passage, propositions 2, 5, and 6 are closer to the superordinate
TABLE 1

EXAMPLE OF THE PROPOSITIONS DERIVED FROM A SHORT TEXT

The Red Sox were very happy. They finally defeated the Yankees. The Yankee season had ended. The Red Sox hung Bucky Dent from the left fieldwall. He would never hit another home run.

1 (FEEL, RED SOX, HAPPY)
2 (VERY, HAPPY)
3 (DEFEAT, RED SOX, YANKEES)
4 (QUANTIFY, 3, FINALLY)
5 (YANKEE, SEASON)
6 (END, SEASON)
7 (HANG, RED SOX, BUCKY DENT)
8 (LOCATION: FROM, 7, WALL)
9 (LEFT FIELD, WALL)
10 (HIT, BUCKY DENT, HOME RUN)
11 (QUANTIFY, 10, NEVER)
12 (ANOTHER, HOME RUN)
FIGURE 1

EXAMPLE OF A COHERENCE GRAPH FOR THE PROPOSITIONS CONTAINED IN TABLE 1
proposition, while in the coherence graph proposition 7 is closer. Thus, the underlying representation of a text need not correspond directly to the surface structure.

The psychological reality of the coherence graph is also well supported. Kintsch, Kozminsky, Streby, McKoon, and Keenan (1975) found that reading times were longer for texts utilizing several different propositional arguments than for texts containing only a few different arguments. Furthermore, subjects recalled less from passages containing several different arguments. Kintsch et al. argued that readers found it easier to process and retain in memory a proposition that was built up from old, already familiar concepts than to process new, unfamiliar concepts. This is because when new arguments are introduced, the reader must establish new concept nodes. If, however, a concept node has already been established, the reader simply connects repeated arguments to the existing node. (see also Manelis & Yekovich, 1976). This is consistent with the position that coherence is maintained through argument overlap. A text that has introduced only few arguments is more likely to have propositions with concepts in common. Increases in argument commonality should facilitate comprehension by decreasing the number of new nodes that need to be established and increasing the
likelihood that connections can be found with existing nodes. The process of discovering and connecting referents is consistent with Clark's position (1977; 1978) and has formed the basis for Haviland and Clark's (1974) "Given-New Hypothesis".

McKoon and Ratcliff (1980) provide further evidence that propositions are connected through argument overlap. Subjects read passages that were varied with respect to the distance between word concepts in both the surface structure and the underlying coherence graph. Ratcliff and McKoon found that when two propositions were distant in the surface structure but connected in the coherence graph, priming among concepts from those propositions was substantial. On the other hand, if concepts were close in the surface structure, but distant in the coherence graph, priming was severely attenuated. Thus, in those instances in which the surface structure and the coherence graph differed, priming effects were determined by the structure of the coherence graph.

In support of the hierarchical nature of the coherence graph, Kintsch et al. (1975) found that superordinate propositions were better recalled than subordinate propositions. Although superordinate propositions are often found in earlier serial positions, in the Kintsch et
al. data superordinate propositions were better recalled at all serial positions.

Certainly none of the evidence cited in these two section can, by itself, substantiate the reality of propositions as the unit of meaning or the text base as the memory representation for text. Together, however, these studies do provide convergent support for the representation proposed by Kintsch (1974). Although this representation is at best a first approximation; it does seem to be a reasonable place to start.

THE KINTSCH AND VAN DIJK MODEL

In the previous section it was suggested that the proposition is the unit of meaning, and that the memory representation for a text is made up of an ordered list of propositions: each proposition connected to a preceding proposition through argument overlap. Empirical support was offered for such a representation. What has been lacking thus far is a process model that describes how such a memory representation is created and stored in long-term memory. One such model is that proposed by Kintsch and van Dijk (1978); the rest of this proposal will concern itself with aspects of that model. In the present section, the
model will be presented, followed by data that offer empirical support.

The Kintsch and van Dijk model assumes two general sets of operators that are used in processing and comprehending a text: micro-operators and macro-operators. The micro-operators deal with the storage and retrieval of individual propositions while the macro-operators are responsible for storage and retrieval of the discourse as a whole.

**Microprocessing**

There are two major assumptions that the model makes in processing a text and creating a coherent text base. First, each proposition must be connected to another proposition through argument overlap. Thus, the first step in creating a coherent text base is ensuring that it maintain referential coherence. If so, then the text can be accepted for further processing. If not, then inferential processes must be initiated to establish coherence. This leads to the second major assumption of the model. Assuming an information processing system of limited capacity, it is unlikely that an entire text could be checked for referential coherence at the same time. Thus, the model assumes that a text is processed in cycles,
with only a few propositions being processed on each cycle. The number of propositions that can be processed on any given cycle is a free parameter of the model but has been estimated to vary between 6 to 10 propositions (Kintsch & Vipond, 1979). This freedom in the number of input propositions allows the reader to seek convenient points in a text at which to conclude an input segment (e.g. end of a sentence, end of a clause).

When a reader begins reading a text, the first several propositions are input into working memory. During this first processing cycle, one proposition is chosen to serve as a superordinate proposition. As stated earlier, the rule governing selection of this proposition is not specified. The remaining propositions are then connected on the basis of argument overlap in the same manner as in Figure 1.

Once a coherence graph has been completed, some propositions are selected to be retained in a short-term memory buffer. The buffer is a separate part of short-term memory that is set aside for the maintenance of a subset of propositions. This is done to provide possible connections for the next set of propositions to be input. The main graph is then stored in long-term memory in its entirety. Thus, some propositions are held in short-term memory for
more than one processing cycle while others are only processed once. Again, given that the system is of limited capacity, the number of propositions that can be held over from one cycle to the next is limited. Since it would be inefficient for these propositions to be chosen at random, a series of rules referred to as the leading edge strategy has been established to guide this decision process. Because this is the most critical aspect of processing at the micropropositional level, it will be discussed in some detail.

The major assumptions of the leading edge strategy are that important propositions (those high in the coherence graph), and those most recent in the graph, are to be favored. More specifically, the strategy operates as follows. The superordinate proposition, and the most recent level 2 proposition pointed to by the superordinate proposition, are both maintained in the buffer. This process continues with the most recent level 3 proposition pointed to by the most recent level 2 proposition also maintained and so on until the short-term memory buffer is full. If the bottom of a coherence graph has been reached and the buffer is still not full, then propositions from level 2 are added as a function of recency. As an example, consider the coherence graph in Figure 2. Ten propositions
FIGURE 2

EXAMPLE OF A COHERENCE GRAPH
have been input, and it will be assumed that referential coherence has been maintained. Proposition 7 has been chosen to serve as the superordinate proposition at level 1. Connected to it at level 2 are propositions 1, 2, 3, 4, 5, 8, and 10. Level 3 contains propositions 6, 9, and 11 while at level 4 there is proposition 12. Following the leading edge strategy, and assuming a buffer of size 5, the following propositions would be chosen for maintenance in the buffer. First, proposition 7 would be selected since it is the superordinate proposition. Propositions 10, 11, and 12 would also be chosen since they are the most recent propositions at each succeeding level pointed to by the most recent proposition at the preceding level. At this point, the buffer is still not full, so propositions are added from level 2 on the basis of recency. This results in proposition 8 also being added.

Once a set of propositions have been processed with a select few being held in the buffer, short-term memory is purged and the next set of propositions are input. If any of these propositions can not be connected due to a lack of referential coherence, there are two possible solutions. First, the reader will conduct a reinstatement search. That is, the reader will search the long term memory graph in an attempt to find a proposition that shares an
argument. If a linking proposition can be found, that proposition is reinstated into short-term memory and a connection made. If this search fails, the reader then attempts to create a bridging inference in order to establish argument overlap. There are two important characteristics of these processes used to overcome breakdowns in coherence. First, the order is assumed to be invariant; readers will only generate an inference if a reinstatement search has failed. Second, both processes make heavy demands upon available resources.

Macroprocessing

At the same time that the text microstructure is being derived, the macrostructure is also derived. Macro-operators transform micropropositions into macropropositions that reflect the gist of a text. Macropropositions are generally organized reductions of the more detailed microstructure of a text; they combine the same information as the microstructure but in a more global fashion. The rules that govern the use of the macro-operators are deletion, generalization, and construction. The deletion rule requires that any proposition that is not a direct or indirect interpretation of a subsequent proposition be deleted. Generalization permits a series of propositions
to be represented by a general proposition. Construction allows a new macroproposition to be generated that can be used to denote a global fact that is either an implied or necessary condition of a series of micropropositions.

These macrorules are applied under the operating control of a schema. The schema is used to determine what micropropositions are relevant for maintaining the gist of the text. By using a schema to guide the use of macro-operators, irrelevant micropropositions never become macropropositions. However, with some probability, if irrelevant micropropositions have generalizations or constructions, those may in fact become macropropositions. With a somewhat higher probability, relevant micropropositions may become direct macropropositions or, if micropropositions have generalizations or constructions, they may also become macropropositions.

The macro-operators are applied recursively on the macrostructure creating several levels of the macrostructure. These levels are hierarchical in nature and, as such, the macro-operators are applied with increasingly stringent criteria of relevance. At the lowest level, many propositions are selected by the schema to be transformed by the macro-operators. At higher levels, the criteria for relevance become stricter until
finally, at the highest level, only a single macroproposition remains. This generally reflects the title of a text.

**Storage and Retrieval**

Micropropositions are all stored in the long-term memory graph. The probability of recall of a particular microproposition is assumed to increase with the number of cycles during which it has been maintained in the short-term memory buffer. Therefore, propositions that have a high degree of argument overlap also have a high probability of being carried over in the buffer and, as a result, have a higher probability of being recalled. This relationship between time in the short-term buffer and subsequent recall is consistent with aspects of the short-term memory store proposed by Atkinson and Shiffrin (1968).

The probability of storage and retrieval of a macroproposition is a function of its relevance to the text as determined by the governing schema. When macropropositions are no longer available for recall, the reader will attempt to reconstruct the text using that schema. There are three rules that govern the reconstructive process and they are simply the inverse application of the macro-operator rules. Of course, for
those rules to be applied, some macropropositions must be available.

EVIDENCE SUPPORTING THE MODEL

Comprehension and Recall

In early research (Kintsch & van Dijk, 1978; Kintsch & Vipond, 1979; Miller & Kintsch, 1980) passages were processed using the model and predictions were generated about passage recall. The model was then evaluated in terms of its ability to accurately predict recall performance of real subjects. Kintsch and van Dijk (1978) specified five parameters of the model: (1) the number of propositions input on a cycle \((n)\), (2) the number of propositions held over in the short-term buffer \((s)\), (3) the probability of micropropositional recall \((p)\), (4) the probability of relevant macropropositional recall \((m)\), and (5) the probability of irrelevant macropropositional recall \((g)\). Comparisons of the predicted frequency of recall of micro- and macropropositions with those observed from subjects' protocols yielded excellent fits (Kintsch & van Dijk, 1978; Miller & Kintsch, 1980).

The model has also been used to assess text readability (Kintsch & Vipond, 1979; Miller & Kintsch,
It has often been assumed that text readability is simply a function of features such as word frequency and sentence length. Kintsch and Vipond (1979) offer an alternative approach that assumes that readability (defined as reading time divided by percentage recall) is an interaction of the text and the reader. Specifically, they argued that at those points in a text where coherent relations are absent, readers will experience comprehension difficulties. As noted earlier, coherence is a function of argument overlap. When argument overlap is not present, a reader must either perform a reinstatement search or create a bridging inference. Miller and Kintsch (1980) tested these assumptions and found that the number of inferences and reinstatements necessary to maintain coherence were, in fact, critical determinants of readability (see also Kintsch & Vipond, 1979).

Vipond (1980) found that maximum breadth of processing (i.e. the number of hierarchical levels) also influenced comprehension difficulty. Vipond argued that readers find text easier to process when only a few superordinate nodes need to be established that can be used repeatedly. In support of earlier studies (Kintsch & Vipond, 1979; Miller & Kintsch, 1980), Vipond also found that the number of reinstatements necessary was also a critical determinant of
readability.

Hierarchical Representation

Many researchers have demonstrated that higher-level propositions are recalled better than lower-level propositions (Kintsch & van Dijk, 1978; Thorndike, 1977; Waters, 1978; Yekovich & Thorndike, 1981). Cirilo and Foss (1980) created pairs of passages in which a particular proposition was embedded either high or low in the hierarchical representation of a passage. They found that when a particular proposition was high in the hierarchy, read time was longer than when it was low in the hierarchy.

Initially, it is not clear why Cirilo found that high level propositions were difficult to process whereas earlier studies have found that they are also better recalled. However, the Kintsch and van Dijk model does provide a nice account of these results. First, consider the finding that high level propositions are more difficult to process. Since high level propositions typically introduce new material, there is often little argument overlap between them and propositions that have been presented earlier. Therefore, when readers encounter high level propositions, they must engage in additional inferential processing in order to maintain argument
overlap. (A similar explanation has been offered by Yekovich & Thorndike, 1981). Now consider the result that high level propositions show better recall. Typically, higher level propositions introduce a textual theme which is then elaborated upon by lower-level propositions that follow in the text. As a result, these high level propositions will tend to be maintained in the buffer over several processing cycles since they bear direct relevance to many of the propositions that follow them. A result of this increased number of processing cycles is an increase in recall probability.

**Short-Term Memory Buffer**

The assumption in the Kintsch and van Dijk model that texts are processed in a series of cycles is supported by several results (Glanzer, Dorfman, & Kaplan, 1981; Jarvella, 1971; 1979). For example, Jarvella (1971) interrupted subjects while they were listening to stories and asked them to recall as much of the story as possible. He found that subjects were able to produce verbatim recall for the most recent information but that performance dropped for anything that had occurred earlier in the passage. Similar results have been obtained by Caplan (1972) and Chang (1980). The conclusion from studies such
as these is that small segments of a text (e.g. sentences or major clauses) are input into short-term memory, these then are processed semantically with the result stored in long-term memory. Short-term memory is then purged so that the next segment of text can be processed.

While the above results are suggestive of the short-term memory buffer, a more direct test was provided by Fletcher (1981). He created a set of passages for which, the leading edge strategy mediated what should and should not be in the short-term memory buffer on any given processing cycle. Given earlier results (e.g. Jarvella, 1971; Caplan, 1972; Chang, 1980) propositions which the leading edge strategy predicts to have been carried over in the buffer should be more available than propositions that have been processed on the same cycle but dropped from short-term memory. At some point during the reading of a passage, Fletcher presented a word read earlier. The subjects' task was to recall the content word that immediately followed the cue word in the passage. The recall cue was either contained in a proposition that was assumed to have been carried over in the short-term buffer from the previous cycle or was from a proposition that was assumed to have been dropped from the buffer on the previous cycle. Results showed that if the model predicted
that a proposition was still in the buffer, probability of recall was significantly higher than for propositions from the same processing cycle that the model predicted to have been dropped from the buffer. Further, those just dropped propositions did not differ in recall from propositions read earlier in the text. Thus it would appear that propositions in the buffer remain highly available while propositions that have just been dropped are no more available than propositions that had occurred earlier in the text.

These results offer strong support for several aspects of the model. First, the notion of a short-term memory buffer was substantiated. Second, the position that portions of a text are selectively maintained from one processing cycle to the next was strongly supported. Finally, these results validate the leading edge strategy as a means for predicting which propositions will be maintained in the buffer.

Reinstatement Searches

Much of the evidence in the preceding section has suggested that texts can be described in terms of their cohesiveness (Miller & Kintsch, 1980; Vipond, 1980) and that the more cohesive a text, the easier it will be to
process (Cirilo & Foss, 1980; Vipond, 1980). It was argued that cohesion is a function of common referents among groups of propositions that form a text.

In order for readers to maintain coherence, they must be able to find common arguments between currently input propositions and propositions that were processed on a previous cycle. The process of referring back to previously introduced concepts is called anaphoric reference and may be accomplished in a number of ways (e.g. noun repetition, pronominalization, definite noun phrase).

Generally, finding referents occurs with little difficulty since the reader is able to maintain a select set of propositions from previous cycles in an active state in the short-term memory buffer. This maintenance of propositions facilitates connections between old and new propositions by allowing for an immediate match. However, the use of a short-term memory buffer can not guarantee that connections can be found within short-term memory. When such a case arises, the reader must perform a reinstatement search. That is, the reader must search the long-term memory graph, find a proposition that shares argument overlap with the present set of propositions, and reinstate that proposition into short-term memory so that
connections can be formed and coherence maintained.

The selection process whereby propositions are held over in the buffer is heavily biased towards recency. Therefore, when propositions sharing arguments are relatively close together in the surface structure of a text, coherence problems do not generally arise. Coherence problems become more common as the distance between propositions sharing an argument increases. This phenomena is referred to as a distance effect and has been demonstrated in a number of studies (Lesgold, Roth, & Curtis, 1979; Carpenter & Just, 1977; Clark & Sengal, 1979; Cirilo, 1981; Daneman & Carpenter, 1980; Manelis & Yekovich, 1976).

Investigating the process of searching long-term memory for referents, Cirilo (1981) had subjects read a series of relatively long passages. In one version, a target sentence shared no referents with any of its precursors. In two other versions, the same target sentence shared a single referent with an earlier sentence. For these latter conditions, the target sentence and its precursor were either directly adjacent in the text or were separated by three sentences. Read times on the target line revealed the following pattern. Having no precursor produced the longest read time while sentences with a
distant precursor took longer to comprehend than sentences with a near precursor. These results offer some support for the Kintsch and van Dijk model. First, consider that the target sentences with a near precursor were read fastest. Presumably, the precursor was still in the buffer allowing for an immediate match that required little additional time. In the case of the distant precursor, a long term memory search would be necessary to reinstate it before a match could be made. Finally, target sentences with no precursor would be expected to produce the longest read times since an exhaustive reinstatement search would be performed followed by an inference.

Lesgold, Roth, and Curtis (1979) presented subjects with passages that contained an introductory segment of several sentences which described the general setting of a passage. The last sentence of these introductory segments contained a referent for a target sentence that followed. For example, the last sentence of an introductory segment "A thick cloud of smoke hung over the forest" was followed by a target sentence "The forest was on fire". In foregrounding conditions either 0, 2, or 4 sentences intervened but preserved the referent in short-term memory. In the backgrounding conditions, either 2 or 4 sentences were interjected that were irrelevant to the target-
referent context of the introductory segment, and presumably caused the referent to be dropped from short-term memory. Lesgold et al. found that reading was slower in the background conditions where a reinstatement search was necessary than in the foreground conditions where an immediate match was possible.

These data would seem to support the reinstatement search assumption of the Kintsch and van Dijk model. There is, however, an interpretive problem. Lesgold et al had subjects read the passages presented on a screen in their entirety except for the target sentence. When subjects had finished reading the introductory segment, they pressed a key causing the passage to disappear and the target sentence to appear. They then pressed a key when they had comprehended the target sentence. Not only is this reading situation unnatural, but it clearly draws the subjects' attention to the target sentence by presenting it in isolation, leading to the real possibility that it was somehow processed differently. In fact, evidence suggesting this possibility has been provided by a failure to replicate when this procedural problem was eliminated and smooth transitions were added between ideas (Myers, personal communication).

A more serious problem with both the Lesgold et al.
and Cirilo (1981) data is the use of reading time differences as the sole evidence for a reinstatement search. A slowdown in read times at the point at which a reinstatement search is expected could result for reasons other than the reader actually reinstating. Consider an example from the Lesgold et al materials. Early in a passage a reader is told about a cloud of smoke hanging over a forest. Then several sentences intervene that change the topic of the discourse followed by the sentence "The forest was on fire". It is possible that a reader experiences a moment of confusion wondering what forest is being referred to but, after some hesitation, continues without ever having reactivated the referent earlier in the text.

Addressing this issue of reactivation of referents, McKoon and Ratcliff (1980) had subjects read short paragraphs in which the first sentence introduced a referent that was to be either reactivated or not by an anaphor in the final sentence. For example, the first sentence would introduce the concept "Burglar" and the final sentence would then either mention "The criminal," reactivating its referent "Burglar," or would mention some unrelated concept (e.g. "cat"). Immediately upon reading the final sentence, subjects were asked to give a
recognition response to the potential referents in the first sentence. McKoon and Ratcliff found that if the final sentence contained an anaphor whose referent was in the first sentence, subjects were able to recognize the referent more quickly than when the final sentence did not contain an anaphor. In a second experiment, they demonstrated that not only was the referent activated but, consistent with Kintsch and Vipond (1979), the entire proposition containing the referent was also activated.

Unfortunately, there are some interpretive problems with this study. McKoon and Ratcliff want to claim that the anaphor in the first sentence has served to reactivate its referent. That is, they are assuming that the referent has been dropped from the short-term memory buffer and is then accessed from long-term memory in the presence of an anaphor. However, it does not seem that their passages were long enough to accomplish this. Each passage was either two or four sentences long and, from the example given, it appears that they varied in length from about 4 to 10 propositions. Kintsch and Vipond (1979) have suggested that between 6 to 10 propositions can be input on any given processing cycle. Thus there is some question as to whether any propositions were ever dropped from short-term memory. Even if it is assumed that capacity was
exceeded and some propositions had to be dropped from the buffer before an anaphor was encountered, it is very unlikely that the very first proposition (the one containing the referent) would be dropped. In fact, it is more likely that it would serve as a good candidate for a superordinate proposition and, as a result, be maintained over several processing cycles. Clearly, what this study lacks is some indication that prior to encountering an anaphor, the referent is indeed no longer in either short-term memory or the buffer.

In an extension of this work, Dell, McKoon, and Ratcliff (1983) found that an anaphor can activate its referent within 250 msec. However, the same materials were used as in McKoon and Ratcliff (1980) and, as a result, it remains questionable as to whether or not the referent really needed to be reactivated. In fact, in this study they do probe for the referent just prior to the occurrence of an anaphor and find no difference in recognition latency between these probes and probes occurring after presentation of an anaphor.

SUMMARY

In summary, the research supporting the reinstatement
search process is weak and there is no data suggesting how reinstatement searches proceed. The goal of present research was to further examine the nature of the reinstatement search process. In Experiment 1, the manner in which readers search long-term memory for referents was explored. Experiment 2 addressed the issues raised with previous studies. More importantly, however, it provided convergent evidence for an integrated text representation and a backward parallel search model. Experiments 3 and 4 were designed to test further these assumptions.
According to the Kintsch and van Dijk model, if a set of propositions presently being processed contains a reference to a concept no longer in the short-term memory buffer, the reader will perform a time-consuming search through long-term memory in order to reinstate that concept. Several researchers (Cirilo, 1981; Lesgold, et al., 1979; Miller & Kintsch, 1980) have suggested that this search reflects the structure of the stored propositional network. For example, Miller and Kintsch (1980) have proposed that the search begins at level 1 (The highest level of the network) and proceeds downward while Cirilo has hypothesized that the search begins with the current contents of the buffer and proceeds backward.

Experiment 1 was designed to suggest how the search for referents proceeds. Subjects were asked to read passages that contained two possible referents. The position of these referents varied with one referent occurring early in a passage and the other relatively late; height in the hierarchy remained constant. The final sentence of each passage required the reader to reinstate one of the two possible referents. Comprehension times on
this final line should reflect any differences in the time to reinstate either referent. In order to avoid possible recency effects, at least 20 propositions intervened between the late referent and the end of each passage. Given the amount of material succeeding the late referent in the experimental passages, this seemed reasonable but Experiment 2 will present further evidence.

The search for a referent could proceed in a number of ways. However, any instantiation of a search model should fall into one of three distinct class consisting of either a serial search, a parallel search, or direct access. To facilitate understanding the predictions each of these search models make with respect to the present design, a simplified coherence graph is presented in Figure 3. Assume that propositions 5 and 11 represent an early and late referent respectively and that proposition 11 has been sufficiently backgrounded so that is no longer available in short-term memory when a reinstatement is required. Also, note that since propositions 5 and 11 are at the same level in the hierarchy, they are considered to be equally important.

First, consider the class of serial search models. This type of search could begin at either level 1 or level 3 of the hierarchy. However, a search beginning at level 3
FIGURE 3

EXAMPLE OF A COHERENCE GRAPH WITH AN EARLY AND LATE REFERENT
(the lowest level) does not seem reasonable since it would predict that unimportant details should be retrieved more quickly than relatively important propositions. A serial search beginning at level 1 could proceed forward, reflecting the order in which propositions were connected, in either a depth first or breadth first manner. Also, the search could proceed backward on the basis of recency in either a depth first or breadth first manner. Since the height of the early and late referent are the same, both forward serial search models would predict that proposition 5 should be accessed more quickly than proposition 11 and both backward serial search models would predict that proposition 11 should be accessed more quickly. Therefore, in what follows, these search models will be referred to as a forward serial search and a backward serial search.

Next, consider a parallel search. There are undoubtedly many variations of a parallel search that could be constructed. However, since height in the hierarchy remains constant and time since a referent appeared should not be a factor, any instantiation of a parallel search would result in the same prediction; there should be no difference in time to reinstate either proposition 5 or 11.

Finally, consider a direct access model. For this model it is assumed that accessibility is not a function of
text structure. If this assumption is not made, there seems no meaningful distinction between a direct access model and search models which are, in some way, guided by the structure of the text representation. Again, given the assumption that the time since a referent appeared is not a factor, this direct access model predicts that reinstatement time for propositions 5 and 11 should not differ.

In summary, a forward serial search model predicts that early referents should be reinstated more quickly than late referents. A backward parallel search model predicts that late referents should be reinstated more quickly. The parallel search and direct access models predict that there should be no difference in reinstatement time for the early and late referent.

METHOD

Subjects

Thirty-two University of Massachusetts undergraduates were recruited from the Department of Psychology subject pool. Subjects were given course credit for their participation.
Materials

Each of sixteen passages contained two possible referents; one referent occurred early in the passage and the other occurred late. The final sentence of each passage was designed to reinstate either the early or late referent. As an example, consider the passage in Table 2. The two possible referents are "major" and "banker" which occur early and late respectively. There are two versions of the final sentence. In one version ("...recall the rank of the arresting officer.") reinstatement of the earlier referent "major" is required. In the other version ("...recall the profession of his cell mate.") reinstatement of the later referent "banker" is required. Using the procedures described in Turner and Greene (1977), a coherence graph was constructed for each passage to ensure control over several factors. In order to ensure that the late referent was backgrounded at the point at which a reinstatement was required, each passage always had 20 to 30 propositions intervening between the late referent and the end of the passage. To control for possible primacy effects, there were always 20 to 40 propositions intervening between the beginning of each passage and the proposition containing the early referent. Also, the distance between referents was controlled by always having
As a correspondent for United Press, Mike had often covered revolutions in small third world countries. Mike was presently working in a very dangerous country. The country's military had seized power and Mike was covering the story. He had seen people being arrested on the streets and shot. Mike was taking pictures of a damaged building when a pair of jeeps came to a screeching halt in front of him. Several soldiers jumped out and grabbed him. A small stocky officer walked up to him and informed him that he was under arrest. Mike noticed that the officer was a major and realized that the situation must be serious. The military seldom sends a major on a routine arrest. Mike was handcuffed and thrown into the back of a jeep. Although Mike asked about the arrest, he wasn't given any answers. It really didn't matter, he thought, because the American embassy would have him released. When he arrived at the police station, however, he was thrown in a cell without being allowed to call the embassy. Now he really began to worry. If nobody was informed that he was arrested, it could be weeks before anybody found him. He sat back on his bunk and realized that he was not alone.
He saw an old man sitting on the floor smoking a cigarette who told Mike that he was a banker. Mike learned that all banker were being arrested for questioning. Mike was both surprised and relieved when later that day an embassy official had him released. Mike arrived at the embassy and was brought immediately to the ambassador who had some rather unusual questions. He told Mike that it was very important that he recall the rank of the arresting officer (the profession of his cell mate).

Comprehension Questions

What was the rank of the arresting officer?
(What was the profession of Mike's cellmate?)
Who had Mike released from Jail?
What was Mike's job?
40 to 50 propositions intervening between the early and late referent. Finally, both referents occupied the same level in the hierarchy. This was always the third or fourth level. Each passage was followed by three comprehension questions; examples can be seen in Table 2. The answer to the first question for each passage was always the referent that needed to be reinstated. Two sets of materials were constructed such that, within each set, one half of the passages required reinstatement of the early referent and the other half required reinstatement of the late referent. Each passage was used to reinstate the early referent for half the subjects and the late referent for the remaining half.

Procedure

Subjects were run individually in an experimental session that lasted approximately 30 minutes. All materials were displayed on a video monitor controlled by a Northstar Horizon computer. Subjects were told that their task was to read a series of passages carefully enough to be able to correctly answering a series of questions that would follow. Each trial began with the word "ready" on the center of the display screen. When subjects were ready to begin reading each passage, they pressed a line-advance
key which erased the screen and presented the first line of a passage. Subjects were instructed to read each line and to press the line-advance key when they had understood it. Each press of the key erased the current line and presented the next line. Comprehension time for a particular line was considered to be the time between key presses. After pressing the line-advance key to erase the last line of a passage, a ready cue (XXX) was presented for 500 milliseconds followed by the first question. The correct answer to the first question was always the referent that should have been reinstated while the subject was reading the last line of the passage. Subjects were told to answer each question by speaking into a microphone. Subject responses triggered a voice key that erased the question and recorded answering time. The experimenter then provided feedback over an intercom from an adjoining room before presenting the next question. The second and third questions were more comprehensive than the first and generally required more than a one word answer. Subjects were told that answering the questions was the most important part of the task and that they should always be prepared to answer as quickly and as accurately as possible. Three practice passages were used to ensure that subjects understood that reinstating the proper referent
would facilitate the speed and accuracy with which they could answer the questions.

RESULTS AND DISCUSSION

The data of interest were the mean comprehension times for the final line of each passage. Read times that were 3 standard deviations from the mean for a subject were eliminated from the analyses. Also those trials for which a subject could not correctly answer the first question were not considered. These cut-off procedures eliminated less than 4% of the scores. In what follows, $F_1$ refers to tests against an error term based on subject variability and $F_2$ refers to tests against an error term based on item variability.

Mean reading times for the last line of a passage and response times for the first question are presented in Table 3. As can be seen, subjects took considerably longer to read the last line of a passage when it required reinstatement of the early referent than when it required reinstatement of the late referent; $F_1(1,36) = 29.47, p < .001, \text{Mse} = 38391; F_2(1,14) = 8.45, p < .02, \text{Mse} = 65950$. Response times to the first question did not differ as a function of which referent was reinstated; $p > .1$. 
TABLE 3

MEAN REINSTATEMENT TIME AND RESPONSE TIME TO THE FIRST
QUESTION (IN MSEC) AS A FUNCTION OF REFERENT
POSITION IN EXPERIMENT 1

<table>
<thead>
<tr>
<th>Reinstated Referent</th>
<th>Early Referent</th>
<th>Late Referent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Read Time</td>
<td>2257</td>
<td>1991</td>
</tr>
<tr>
<td>Question Response</td>
<td>1059</td>
<td>1037</td>
</tr>
<tr>
<td>Time</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
There are two major results of Experiment 1. First, subjects took longer to reinstate an early referent than a late referent. This finding provides some support for a backward serial model and eliminates the forward serial search model which predicts that the early referent should have been reinstated more quickly than the late referent. It also poses serious problems for both a parallel search model and the direct access model since each model predicts that there should have been no difference in reinstatement time. However, a prediction of no difference only holds for these models if it is assumed that the difference in time since a referent appeared is not a factor in the availability of referents. Under any of these models, the late referent could have been retrieved more quickly simply because it appeared more recently and as a result was more active in memory. Experiment 2 was designed, in part, to explore this possibility. Further discussion of search strategies will be postponed until after presenting those results.

The second major finding was that subjects responded to the first question following each passage equally fast regardless of whether they had to reinstate the early or late referent. This result is not surprising and suggests that subjects were performing the reinstatement searches.
Recall that the answer to the first comprehension question was always the referent that should have been reinstated. If subjects performed the reinstatement, answers to the first question should have been equally available independent of which referent had been reinstated. Experiment 2 will provide a stronger test of the availability of referents following a reinstatement. The number of question answering errors were exactly the same across conditions with subjects making approximately 3% errors in both the early and late referent conditions.
As noted earlier, several researchers have demonstrated an increase in comprehension time at the point where a reinstatement search is expected (Cirilo, 1981; Legold et al., 1979). What has been lacking in these studies is some indication that a referent has indeed been reinstated. Others have shown that a referent is in short-term memory following the presence of an anaphor (Dell et al., 1983; McKoon & Ratcliff, 1980). However, as discussed earlier, it is unclear from these studies whether the referent was in fact reinstated by the presence of an anaphor or had been merely maintained in short-term memory. The question answering results from Experiment 1 suggest that referents are more active following a reinstatement search. However, Experiment 2 will provide a more direct test of this assumption.

The motivation behind Experiment 2 was twofold. First, it addressed the issues raised above with respect to previous research. The primary purpose, however, was to provide a further test of the parallel search and direct access models. The results of Experiment 1 reject those models if it is assumed that the early and late referents
differ in activation level due to the difference in time since they were read. This experiment tests that assumption.

The same passages were used as in Experiment 1. Immediately after reading each passage, subjects were asked to read aloud a single word probe that was either the referent reinstated by the final sentence or the nonreinstated referent. In a control condition, subjects were asked to name referents just prior to the sentence requiring a reinstatement. As in Experiment 1, it is expected that reading times will be shorter in the late referent condition; that is, subjects will reinstate the late referent more quickly than the early referent. This result would provide further support for the backward serial search model. It is further expected that if subjects are actually reinstating referents, they should be able to name a reinstated referent more quickly than a nonreinstated referent. The control condition should determine whether there are differences in the activation level of either referent prior to reinstatement.

Both the parallel search model and the direct access model are capable of predicting that the late referent will be reinstated more quickly than the early referent but only if the late referent is more active. If the time since a
referent appeared is not a factor and the importance level of the early and late referent is the same, then both search models make the same prediction; there should be no difference in the time to retrieve either referent. It should be noted that since the direct access model does not make use of the text representation, it would make this prediction even if the importance level of the early and late referent were allowed to vary. With this in mind, the control condition in the present experiment provides a critical test for these two search models. In order to account for faster reinstatement of the late referent, both the parallel search model and the direct access model must predict that prior to reinstatement, the late referent should be more active and therefore responded to more quickly than the early referent. Assuming that naming time reflects the activation level of items, a finding of no difference in such times for the two referents, in conjunction with faster reinstatement of the late referent would reject each of these models.

METHOD

Subjects

Seventy-two University of Massachusetts undergraduates
were recruited from the Department of Psychology subject pool. Subjects were given course credit for their participation.

Materials

The materials were the same 16 passages used in Experiment 1. The only exception was that the two possible referents from each passage were used as probes. For the reinstatement conditions, four sets of materials were constructed. Within each set, one half of the passages required reinstatement of the early referent and the remaining half required reinstatement of the late referent. These sets were further subdivided such that for half of the passages, the probe matched the reinstated referent and for the remaining half it matched the nonreinstated referent. Each passage appeared an equal number of times in each of these four conditions. For the control condition, two sets of materials were constructed. These were the same sixteen passages but with the last sentence eliminated. Within each set, subjects were required to name the early referent in half the passages and name the late referent in the other half. Each passage was probed for the early referent for half the subjects and probed for the late referent for the remaining half.
**Procedure**

Subjects read the passages in the same manner as in Experiment 1. Immediately upon pressing the line-advance key to erase the last line of a passage, a cue (XXX) was presented for 750 milliseconds followed by a probe. Subjects were instructed to read the probe aloud as quickly as possible. This triggered a voice key that erased the probe and recorded naming times. In the control condition, the procedure was identical except that the last sentence was not presented. Subjects were then required to answer two comprehension questions. These questions were the second and third questions used in Experiment 1. However, in Experiment 2, subjects were not required to answer these questions as quickly as possible. Each question remained on the screen until the subject gave a sufficient answer. The experimenter then provided feedback and presented the next question.

**RESULTS**

Read times and probe response times that were three standard deviations from the mean for a given subject were eliminated from the analyses. Also, those trials on which a subject could not answer both of the comprehension
questions were eliminated. Probe response times under 200 miliseconds were also not considered. These cut-offs resulted in the loss of approximately 2% of the read times and 5% of the probe response times. All planned comparisons used a Bonferroni t procedure with EF = .05 and an error term based on subject variability (see Myers, 1979).

Read Times

The mean read times for the last line of the reinstatement passages are presented in Table 4. As in Experiment 1, subjects took longer to read a line of text when it required reinstatement of an early referent than when it required reinstatement of a late referent. This result was significant in a subjects analysis, $\frac{F_1}{(1,44)} = 8.32, p < .01$, but failed to approach significance in an items analysis, $p > .1$. No other effects approached significance.

Reinstated Probes

The mean naming times for the probes in the reinstatement conditions are presented in Table 5. Naming times confirmed that subjects were performing the required reinstatement. Subjects named a referent significantly
TABLE 4

MEAN REINSTATEMENT TIME (IN MSEC) AS A FUNCTION OF REFERENT POSITION AND PROBE TYPE IN EXPERIMENT 2

<table>
<thead>
<tr>
<th>Reinstated Referent</th>
<th>Early Referent</th>
<th>Late Referent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Probe Type</td>
<td>Early Referent</td>
<td>Late Referent</td>
</tr>
<tr>
<td><strong>Early Referent</strong></td>
<td>2141</td>
<td>1994</td>
</tr>
<tr>
<td><strong>Late Referent</strong></td>
<td>2115</td>
<td>2024</td>
</tr>
<tr>
<td><strong>Mean</strong></td>
<td>2128</td>
<td>2009</td>
</tr>
</tbody>
</table>
**TABLE 5**

**MEAN NAMING TIME (IN MSEC) AS A FUNCTION OF REINSTATEMENT AND PROBE TYPE IN EXPERIMENT 2**

<table>
<thead>
<tr>
<th>Probe Type</th>
<th>Early Referent</th>
<th>Late Referent</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td>Reinstated</td>
<td>477</td>
<td>452</td>
<td>465</td>
</tr>
<tr>
<td>Not Reinstated</td>
<td>534</td>
<td>532</td>
<td>533</td>
</tr>
</tbody>
</table>
faster when it had been reinstated than when the alternative referent had been reinstated, $F_1(1,44) = 67.16$, $p < .01$, Mse = 29031; $F_2(1,12) = 59.83$, $p < .01$, Mse = 1799. This was true for both the early referent, $t(44) = 6.05$, $p < .05$ and the late referent, $t(44) = 9.01$, $p < .05$.

There was also an effect of probe type with late probes named more quickly than early probes; a result significant in a subjects analysis $F_1(1,44) = 4.44$, $p < .05$, Mse = 3343, but unreliable in an items analysis, $p > .1$. However, this advantage of the late probe over the early probe was only evident when the reinstated referent and following probe matched. This interaction of reinstatement and probe type was significant in an analysis by subjects $F_1(1,44) = 4.69$, $p < .05$, Mse = 1987, but failed to reach significance when tested against item variability, $p > .1$.

Simple effects tests confirmed that when the reinstated referent and the following probe matched, subjects responded to the late probe more quickly than to the early probe, $t = 2.74$, $p < .05$. However, when the reinstated referent and following probe did not match, naming times for the early and late referent did not differ, $p > .1$.

**Control Probes.**

The mean naming times for the early and late referent
in the control condition are presented in Table 6. Analysis of the probe response times in the control conditions confirmed that there was no difference in the availability of the early and late referent prior to reinstatement, \( p > .5 \). The power to reject this null finding was computed using the appropriate Mse from the subjects analysis. The power to reject a difference as small as 12 miliseconds was 93% and rises to 98% for a difference of 16 miliseconds.

In order to make direct comparisons between probe response times in the reinstatement and control conditions, quasi F ratios were computed and the Bonferroni procedure was used. This was necessary because the error variance and the number of subjects differed for these two conditions. The computed error variance for all the following contrasts was 250.17. These analyses showed that there was no difference in naming times for the control and reinstatement conditions \( p > .1 \). However, reinstated probes were named more quickly than the average naming time in the control condition, \( F(1,54) = 11.22, p < .05 \). When considering the early and late referent separately, a similar trend emerges. Late referents that had been reinstated were responded to more quickly than late referents in the control condition, \( F(1,54) = 7.05, p < \)
### TABLE 6

**MEAN NAMING TIME (IN MSECS) FOR EARLY AND LATE REFERENTS PRIOR TO REINSTATEMENT IN EXPERIMENT 2**

<table>
<thead>
<tr>
<th>Probe Type</th>
<th>Early Referent</th>
<th>Late Referent</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>488</td>
<td>496</td>
<td>492</td>
</tr>
</tbody>
</table>
.05. However, this difference did not reach significance for the early referent. Also, nonreinstated probes were named more slowly than probes in the control condition, \( F(1,54) = 28.20, p < .05 \). This was true for both the early referent, \( F(1,54) = 7.74, p < .05 \) and the late referent, \( F(1,54) = 6.35, p < .05 \).

**DISCUSSION**

The read time results replicated the first experiment and showed that subjects took longer to reinstate an early referent than a late referent. Response times to the probes in the reinstatement conditions confirmed that subjects were reinstating the appropriate referent. A referent was named more quickly when it had been reinstated than when the alternative referent had been reinstated. This was true for both the early and late referent. Results from the control conditions showed that prior to reinstatement, the late referent was no more available than the early referent. This result is not surprising and is consistent with other findings. For example, Fletcher (1981) found that recently processed propositions that are not in short term memory are no more available that propositions from early in text.
It was suggested earlier that both a parallel search and a direct access model could account for the finding that the late referent was retrieved more quickly than the early referent if time since a referent appeared influenced the activation level. First, consider the direct access model. As presently interpreted, direct access implies that the search process does not involve the use of connections or pathways within a text representation and therefore should not be affected by the nature of the representation. However, differences in activation levels could affect access time. If there was residual activation of the late referent because of its recency, a direct access model could account for the shorter retrieval time of the late referent. However, the finding from the control condition that there was no difference in the activation level of either the early or late referent prior to reinstatement eliminates the direct access model as a possible alternative. The lack of a difference in the control conditions confirmed that differences in retrieval time in the reinstatement conditions must be a function of a search through the representation.

The parallel search model fails for similar reasons. Since the importance level of the early and late referent were held constant, the parallel search model could only
predict faster retrieval of the late referent if it were more available prior to reinstatement. Again, the results from the control condition eliminated this possibility. As a result, the parallel search model must also be rejected.

Finally, consider the backward serial search model. Under this model, the search starts with the current contents of the short term memory buffer and then proceeds backward; concepts are searched serially until the appropriate referent is found. Such a model would predict that the late referent should always be found more quickly than the early referent. However, analysis of the individual passages revealed that this was not always true. In fact, when read times were averaged across experiments, there were six passages in which the early referent was retrieved more quickly. As a result, a backward serial search model can not be correct.

A breadth first backward serial search model could account for this finding it is assumed that for those six passages in which the early referent was reinstated more quickly, the early referent was higher in the hierarchy than the late referent. However, this seems unlikely. In constructing the coherence graphs for each of the passages, the number of propositions that could be input on any processing cycle was allowed to vary between 4 to 8
propositions and the short-term buffer size was set at 4. These values are well within the parameter estimates established by Kintsch and van Dijk (1978) and Kintsch and Vipond (1979). Also, great care was taken to ensure that propositions input on any given cycle were always coreferent with the current contents of the short-term buffer. As a result, even if the parameter estimates were allowed to vary, the resulting coherence graph should not differ. It is important to note that this does not mean that the early referents in those six passages were not more important than the late referents but rather that according to Kintsch and van Dijk, they were at the same level in the hierarchy.

Within the constraints of a hierarchical representation, there does not appear to be any viable search model capable of predicting faster access to the late referent. It is possible, however, that a hierarchical representation, as proposed by Kintsch and van Dijk (1978) is not entirely correct. Kintsch and van Dijk assume that propositions can only be connected in memory through coreference; if coreference is absent, coherence breaks down and comprehension becomes difficult. However, others have argued that coreference is not necessary to produce coherence (Garrod & Sanford, 1982; Johnson-Laird,
1983; Keenan, Baillet, & Brown, 1984). For example, Garrod and Sanford found that sentence pairs that were not coreferential were no more difficult to comprehend than sentence pairs that expressed the same meaning but maintained coreference. Van Dijk (1977) has proposed that rather than coreference, the presence of knowledge-based relations is the most important component necessary for coherence.

A text representation constructed through the use of knowledge-based relations would result in a representation considerably different than one constructed solely on the basis of argument overlap. First, readers would be continually drawing low level inferences based on world knowledge to connect propositions rather than seeking argument overlap. This would allow any one proposition to have direct connections to several other propositions independent of importance level. The result would be a completely integrated text representation similar to network representations proposed by Myers, O'Brien, Balota, and Toyofuku (1984) and Anderson and Reder (1979). In a hierarchical representation where propositions are connected solely on the basis of argument overlap, connections cannot cross importance levels. For example, a proposition at level 4 can not be directly connected to a
proposition at level 2. It only can be indirectly connected through a proposition at level 3. As a result, a text representation that makes use of knowledge-based relations need not be hierarchical in nature. Rather, important propositions would be distinguished from less important propositions by the number of connections leading to them. This larger number of interconnections for important propositions would provide an increase in the number of possible retrieval routes facilitating their retrieval relative to less important propositions.

The primary purpose for proposing this alternative representation is to attempt to develop a reasonable search model capable of predicting faster retrieval of the late referent. If it is assumed that an integrated network provides a better account of the memory representation, a backward parallel search model provides this.

The backward parallel search model assumes that the search begins with the current contents of the short-term memory buffer and then proceeds backwards in parallel. This model would predict that the less distant late referent should generally be retrieved more quickly than the early referent. However, under this model some early referents could be retrieved more quickly if the number of retrieval routes to them was greater than for the late referent. How
could such a situation arise? As suggested earlier, within an integrated text representation, important propositions would have a relatively large number of interconnections that would provide an increase in the number of possible retrieval routes. These could facilitate retrieval of some early referents relative to the late referents. It is possible that for those six passages in which the early referent was retrieved more quickly, it was more important to the passage than the late referent.

Initial analysis of the sixteen passages using procedures described in Turner and Greene (1977) showed that the early and late referent did not differ in importance. However, given the read times results described above, it was decided to run a norming study to determine if there were differences in importance not captured by this initial analysis. Forty subjects were asked to read each of the sixteen passages and then rate the importance of the early and late referent to the passage. Ratings showed that for the six passages in which the early referent was retrieved more quickly, the early referent was rated as more important. For the remaining ten passages, there was no difference in the rated importance of the early and late referent. The overall correlation between search time and rated importance was
marginally significant, \( r = .44, p < .1 \). Thus, it appears that importance as measured by the rating task does play a role in the retrieval process.

It could be argued that the importance ratings raise the possibility that a pure parallel search model starting at all possible terminal nodes is viable since it could predict faster access time for the early referent when it is more important to the text. However, this instantiation of a parallel search would make the same predictions for an integrated network representation that it did for a hierarchical representation. Specifically, when there is no difference in the importance of the early and late referent, this model predicts that there should be no difference in retrieval time. When considering those ten passages for which rated importance of the early and late referent did not differ, the average reinstatement time was 400 milliseconds faster for the late referent than for the early referent. A pure parallel search model can not account for this finding and therefore remains rejected as a possible search strategy.

The only viable search model that remains is the backward parallel search. This model predicts that the late or more recent referent should generally be found more quickly than the more distant early referent. However,
under this model, it is also possible that a large number of retrieval routes to the early referent could override the proximity of the late referent to the concepts currently in the short term buffer and lead to faster retrieval of the early referent. Experiments 3 and 4 will provide a stronger test of this assumption.

There are several other results from Experiment 2 that should be noted. First, the difference in reinstatement time for the early and late referent was 265 and 118 milliseconds in Experiments 1 and 2, respectively. The markedly smaller read time difference in Experiment 2 reflects a change in the task that undoubtedly affected subject motivation for completing a reinstatement search. Recall that in Experiment 1, a reinstatement was always followed by a question that could be answered more quickly if the reinstatement had been completed. In Experiment 2, this question was replaced by a probe; responses to this probe could be facilitated by a completed reinstatement search on only half the trials. This reduction in motivation should have had its largest effect on the more difficult early reinstatement. The data confirmed this expectation. Reinstatement times for the early referent were 125 milliseconds faster in Experiment 2 than in Experiment 1 suggesting that subjects did not always
complete the search for the early referent in Experiment 2. In contrast, the time to reinstate the late referent differed by only 18 milliseconds across experiments.

It was further found that response times to the early referent, when it had been reinstated, were slower than for the late referent when it had been reinstated. However, as suggested earlier this resulted from subjects not always completing the more difficult reinstatement of the early referent.

Contrasts between the probes in the reinstatement and control conditions demonstrated that when a reinstated referent and probe matched, response times were faster than response times to the same probe in the control conditions. This result held for both early and late referents. The failure of this contrast to reach significance for the earlier referent resulted for two reasons. First, as stated early, responses to the early referent reflected a mix of fast and slow times; subjects did not always complete the search for the early referent. Second, because of the nature of the design, this contrast required a quasi F ratio which had little power. A more direct test was made in Experiment 3.

Finally, when reinstated referents and ensuing probes did not match, response times were slower than for the
corresponding probe in the control conditions. This difference was significant for both the early and late referent. This suggests that the response time differences in the reinstatement conditions reflect both facilitation and inhibition. The inhibition resulted from subjects being prepared to name the referent they just reinstated but instead being required to name the other referent. As a result, a purer measure of activation due to reinstatement can be made by contrasting response times to reinstated probes with the corresponding probe in the control condition.
CHAPTER IV

EXPERIMENT 3

Following Experiment 2 it was proposed that a text is represented in memory as a nonhierarchical integrated network. Propositions are connected through the use of knowledge-based relations rather than through coreference, and propositions can be connected to several other propositions independent of importance to the text. It was further proposed that within this representation, a backward parallel search model provided a reasonable account of the finding that late referents are generally reinstated more quickly than early referents. The primary purpose of Experiment 3 was to test further this search model. If a backward parallel search model is correct, then depending upon which referent is reinstated, other concepts should become active during the search process.

The second purpose was to determine the circumstances under which reinstatement facilitates the naming of a referent. Within the Kintsch and van Dijk framework, there are two reasonable interpretations of why this occurs. First, when a referent is reinstated, it is presumably returned to short-term memory in an active state. This increase in activation should facilitate naming of that
referent. A second interpretation, however, is that when a referent is reinstated it receives additional processing. This reprocessing should serve to strengthen that concept and facilitate its access from the long-term text representation.

In the present experiment, subjects reinstated only the early referent. Then they were required to name three critical probes: the early referent, the late referent, and a concept that preceded the early referent. These critical probes were embedded in a list of seven probes so that test position could be varied. In this way, facilitation was measured both immediately and after a delay.

First consider the predictions of the backward parallel search model with respect to the present design. It is expected that if the backward parallel search model is correct, a search for the early referent should encounter and therefore activate the late referent; thus naming times for the late referent should be facilitated. This should only occur, however, for those passages in which the late referent was reinstated more quickly than the early referent in the first two experiments. For those passages in which the early referent was reinstated more quickly, reinstatement of the early referent should not activate the late referent. Also, since the search
should terminate when the early referent is found, reinstatement of the early referent should have no effect on concepts that preceded it in a passage.

The second set of predictions concerns the interpretation of the facilitation in the naming of a reinstated referent. If this facilitation occurs solely due to a returning of a referent to short-term memory, then it should be evident only when tested immediately and not when tested after a delay. However, if the strengthening of a reinstated referent in the long-term text representation contributes to this facilitation, then reinstatement should facilitate naming both immediately and after a delay.

METHOD

Subjects

Forty University of Massachusetts undergraduates were recruited from the Department of Psychology subject pool. Subjects were given course credit for their participation.

Materials

The materials were the same 16 passages used in the first two experiments. The only difference was that subjects were required to reinstate only the early
referent. Two sets of materials were constructed such that for half the passages, the last sentence required reinstatement of the early referent. For the remaining half of the passages, the last sentence was eliminated so that no reinstatement was necessary. Each passage was followed by seven probes, three of which were the critical probes. These were the early referent, the late referent, and a concept that preceded the early referent; examples can be seen in Table 7. The materials were further subdivided such that each of these probes appeared either early or late in the list. The early referent appeared in either position 1 or 7. The late referent was in position 2 or 6, and the preceding concept appeared in either position 3 or 5. For half the probe lists, the four filler probes consisted of words that did not appear in the passage. The remaining half consisted of three words that did not appear in the passage and one word chosen randomly from the passage. The fillers were counterbalanced such that each test position contained a word from the passage half the time and an unrelated word for the remaining half. Two comprehension questions followed each probe list. These were the same questions used in Experiment 2.
### Table 7

**Example of Probes Used in Experiment 3 and Verification Statements Used in Experiment 4 for the Passage Presented in Table 2**

#### Experiment 3

<table>
<thead>
<tr>
<th>Probe Type</th>
<th>Probe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Referent</td>
<td>Major</td>
</tr>
<tr>
<td>Late Referent</td>
<td>Banker</td>
</tr>
<tr>
<td>Preceding Concept</td>
<td>People</td>
</tr>
</tbody>
</table>

#### Experiment 4

<table>
<thead>
<tr>
<th>Probe Type</th>
<th>Probe</th>
</tr>
</thead>
<tbody>
<tr>
<td>Early Referent</td>
<td>The Arresting Officer Was a Major.</td>
</tr>
<tr>
<td>Late Referent</td>
<td>Mike's Cellmate Was a Banker.</td>
</tr>
<tr>
<td>Preceding Concept</td>
<td>Mike Had Seen People Shot.</td>
</tr>
</tbody>
</table>
Procedure

The procedure for reading the passages was the same as in Experiment 2. Immediately upon pressing the line-advance key to erase the last line of a passage, a ready cue (********) was presented for 2 seconds. This was done to prepare subjects for the probe list that was to follow. After this initial cue, each probe was preceded by a cue (XXX) for 750 miliseconds. Subjects were instructed to read each word out loud as quickly as possible. This triggered a voice key that erased the word, recorded response time, and presented the cue for the next word. After the last word had been named, subjects saw another cue (**questions**) for 2 seconds. The two comprehension questions were then presented, preceded by a 500 milisecond cue (??????????). Subjects were instructed to answer each question out loud. The experimenter listened for their answers over an intercom from an adjoining room. After each response, the experimenter provided feedback, and presented the next question.

RESULTS

Response times that were either 3 standard deviations from the mean for a subject or less than 200 miliseconds
were eliminated from the analyses. This cut-off procedure eliminated less than 2% of the scores.

Mean response times to the critical probes are presented in Table 8. As can be seen, subjects responded to any early referent more quickly when it had been reinstated than when there had been no reinstatement, $F_1(1,36) = 4.43, p < .05, \text{Mse} = 1686; F_2(1,12) = 9.10, p < .05, \text{Mse} = 110$. However, this difference decreased from test position 1 to test position 7. This interaction was significant in a subjects analysis $F_1(1,36) = 6.28, p < .05, \text{Mse} = 911$, and marginal in an items analysis, $F_2(1,12) = 3.63, p < .1, \text{Mse} = 236$. Simple effects tests confirmed that at test position 1, the early referent was responded to more quickly when it had been reinstated than when there was no reinstatement, $t(36) = 4.1, p < .05$. By test position 7, reinstatement had no effect on response time to the early referent, $p > .1$. There was no effect of reinstatement of the early referent on response time to the late referent independent of which referent had been reinstated more quickly in the first two experiments, $p > .1$. The only effect to reach significance was test position. Subjects responded more slowly to the late probe when it was in test position 2 than when it was in test position 6, $F_1(1,36) = 15.53, p < .01; \text{Mse} = 586, F_2(1,12)$
TABLE 8

MEAN NAMING TIME (IN MSEC) AS A FUNCTION OF REINSTATEMENT OF THE EARLY REFERENT, PROBE TYPE, AND TEST POSITION IN EXPERIMENT 3

<table>
<thead>
<tr>
<th>Test Position</th>
<th>Early Referent</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reinstatement</td>
<td>No Reinstatement</td>
<td></td>
</tr>
<tr>
<td>Position 1</td>
<td>437</td>
<td>455</td>
<td></td>
</tr>
<tr>
<td>Position 7</td>
<td>447</td>
<td>448</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>442</td>
<td>452</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Position</th>
<th>Late Referent</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reinstatement</td>
<td>No Reinstatement</td>
<td></td>
</tr>
<tr>
<td>Position 2</td>
<td>450</td>
<td>446</td>
<td></td>
</tr>
<tr>
<td>Position 6</td>
<td>436</td>
<td>430</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>443</td>
<td>438</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Test Position</th>
<th>Preceding Concept</th>
<th></th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reinstatement</td>
<td>No Reinstatement</td>
<td></td>
</tr>
<tr>
<td>Position 3</td>
<td>433</td>
<td>427</td>
<td></td>
</tr>
<tr>
<td>Position 5</td>
<td>436</td>
<td>432</td>
<td></td>
</tr>
<tr>
<td>Mean</td>
<td>435</td>
<td>430</td>
<td></td>
</tr>
</tbody>
</table>
= 7.78, p < .05, Mse = 40. For the preceding concept, no effects approached significance.

**DISCUSSION**

Experiment 3 confirmed that when the early referent was reinstated, it was named more quickly than when no reinstatement was required. In Experiment 2 this difference failed to reach significance. However, it was argued that this resulted from a contrast that lacked power. The present experiment provided a more direct and powerful test, confirming the result.

Although reinstatement facilitated naming of the early referent, it did so only when tested in position 1. By position 7, any effect of reinstatement had diminished. This suggests that when a referent has been reinstated, it is returned to short-term memory in an active state and can be named more quickly. However, with delay, this activation decays and naming time is no longer facilitated. This does not mean that there is no long-term memory benefit for a reinstated referent but rather that the naming task, as used in the present design, measures only immediate activation or availability. Since the naming of a referent does not require the retrieval of that referent
from the text representation, naming time would not be sensitive to changes in the accessibility of concepts in the long term-text representation.

Reinstatement of the early referent also had no effect on naming time for any of the late referents or the preceding concepts. However, this lack of a difference is consistent with the explanation provided above. Since it was never required that either of these probes be reinstated or maintained in an active state in short-term memory, it is unlikely that they would be highly available at the time they were named. However, this does not mean that these concepts were not considered or reviewed during the search for the early referent but merely that they were not held in an active state. It is likely that if they were considered during the search that this would affect their accessibility in the long term text representation. Experiment 4 is designed to test this possibility. Therefore, discussion of how these results address the backward parallel search model will be postponed until after presenting those results.
As pointed out in the discussion section of Experiment 3, a backward parallel search model predicts that the search for an early referent should activate a late referent and facilitate its naming. The naming time results from Experiment 3 showed that the late referent was not active at the time of test. However, responses to the early referent suggested that naming time measures only immediate activation and that this activation decays rapidly. It remains possible that the late referent was activated during the search for the early referent but since it was not the appropriate referent, it was not held in short-term memory in an active state at the time of testing. To test this possibility, a verification procedure was used that should be sensitive to changes in the long term text representation. If the search for an early referent does involve a brief activation of the late referent, this reactivation should affect the strength or accessibility of the late referent in the long term text representation. Since concepts that precede the early referent should not be activated during the search for an early referent, they should not benefit from a search for
an early referent. Experiment 4 was designed to evaluate these hypotheses.

The design of Experiment 4 was similar to that used in Experiment 3. The only major difference was that propositions containing the preceding concept, the early referent, and the late referent were converted into declarative sentences. Subjects were then required to verify each of these sentences. Since verification requires retrieval of information, it should be sensitive to changes in the strength or accessibility of information in the long-term text representation.

It is expected that reinstatement of the early referent should increase its strength in the text representation and facilitate verification of a statement containing the early referent. This should occur when such a statement is tested both immediately and after a delay. If verification times are facilitated after a delay, this would confirm that the early referent has been strengthened in the long term text representation and that the naming time measure used in Experiment 3 was not sensitive to this change. Assuming a backward parallel search model is correct, there are two possible outcomes for statements containing the late referent. First, if the late referent is briefly activated during the search for an early
referent, this reactivation could strengthen the late referent and facilitate verification of statements containing it. Another possibility is that a negative tag is attached to any activated concept that is not appropriate, resulting in a slowdown in verification times. The mechanisms underlying these two possible outcomes will be discussed in more detail after presenting the results. It is further expected that any effect on verification times for statements containing the late referent should only occur for those passages in which the late referent was reinstated more quickly than the early referent in the first two experiments. For those passages in which the early referent was reinstated more quickly, the late referent should not be reactivated and therefore should not be strengthened in the long term text representation. As a result, reinstatement of the early referent should not facilitate verification times for these latter passages. Since concepts that precede the early referent should not be activated during the search for an early referent, it is expected that reinstatement will have no effect on verification times for statements containing the preceding concept.
METHOD

Subjects

Forty university of Massachusetts undergraduates from the psychology department were recruited for this experiment. Subjects received course credit for their participation.

Materials

The sixteen passages were the same as those used in the previous experiment. The verification statements for the early referent, the late referent, and the preceding concept were constructed by converting the propositions containing them into simple declarative sentences. The filler statements were simple sentences that were false but consistent with the theme of the passage. The positioning of these statements within each test list was the same as in Experiment 3. Examples of each type of verification statement can be seen in Table 7.

Procedure

The procedure for reading each passage was identical to that used in previous experiments. When the subject pressed the line-advance key to erase that last line of a
passage, the word "QUESTIONS" was presented for 2 seconds. Each statement was preceded by a cue (?????) for 750 milliseconds. Subjects were instructed to respond as quickly but as accurately as possible, deciding whether each of the statements was true of the passage or not. A maximum of 3.5 seconds was allowed for a subject to make a response. Immediately after responding, the cue for the next statement was presented, except on those trials on which an error had occurred. On those trials, an additional .5 second delay was added while the word "ERROR" was presented for feedback. Since correct verification of these statements required comprehension of the passages, the two comprehension questions used in Experiment 3 were eliminated.

RESULTS

Response times that were 3 standard deviations from the mean for a subject were not considered in the analyses. Mean verification times for correct responses and error rates are presented in Table 9.

Early Referent

Statements containing the early referent were verified
more quickly when the early referent had been reinstated than when there was no reinstatement, $F_1(1, 36) = 31.92, \ P < .01$, Mse = 23846; $F_2(1, 12) = 22.95, \ P < .01$, Mse = 13291. This was true at both test position 1, $t(36) = 5.57, \ P < .05$ and at test position 7, $t(36) = 5.77, \ P < .05$. Subjects were also slower to respond to a statement containing the early referent when it appeared in position 1 than when it was in test position 7, $F_1(1, 36) = 25.10, \ P < .01$, Mse = 38045; $F_2(1, 12) = 19.47, \ P < .01$, Mse = 19981.

Late Referent

Due to a programming error, one of the statements containing the late referent was eliminated from the analyses. As a result, four scores needed to be estimated to maintain an equal N in the items analysis (see Myers, 1979). When verifying statements containing the late referent, subjects responded significantly slower when the early referent had been reinstated than when there had been no reinstatement. This result was significant in an analysis based on subject variability, $F_1(1, 36) = 5.16, \ P < .05$, Mse = 30394, and marginally significant in an analysis based on item variability, $F_2(1, 9) = 3.17, \ P < .1$, Mse = 21,507. This difference did not reach significance when tested independently at either position 2 or position 6, P
TABLE 9

MEAN VERIFICATION TIME (IN MSEC) AND PERCENTAGE ERRORS (IN PARENTHESES) FOR STATEMENTS CONTAINING THE EARLY REFERENT, LATE REFERENT, AND PRECEDING CONCEPT AS A FUNCTION OF REINSTatement OF THE EARLY REFERENT AND TEST POSITION IN EXPERIMENT 4

<table>
<thead>
<tr>
<th>Test Position</th>
<th>Early Referent</th>
<th>Late Referent</th>
<th>Preceding Concept</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Reinstatement</td>
<td>No Reinstatement</td>
<td>Reinstatement</td>
</tr>
<tr>
<td>Position 1</td>
<td>1627 (.05)</td>
<td>1763 (.06)</td>
<td>1657 (.02)</td>
</tr>
<tr>
<td>Position 5</td>
<td>1470 (.05)</td>
<td>1611 (.06)</td>
<td>1563 (.02)</td>
</tr>
</tbody>
</table>

Mean: 1549 (.05) 1687 (.06) 1610 (.02) 1549 (.025) 1657 (.02) 1658 (.03)
Subjects also responded more slowly to statements containing the late referent when it appeared in test position 2 than when it appeared in test position 6, $F_1(1, 36) = 5.81$, $p < .05$, Mse = 50029; $F_2(1, 9) = 7.10$, $p < .01$, Mse = 24927.

**Preceding Concept**

Neither reinstatement of the early referent nor test position had any effect on verification times for statements containing the preceding concept, $p > .5$.

**DISCUSSION**

The verification times for the statements containing the late referent and the preceding concept offer strong support for the backward parallel search model. According to this model, the search begins with the most recent end points and proceeds backwards through an integrated network until the appropriate referent is found. Therefore, it was expected that a search for an early referent would encounter and possibly affect responses to the late referent. Since the search should terminate when an early referent has been found, there should have been no effect on the preceding concept. The results confirmed these
expectations. When subjects were required to reinstate the early referent, verification times for statements containing the late referent were significantly slower than when there was no reinstatement. Also, reinstatement of the early referent had no effect on verification times for statements containing the preceding concept.

Analysis of the individual passages provides even stronger support for the backward parallel search model. Recall that this model must predict that any effect on verification times for statements containing the late referent should only be evident in those passages in which the late referent was reinstated more quickly than the early referent in the first two experiments. For the remaining six passages in which the early referent was reinstated more quickly, the late referent should not have been considered and therefore should not be affected by a search for the early referent. The average verification times for these two sets of passages are presented in Table 10. As can be seen, for those 10 passages in which the late referent was reinstated more quickly than the early referent, subjects verified statements containing the late referent significantly slower following reinstatement of the early referent than when there was no reinstatement, \( t = 2.37, p < .05 \). For those six passages in which the early
TABLE 10

MEAN VERIFICATION TIMES (IN MSEC) FOR STATEMENTS CONTAINING THE LATE REFERENT IN EXPERIMENT 4 AS A FUNCTION OF REINSTATEMENT OF THE EARLY REFERENT AND WHICH REFERENT WAS REINSTATED MORE QUICKLY IN EXPERIMENTS 1 AND 2

<table>
<thead>
<tr>
<th>Test Position</th>
<th>Reinstatement</th>
<th>No Reinstatement</th>
</tr>
</thead>
<tbody>
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referent was reinstated more quickly than the late referent, there was no effect of reinstatement of the early referent on the verification of statements containing the late referent, \( p > .1 \).

The finding that reinstatement of the early referent actually slowed response times to statements containing the late referent is somewhat unintuitive. It might be expected that if the late referent were activated during the search for an early referent that this reactivation would strengthen the late referent and facilitate access time. However, it is possible that the late referent is not only activated during the search for an early referent but is also considered as a possible referent. If a late referent is accessed as a possible candidate during the search process, the reader must then decide whether or not it is the appropriate referent. Since it is not, the reader tags it as "not appropriate" while the search for the correct referent continues. When asked to verify statements containing the late referent, this "not appropriate" tag would produce response competition that would slow response times to statements containing the late referent.

Although this account of the slowdown in verification of statements containing the late referent seems
reasonable, further research that directly tests this assumption is necessary. In any event, it is clear that reinstatement of an early referent can influence response times to a late referent but not to a preceding concept, and a backward parallel search model is strongly supported by these findings.

The results of Experiment 4 also confirmed that reinstatement increases the long term strength of a referent and that the naming time measure used in Experiment 3 was not sensitive to this change. In the present experiment, subjects verified statements containing the early referent significantly faster following reinstatement of the early referent than when there was no reinstatement. This difference was reliable on both an immediate and delayed test. It could be argued that the facilitation in verification times on the immediate test reflects an increase in the activation level of the early referent. However, Experiment 3 demonstrated that by test position 7, this activation has decayed. As a result, the facilitation in verification times at test position 7 can not be due to a higher activation level of the early referent but rather must be due to an increase in the strength of the early referent that facilitates its retrieval from the long term text representation. The fact
that reinstatement of the early referent had no effect on naming time for the early referent at test position 7 supports the position that the naming time measure used in Experiment 3 was not sensitive to an increase in the long-term strength of the early referent.

Subjects also responded significantly slower to statements containing the early and late referent when they appeared early in a test list than when they appeared late in a test list. This difference merely reflects the fact that subjects were able to respond more quickly as they made their way through a test list. This difference did not approach significance for statements containing the preceding concept because the early and late positionings of this statement differed by only two positions whereas the early and late statement positionings differed by six and four positions respectively.
The goal of the present research was to determine the process whereby a referent is reinstated into working memory. The results of four experiments have led to two major conclusions. First, a backward parallel search model provides the best account of the nature of the search for a referent. Second, text is represented in memory as an integrated network rather than as a hierarchical representation based on coreference. In what follows, several results will be reviewed that support these conclusions.

First, consider the read time results from the first two experiments. In both experiments, reading time differences showed that subjects reinstated a late referent significantly faster than an early referent. Prior to Experiment 1, several viable search strategies within the Kintsch and van Dijk hierarchical representation were proposed. Of these search models, only the backward serial search, the parallel search, and direct access models could predict faster access to the late referent. The backward serial search model predicted that late referents should always have been reinstated more quickly than early
referents. The finding that for some passages, the early referent was reinstated more quickly than the late referent eliminated this model. In order for the parallel search and direct access models to predict faster access to the late referent required that the late referent be more active than the early referent at the time of reinstatement. The naming time results from the control condition of Experiment 2 demonstrated that the activation level of these two referents did not differ prior to reinstatement. As a result, there was no viable search model within this representation that could predict faster reinstatement of a late referent.

The hierarchical representation, as proposed by Kintsch and van Dijk, assumes that coherence is maintained solely on the basis of coreference. However, as van Dijk and Kintsch (1983) have more recently argued, this strategy is much too simplistic, not taking into account the readers use of world knowledge. Other researchers have made similar arguments (Garrod & Sanford, 1979; Keenan, Baillet, & Brown, 1984; van Dijk, 1977). Van Dijk, in particular, has proposed that the existence of knowledge-based relations is the most important component of comprehensibility.

Following Experiment 2, an alternative
representation was proposed in which coherence was maintained through the use of world knowledge. Propositions could be connected to several other propositions, independent of importance level, resulting in an integrated network. Important concepts would be differentiated from less important concepts by the number of connections to them. Within this alternative representation, a backward parallel search model provided the best account of the finding that late referents were reinstated more quickly than early referents. Under this model, the search for a referent begins with the most recent end points and proceeds backwards in parallel until the appropriate referent is found. As a result, this search model predicts that late referents will be reinstated more quickly than the more distant early referents. However, if the early referent is sufficiently important to the passage, the number of retrieval routes to the early referent can overcome the proximity of the late referent and lead to faster retrieval of the early referent.

Although the results of the first two experiments support an integrated text representation and the backward parallel search model, the verification results from Experiment 4 provided the strongest support. Within an
integrated text representation, a backward parallel search model must predict that the search for an early referent should have activated and affected responses to the late referent. This should only have occurred for those passages in which a late referent was reinstated more quickly than an early referent. Also, since the search for an early referent should have terminated when an early referent was found, concepts that preceded the early referent should not have been affected by a search for an early referent. The verification results from Experiment 4 confirmed these predictions. Subjects verified statements containing the late referent more slowly following reinstatement of an early referent than when there was no reinstatement. More importantly, however, this difference was entirely accounted for by those passages in which the read time results of the first two experiments showed that the late referent was reinstated more quickly than the early referent. For the remaining passages, reinstatement of the early referent had no effect on verification times for statements containing the late referent. For statements containing a concept that preceded the early referent, reinstatement of the early referent had no effect on their verification.

As noted earlier, the finding that reinstatement of
the early referent slowed verification times for statements containing the late referent suggested that the late referent was not only activated but was also considered as a possible referent. Since it was not the correct referent, it was tagged as "not appropriate." This negative tag produced response competition resulting in a slowdown in verification time. Although this raises the possibility that all activated concepts are tagged as "not appropriate", it seems unlikely. Rather, it seems more reasonable to assume that the search proceeds backwards in parallel and is simply monitored by the reader. The only concepts that are actually considered and tagged are those that could be the correct referent but are not. More specifically, only concepts that are from the same general class as the appropriate referent would be tagged. However, this assumption requires further research.

In any event, the differences in reinstatement time for the early and late referent established in the first two experiments in conjunction with the verification times from Experiment 4 provide strong convergent evidence that a text is represented as an integrated network of propositions and that the search for referents through this representation proceeds in a backward parallel fashion.

Another way of characterizing this integrated network
is that propositions are not just connected to immediately
preceding propositions but are also connected to more
distant propositions. The procedure used in developing the
present set of materials made this distant linking
unnecessary; successive propositions were always
coreferential. This was done to ensure that a coherent
text representation could be constructed using only
coreference. Even so, the results discussed earlier showed
that the resulting memory representation could not have
been based solely on coreference. Therefore, it appears
that coreference is not only unnecessary for comprehension,
(c.f. Garrod & Sanford, 1982; Keenan, Baillet, & Brown,
1984) it is also not sufficient.

A second purpose of the present set of studies was to
clearly establish that readers do, in fact, perform
reinstatement searches. As noted earlier, several
researchers have shown an increase in reading time at the
point at which a reinstatement search is required (Cirilo,
1981; Lesgold, Roth, & Cutis, 1979). However, read times
could be slowed for reasons other than a reinstatement
search such as an unsignaled change in topic (c.f. Myers,
Hansen, O'Brien, Rayner, 1984; O'Brien, Duffy, & Myers,
1984). Others have shown that a referent is highly
available following a reinstatement search (Dell, McKoon, &
Ratcliff, 1983; McKoon & Ratcliff, 1982). Unfortunately, in these latter studies, there was never any control demonstrating that a referent was not available prior to reinstatement. The naming time results of Experiment 2 clearly demonstrated that prior to reinstatement, the early and late referent were not active in memory. However, in those conditions in which a reinstatement was required, read times were slowed and naming times for reinstated referents were facilitated. These results, controlling for methodological problems with previous research, provided strong evidence supporting the reinstatement search process.

The Kintsch and van Dijk (1978) model assumes that if there is no coreferent in short term memory, the search for a referent is obligatory. If, on the other hand, readers make use of knowledge-based relations, this is not true. Readers can simply draw a low level inference rather than always expending capacity completing a reinstatement search. Van Dijk and Kintsch (1983) have made a similar argument. This would explain the difficulty some researchers have had in establishing the distance effect (Cirilo, 1981; Duffy, 1984; Walker, Jones, & Mar, 1983). The present set of materials was designed to make it clear to subjects that a reinstatement search was necessary,
avoiding this problem. Future researchers in this area should carefully consider materials when attempting to produce a reinstatement effect.

One final issue involves the use of a naming time measure in studying the reinstatement search process. Previous studies have generally employed a probe verification procedure. Although this procedure has generally proved effective, it does raise interpretive problems. First, verification, as demonstrated in Experiment 4, is sensitive to differences in long term memory strength. Also, reinstatement could be taking place during the verification stage as opposed to during reading. The use of naming times avoids these problems. It does not require retrieval and, as demonstrated in Experiment 3, it is not sensitive to differences in long term memory strength. Therefore, naming times provide a more accurate index of the activation level of concepts in a text representation.

CONCLUDING COMMENTS

In summary, the present set of studies have clearly established the reinstatement search process. They have also provided strong support for the position that text is
represented as an integrated network and that the search for referents through this network proceeds in a backward parallel fashion. These results suggest that the original instantiation of the Kintsch and van Dijk model can not be correct. Future research in this area should be directed at determining how and when readers use knowledge based relations and developing a text representation that makes use of these relations.
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APPENDIX A

CRITICAL MATERIALS
Martha had been working as a sales clerk in a small gift shop for only a few weeks when the manager asked her to take over as the head sales clerk during the day shift. One morning when she came in, she found that one of the expensive vases had been broken. Martha figured that the night girl had broken it and hadn't had time to replace it since the shop had been very busy lately. During the day, the shop had also been very busy and it was hard for Martha to take care of all the customers at once. Martha found that she had to help one customer and then immediately have to help another. Martha told the manager that she really needed some help during the day because she was probably losing customers since she couldn't help everyone. The manager agreed with Martha and told her he would try to get somebody for the next day. However, she also knew she should take an inventory before the manager hired somebody. The shop had many expensive things and Martha wanted to make sure nothing was missing. While checking the jewelry case, she found that a watch was missing. Martha figured that a customer must have stolen it while the shop was busy. She continued her inventory and was pleased that nothing else was missing. By five o'clock, Martha was really tired and glad she was going home. She put on her coat and headed for the door. Just then, the manager
called to tell her that he had just hired someone. He also asked her if anything had been broken. (if anything had been stolen.)
Dan had been driving almost all night in order to get home for Thanksgiving. While driving, he found he couldn't stay awake so he stopped at a small all night convenience store for some coffee. He got out of his car and walked around in the fresh air. As he was stretching his legs, a van pulled up and a man jumped out. Dan noticed that the van was old and dented as he followed the man into the store. The clerk was very friendly and asked Dan where he was headed. Dan told him he was in college and that he was going home for Thanksgiving. While Dan was talking and drinking his coffee, the clerk was eyeing the other man. Dan watched the man roam around the store and noticed that he didn't pick up anything. The clerk asked Dan if he would stay until the man left the store. The clerk told Dan that the man was making him very nervous. Dan was anxious to get home but he agreed to stay with the clerk. Dan didn't want to leave him alone. He thought his presence would help avoid any trouble. Finally, the man picked up some gum and walked out. Dan thought it was a little strange to buy only gum but he relieved that the man finally left. He finished his coffee and got another cup. He hoped he could stay awake until he got home. Just as he was leaving, the police came in. They said they wanted to asked about the man who had just left. They asked Dan if
he knew what the man was driving. (the man had bought.)
As the five-thirty flight was leaving the ground, Diane was walking the aisles serving the passengers their drinks. Just as she was about to hand one man his drink, she was grabbed from behind by a young man. He told Diane he wanted to hijack the plane. Diane recognized the hijacker. She remembered that he was the last passenger to board. Diane remembered that he had been carrying nothing but a large book. She remembered thinking he probably stopped to buy the book and almost missed the flight. Now he was holding her tightly and demanding to speak with the pilot. Diane told everyone to be calm and no one would get hurt. Diane took the hijacker to the pilot. The hijacker squeezed her arm and told her not to say a word. He told the pilot that he wanted to go to Cuba. Diane knew the pilot would agree to do anything that the hijacker wanted. Diane realized he needed to ensure the safety of his passengers and crew. He asked the hijacker to release Diane so she could calm the passengers. Diane knew the passengers would be upset. She told them that the hijacker wanted to go to Cuba. She said nobody would get hurt if everybody stayed calm. As she was talking, she noticed a radio under the hijacker’s seat. However, she decided not to touch it. By the time the plane landed in Cuba, Diane had calmed the passengers. When the hijacker left the
plane, Diane told the passengers that they were no longer in danger. The hijacker was arrested by waiting Cuban authorities and the plane took off for Miami. Diane met several F.B.I. agents in Miami. The agents wanted to talk with her about the hijacking. They questioned her for hours. They were very interested in knowing what the hijacker had carried on the plane. (had put under his seat.)
Karen had been working in the emergency room since she had become a nurse several years ago. She loved working in the emergency room because she found the work interesting and she felt useful. She especially liked working on Sundays because she could relax. Unfortunately, Karen had plenty of work this Sunday. She had seen nine people before she could stop for coffee. While drinking her coffee, she watched the police bring in a young boy. She knew he was hurt so she rushed to help him, but she was relieved to find that only a finger was broken. Karen carefully set it and gave him a sedative. Then she called his parents and told them not to worry. Karen was happy to see that the boy had fallen asleep. She went out to the lobby and waited for the parents, knowing she would have a long wait. The parents had told her that the drive was an hour long. Karen sat back in a chair and hoped no more patients would come while she waited. She was tired of seeing injured people. She thought that most accidents were preventable and wondered if people would ever learn to be careful. Karen went back to check on the boy and was glad to see that he was still sleeping. Then she went to the kitchen to get a cup of coffee. When she returned, the boy was awake, and asked her for a game to play while he waited. Karen brought him one and told him to press the
buzzer if he needed anything. Then she went out and started to clean up the emergency room. She wanted to straighten things up before she went off duty. Just before she left, the boy's parents arrived and Karen told them that everything was fine. They wanted to know whether the boy had broken anything. (had asked for anything.)
David had just bought his first house in a small town near his new job. Since he didn't have much money, he had to buy a house that was still unfinished. Every weekend, he worked around the house and yard. One weekend David called his friend Tom to help him paint the house. He was afraid he would finish the front of the house before the cold weather set in. While moving a ladder, David lost his footing and fell, causing the ladder to fall and break a window. David decided to leave the window and start painting. David and Tom worked all day on the front of the house. David figured that if the weather was good, he could finish painting before winter came and then he could work on the inside during the winter. David and Tom were working fast and furiously to finish. David decided not to stop for lunch. He stayed on his ladder and painted while he ate a quick sandwich. By four o'clock, David had finished the front of the house and he became confident that he would finish the whole house before winter. David decided to quit for the day so he and Tom cleaned up. Tom started cleaning the brushed while David went into the garage to put away the paint. David thought the garage looked a little rickety and he hoped to work on it after he finished the house. Just then, David's wife came outside. She stopped and gave along approving look at the house.
She told Tom it looked great and stepped back to get a better view. She really liked the color. She turned to Tom and asked him what broke the window. (where David had gone.)
Cathy decided to go Christmas shopping for her family. She thought that she could find presents for daughter quickly. Her daughter was three and Cathy knew what to buy her. She had seen an adorable doll and had decided to buy it. However, Cathy had no idea what to get for her husband, and she was getting nervous. Cathy wondered why she could never find a good present for her husband. When she got to the mall it was crowded and she wanted to leave. She hated shopping when the stores were so crowded. Cathy went to a clothing store and a sporting goods store but she didn't see anything she wanted to buy for her husband. As she walked by a pet store, she saw a cute puppy. At once she decided that the puppy would be the perfect gift and went in and bought it. When she left the pet store, she decided to postpone the rest of her shopping until the next day. While driving home, she passed by a small bakery and she decided to buy a pie. She knew her family would love it. Cathy got back in her car and continued toward her apartment. Suddenly Cathy realized she couldn't keep the puppy in the apartment because she wanted to surprise her husband. Cathy went upstairs to her girlfriend's apartment and asked her friend if she could leave the puppy there until Christmas. Cathy's friend said yes and invited her inside for coffee. Her friend asked her what she had
bought for her daughter. (at the bakery.)
Nora had been living in New York for two years while she waited for her big break as an actress. During the day she attended acting classes and auditions, and at night she was a waitress in a small restaurant just off Broadway. One night several cast members from the show in the theater down the street came in for dinner. Nora recognized one of the women as the lead actress. She worked up enough courage and went over to her. Nora told her that she too was a dancer and that she was a great admirer of hers. The woman thanked Nora and promptly gave her a ticket to her show. Nora slipped the ticket into her pocket and went off to fill their orders. Nora noticed that the restaurant filled up with customers quickly and before long, she had a line of people waiting for tables. Nora was already tired from being in class all day but she still enjoyed her job. Not only did it provide her with a little money, but it also gave her a chance to meet some famous people. Nora realized that getting acting jobs was difficult without making connections, so she needed to meet all the established dancers she could. Eventually, Nora saw that the restaurant was beginning to quiet down and she started cleaning some of the tables. She started stacking plates on a cart to carry to the kitchen. While she was cleaning tables, Nora found a wallet stuck under some plates. She
ran after the customer and returned the wallet. After the restaurant closed, Nora sat and had a cup of coffee. She was tired and glad she could finally sit. Nora had been working for ten hours and she needed a break. Another waitress joined Nora and asked her what the famous actress had given her. (what she had found under the plates.)
As a correspondent for United Press, Mike had often covered revolutions in small third world countries. Mike was presently working in a very dangerous country. The country's military had seized power and Mike was covering the story. He had seen people being arrested off the streets and shot. Mike was taking pictures of a damaged building when a pair of jeeps came to a screeching halt in front of him. Several soldiers jumped out and grabbed him. A small stocky officer walked up to him and informed him that he was under arrest. Mike noticed that the officer was a major and realized that the situation must be serious. The military seldom sends a major on a routine arrest. Mike was handcuffed and thrown into the back of a jeep. Although Mike asked about the arrest, he wasn't given any answers. It really didn't matter, he thought, because the American Embassy would have him released. When he arrived at the police station, however, he was thrown in a cell without being allowed to call the embassy. Now he really began to worry. If nobody was informed that he was arrested, it could be weeks before anybody found him. He sat back on his bunk and realized that he was not alone. He saw an old man sitting on the floor smoking a cigarette who told Mike that he was a banker. Mike learned that all bankers were being arrested for questioning. Mike was both
surprised and relieved when later that day an embassy official had him released. Mike arrived at the embassy and was brought immediately to the ambassador who had some rather unusual questions. He told Mike that it was very important that he recall the rank of the arresting officer. (the profession of his cell mate.)
Max had been driving cab for a long time. Often he would drive a customer to the airport, about thirty miles away, to catch a plane. Usually he dreaded these trips because he had to drive all the way back alone and he got pretty bored. This time he was called to pick up a man at a nearby hotel and drive him to the airport. When he saw him, he was encouraged because the man was wearing an expensive suit and Max thought he would get a good tip. The man carried only a notebook under his arm and Max was happy because he wouldn't have to carry any luggage. Max tried to start a conversation with him but the man didn't answer any of his questions so Max gave up and concentrated on his driving. He knew this trip by heart since he had made it so many times. Max turned on the radio to pass the time but the man became angry and told Max to shut it off. Max thought that if the man was angry, he wouldn't get a tip so he shut the radio off quickly. Max noticed the traffic was especially heavy and he decided to take a short cut and beat the traffic. Finally, he reached the airport. He drove to the terminal and let the fellow off. The man gave Max a huge tip but never said a word. Max watched the man whisper something to the porter as he entered the airport and then Max drove back to the stand. He was getting tired and thought he would cash out and go home.
While Max was cashing out, an F.B.I. agent came in. He wanted to talk to Max so Max finished cashing out and sat down. The agent wanted to know about the man Max had taken to the airport. He asked Max if the man had been carrying anything. (had spoken with anyone.)
Charlie had been plowing the city for years and he had never seen a worse blizzard. The storm had dropped two feet of snow. Charlie had been plowing the roads all night and he hadn't eaten any dinner but he did have a few coffee breaks. Charlie had been working twenty-eight hours straight. He was tired and worried that he would have an accident. As Charlie entered a new street, he saw a policeman in the middle of the road. The policeman told him he was checking on a burglar alarm. Charlie hadn't seen anything unusual but said he would look around as continued his plowing. He didn't have time to look too carefully though. The snow was falling hard and he'd be lucky if he finished his streets before he went off duty. He still had fifteen streets to go and he was only going to be driving the plow for three more hours. Charlie started to drive faster but was afraid he would hit something so slowed the plow down again. The snow was coming down hard and Charlie knew he should be careful. He had hit a parked car once before and had missed work because of the accident. He couldn't afford to miss any more work. He would simply do his best and hope he could finish his assigned streets before he went off duty in three hours. Charlie was getting hungry and he didn't think he could last the whole three hours without eating something. He found a banana in
his lunch bag. It wasn't much, but it was better than nothing. He managed to almost finish his streets by the time he completed his shift. He had left three streets unplowed but the snow had stopped falling and Charlie knew somebody could plow them easily. He drove the plow into the station and up to the gas pumps. The new driver was already there waiting to take over. They talked for a while about the terrible driving. The new driver asked Charlie if he seen anyone. (if he had eaten anything.)
Nancy had lived in a dormitory for three years and wanted to live in an apartment for her last year at college. Early in the summer, she found an apartment and agreed to move in before school started. In the fall, Nancy borrowed her father's car, packed her belongings and headed for the apartment. During the ride, she realized that she had forgotten her stereo. However, she decided not to go back and get it. Nancy was excited about her new apartment and couldn't wait to move in. She also liked the area and thought she might live there permanently. As she continued to drive, Nancy noticed that the streets were beginning to become familiar. Nancy decided to stop in town and get some things for the apartment before unpacking. She knew she would need some cleaners because the apartment had looked dirty. She had just reached the center of town when a car in front of her came to a sudden stop. Nancy slammed on her brakes and as she did, everything in the car went flying. Nancy pulled over and looked in the back of the car. She was disappointed to see that her perfume has spilled and hoped she would be able to clean it all up. By the time she got to the apartment, her roommate was already there and unpacked. Nancy was glad to see that her roommate had already cleaned the apartment. As she helped Nancy unload the car, she asked her what she
had forgotten at home. (what had spilled in the car.)
Steve thought that working on the fire department had been easy but lately, he noticed a rash of fires had been plaguing the town. Mostly, the fires were empty buildings and summer cottages down by the lake. One night, Steve spotted some smoke down by the lake. By the time he got there, a building was fully engulfed in flames. He was too late to save the building and as the walls began to fall away, Steve could see a boat inside. Unfortunately, he couldn't save the boat either. By sunrise, Steve saw nothing left but some smoking embers and some smoldering beams. He poked around in the remains of the building to make sure there was no chance of the fire starting to burn again. Steve knew it had been a very dry autumn this year and any stray spark would probably start a fire that would burn up a good portion of the forest around the lake if it was uncontainable. The police had also asked Steve to look around for arson clues. Steve thought the fires were suspicious and had wanted to investigate. He wanted to catch the arsonist and end the rash of fires before somebody got killed. When Steve saw that the embers had cooled, he began digging around in the ashes. Unfortunately, he wasn't having much success. He was able to find an old glove but he wasn't sure if the glove was important. By mid-morning, Steve decided that the fire was
sufficiently out so that he could return to the fire station. He was more than happy to go back. Having worked all night, he was cold, tired, and especially hungry. Steve decided to cook some pancakes. While cooking, one of his buddies asked him what had burned in the building. (what he had found in the ashes.)
Bill had finally received three days of shore leave when his ship docked in Boston Harbor. He was thrilled because his grandparents lived in Boston. Bill hadn't seen them for several years and he knew they would be happy to see him. When he got off the ship, he called them, and they were indeed happy to hear from him. When he arrived at his grandparents, Bill's grandmother had a glass of beer waiting for him. While drinking the beer, Bill talked about his experiences since joining the navy. He had traveled all over the Mediterranean and the Pacific. Bill had joined the navy ten years ago and had traveled everywhere. He loved the navy and had decide to make it his career. The pay was good and he had learned to repair computers so he knew he could get a good job when he got out. Bill was in the middle of his story when his grandmother interrupted him because she had to go shopping. Bill decided to sit of the couch and wait for his grandfather. He picked up a magazine but was so excited to see his grandparents that he couldn't concentrate. He decided to watch television. He couldn't watch TV at sea because the reception was so bad. Bill turned on the news. He didn't really like the news but he couldn't find anything else. After a while, Bill heard his grandfather outside. He looked out the window and saw him so he leaped
off the couch, raced to the door and gave his grandfather a big hug. Bill sat back on the couch and talked with his grandfather. Bill's grandfather asked him if he had gotten anything to drink. (what he was watching on television.)
John had been promoted to detective two months ago and he couldn't wait to make his first big arrest. He knew he would be nervous when a case came to trial because the defense attorney would be trying to discredit his testimony in order to get his client off. John decided he would only make careful arrests. Early one night, John responded to a call on Maple street and when he arrived, found a young woman lying on the sidewalk. He turned her over, saw a pool of blood, and realized she was dead. John didn't dare touch the knife that was lying next to the woman. He thought it might have fingerprints. John called the coroner's office and he attempted to keep the growing crowd away while he waited. Suddenly, John saw a man break through the crowd and crouch over the woman. He told John that he was the woman's husband. John immediately pulled him back from the body and questioned him, wanting to know if he knew anything. John was looking for clues and asked the husband to help him. He wanted to solve this case and show his boss that he had deserved his recent promotion. John was being pretty insensitive however. The man had just lost his wife and didn't really want to talk but John kept him around anyway. Actually, John suspected the husband and didn't want to let him go until he was sure he wasn't the murderer. When John found out that the woman's
money had been stolen, he knew the husband was innocent. The stolen money meant that the case was probably a robbery. John didn't need much time to find a suspect and bring him to trial. John took the stand knowing the defense attorney would be tough. He was nervous but he was also ready for any question. The defense attorney asked him what the murder weapon had been. (if anything had been stolen.)
Mark had grown up in the city but he had always wanted to live in the country with lots of land and a large garden. The first opportunity he had, he packed up his belongings and bought a house in the country. Every day Mark would ride the train to and from work. The train ride was long but it was nice and it allowed Mark to read the newspaper in the morning and relax at night. Mark was a teacher who taught at an elementary school in the city. He liked teaching because he could work in his garden during the summer. Country living had its problems however. Mark had left all his friends behind in the city and had no neighbors out in the country. One warm summer day, Mark was out working in the garden. He had done all the planting and he needed to weed the vegetables. Mark was happy to see the progress. He had hoped some vegetables would be ripe and was delighted to see that some of the corn was ripe. Mark decided to have a few ears of the corn with his lunch. Mark was heading for the house when he saw a friend from the city pull in the driveway. Mark was excited to see his friend. He set up some chairs on the porch and told his friend about his new home. He said he missed the city but he really loved living in the country. Mark's friend asked him how he got to work in the morning. (what he had picked from the garden.)
Bob loved to ride his bike on weekends with his friends. This weekend, they decided to ride in the country. Unfortunately, while riding, Bob developed mechanical problems. Bob couldn't find a bike shop so he repaired the brakes himself. These brakes had often given Bob problems. He stopped in front of a small church and made the necessary repairs. Bob was eager to catch up with his friends. He had been the last in line and they probably hadn't noticed that he had stopped. They were planning on making camp about twenty miles further up the road. Bob thought that if he hurried, he could catch them by dark. Bob was watching the foliage while he rode. He enjoyed riding in the fall because he loved the smell of clean air and the colorful leaves. He completely forgot that he needed to hurry to catch his friends before dark. As a result, he was falling further behind. After a while, he started to get hungry but his friends had all the food. Bob stopped by a field and saw several apple trees. He sat on a stone wall and ate an apple before going on. After he had traveled several miles, he recognized a friend riding toward him. He must have noticed that Bob was gone and had come back to find him. Bob was glad to see his friend and together they continued their ride. Bob's friend asked him what he had stopped to fix. (he had stopped to eat.)