Accessibility and Situation Models in Narrative Comprehension

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We investigated the accessibility of information from situation models during narrative comprehension. Subjects memorized a diagram of a building and then read narratives describing a person moving through the building in order to achieve a goal. To probe accessibility, we periodically interrupted the narrative by presenting the names of two objects, and subjects decided whether the objects were located in the same or different rooms of the building. Experiment 1 investigated objects' accessibility after goal sentences (e.g., *Wilbur walked from the storage area into the wash room*). Objects from the goal room, where the character was located, were most accessible. Furthermore, accessibility of the objects tended to decrease as the distance from the location room to the probed room increased, suggesting that the situation model preserves some information about distance. Experiment 2 indicated that accessibility depended on the location of the protagonist in the situation model rather than recency of mention of the rooms in the text. Finally, Experiment 3 showed that after path sentences, where the character is on the path heading toward the goal (e.g., *While Wilbur was walking through the storage area toward the wash room, he looked at the loading dock*), both the path and goal rooms are highly accessible. This finding reflects the fact that the two rooms are relevant to the incomplete motion event. Thus, information accessibility depends more on the described situations than on the surface organization of the narrative. © 1987 Academic Press, Inc.

During narrative comprehension, listeners or readers can only focus their attention on part of the information conveyed by a narrative since only a small part of the preceding information remains available in active or working memory (Kintsch & van Dijk, 1978; Sanford & Garrod, 1981). Problems arising from limited attention are compounded by the fact that a text often implies more than it explicitly states. However, this problem is often reduced by the fact that writers tell their story from a particular perspective, in which some described objects and actions are more important or relevant than others. If writers can communicate their perspective and thereby the relevance of objects and actions within this perspective, the reader's task is greatly simplified. Knowing where to focus attention can greatly constrain the amount of inferencing required to understand the narrative, and may also influence the mental representation of the information conveyed by the narrative (Black, Turner, & Bower, 1979; Greenspan & Segal, 1984; Morrow, 1986; Morrow & Greenspan, 1987).

Focus of attention in narrative comprehension has usually been defined in terms of the accessibility of information from working memory (Kintsch & van Dijk, 1978; Sanford & Garrod, 1981). At any point in comprehension, relevant information in the narrative should comprise the most active elements in working memory, and thus should be readily accessible. The
present article examines how accessibility is established during narrative comprehension. We show that it is strongly influenced by properties of the situations described by the narrative and is an important part of constructing a representation of the situations, that is, a situation model.\(^1\)

According to several theories of comprehension, people understand narratives by constructing a situation model as well as a representation of the text (van Dijk & Kintsch, 1983; Johnson-Laird, 1983; Sanford & Garrod, 1981). The situation model is constructed by integrating linguistic knowledge with general background knowledge about objects and actions, and knowledge of the referent situation. It is used during comprehension to interpret new sentences, which in turn update the model. To update the model appropriately, readers must focus on the entities that writers intend as most relevant to the described situations.

Situation models tend to be organized around important characters and events. Main characters, or protagonists, are part of the narrative topic (e.g., van Dijk, 1979). They are important to narrative organization because writers frequently adopt their perspective; one index of this perspective is that protagonists are frequently pronominalized and mentioned in sentence subject position (e.g., Francik, 1985; Marslen-Wilson, Levy & Tyler, 1982). They are chosen by readers as referents for ambiguous pronouns, or in order to complete a sentence (Anderson, Garrod & Sanford, 1983; Morrow, 1985a). Their perspective is also adopted by readers, which often governs the inferences that help integrate the sentences into the model (Black, Turner, & Bower, 1979; Bower, 1978; Morrow, 1985a).

Situation models are also organized around the sequence of foreground events forming the plot of the narrative. These events are often expressed by simple past tense verbs (e.g., he walked), while events occurring off the timeline, and thus backgrounded to the plot, are expressed by other kinds of verbs, such as progressives (e.g., he was walking; Almeida & Shapiro, 1983; Hopper, 1979; Labov, 1972). Readers expect protagonists to participate in foreground events, so that the protagonist's actions advance the present moment of the narrative (Hopper, 1979). Consider a narrative in which Wilbur is the protagonist and Harry is the nonprotagonist. When reading the following sentence, While Harry was going into the exhibit hall, Wilbur went up to the ferris wheel, readers choose Wilbur as the referent for the pronoun he in a following sentence. However, if the protagonist occurs in the background event, as in While Wilbur was going into the exhibit hall, Harry went up to the ferris wheel, readers are uncertain and tend to choose the last mentioned character as the referent of the pronoun he (Morrow, 1985a). Thus, readers assume that the protagonist in the current foreground event is most relevant at any point in the narrative. Therefore, information relevant to the protagonist's actions should be most accessible from working memory.

The present study is primarily concerned with the accessibility of spatial information because spatial relations such as location and distance are a pervasive part of narratives. Previous research has shown that spatial information is an important part of the memory representation constructed from discourse (e.g., Mani & Johnson-Laird, 1982; Perrig & Kintsch, 1985), and that the linguistic expression of spatial relations helps determine accessibility (e.g., Morrow, 1986).

The location of the protagonist in a situation is an important determinant of accessibility. It has been referred to as the narrative Here/Now because it specifies a spatial

\(^1\) For a more detailed discussion of focus of attention in comprehension see Englekamp & Zimmer (1983) and Morrow & Greenspan (1987).
and temporal reference point from which the narrated situations are described and interpreted (Chatman, 1978; Klein, 1982; Segal, Bruder, & Daniels, 1985). For example, in apartment and route descriptions, where the protagonist is the addressee (the reader), his or her location is used to refer to and describe important parts of the layout (You go down the hallway and to the left is a kitchen, Klein, 1982; Linde & Labov, 1975). Morrow (1985b) showed that protagonist location in narratives influences which objects readers choose as referent for an ambiguous referring expression, which is one index of accessibility. Subjects memorized a model house and then read narratives that involved people moving through the house. When asked about the referent of a noun phrase in a sentence of the narrative, subjects chose objects near the protagonist’s current location. For example, if they read John walked past the kitchen into the bedroom. He saw the rug was dirty, they interpreted the rug as referring to one in the bedroom. However, if they read John was walking past the kitchen to the bedroom. He saw the rug was dirty, they thought the last sentence referred to a rug on the path leading to the bedroom.

Such evidence suggests that readers build situation models organized around protagonists, and that this process is guided by the spatial and temporal information conveyed by prepositions (e.g., from, into, through) and verb aspect markers (e.g., walked vs. walking). The present study investigated how accessibility was influenced by sentences locating the protagonists in a room, where the room either served as the goal of a completed motion event (Then Wilbur walked from the conference room into the laboratory) or as the path along the way to the goal (While Wilbur was walking through the conference room toward the laboratory, he talked to a friend). The prepositions (from/into and through/toward) specify which rooms serve as source, path, and goal, thus indicating the direction of motion. In combination with the verb aspect, they also specify the protagonist’s spatial and temporal location and thus the narrative’s Here/Now point (Morrow, 1985b; Segal et al., 1985). The goal sentences expressed completed foreground events that clearly advance the Here/Now point. Thus, the present moment of the narrative is at the character’s new location in the goal room. However, the path sentences contained progressive verbs and therefore expressed an incomplete event. Thus, the character is located on the path at the time expressed by the sentence, although the intended location is the goal.

The present experiments probed the accessibility of information from the situation model as the model was constructed. The use of an on-line probe allows us to investigate dynamic properties of the model, detecting changes in the accessibility of different aspects of the model as the narrative progresses from one situation to the next. Subjects memorized diagrams of building layouts and then read narratives about events taking place in the buildings. In this experimental situation, the reader and writer shared knowledge about the building layout, and the reader used this knowledge along with general background knowledge about typical actions and goals in order to understand the narratives. Thus, the reader combined prior knowledge about the building layout with narrative information about situations occurring in this building in order to construct a situation model.

Experiment 1 examined the effect of sentences locating the protagonist in the goal room on the accessibility of information about objects in the building. Experiment 2 tested whether the effect of motion sentences on accessibility was due to the structure of the described events, or to the order of mention of the information in the sentences. Experiment 3 examined the effect of sentences locating the protagonist
on the path in addition to examining goal sentences. We probed the accessibility of objects from the model by interrupting the narrative and asking about locations of pairs of objects.

We investigated two main hypotheses. First, protagonist location will determine accessibility: Objects near the protagonist should be highly relevant to the situation, so they should be most accessible from the model being constructed in working memory. Therefore, questions about objects in the room where the protagonist is currently located (i.e., the location room) should be answered more quickly than questions about objects in other rooms (location effect). For goal sentences (from room X into room Y), the goal room should be more accessible. On the other hand, path sentences (while walking through room X toward room Y) may lead to a more complex pattern of accessibility. The path room will be most accessible if the location of the protagonist in the described situation determines accessibility. However, the goal as well as the path is relevant to the situation since the protagonist is going there to accomplish something. This suggests that for path sentences, the narrative Here/Now includes the goal as well as the path room. Therefore, both path and goal rooms may be highly accessible following path sentences rather than goal sentences. This would suggest that accessibility is influenced by aspects of the situation in addition to protagonist location.

The second hypothesis concerns the spatial information used in the situation model. If the distance from the protagonist location to other parts of the building is important to understanding the described situations, it should be preserved in the model. Accessibility of information about rooms in the building may reflect this distance since the further away a room from the protagonist, the less relevant it is likely to be to the protagonist's current experience. If so, response time to probes should increase as distance between the location room and the probed room increases (distance effect). The increase in time with distance will reflect the time necessary to move attention from the location room to the probed room in order to access the information necessary to answer the question. This relationship between distance and response time is predicted by at least two alternative theories of the representational format of the situation model. First, distance can be represented by an analog format such as a spatial array (Kosslyn, 1975). Within this format, focus can be represented as a spreading activation information retrieval system (McNamara, Ratcliff, & McKoon, 1984) or as a point of attention that shifts across the image (Kosslyn, 1975). Second, distance can be represented by a hierarchically organized network (Kuipers, 1978; Stevens & Coupe, 1978) with information retrieved by spreading activation (e.g., Collins & Loftus, 1975). We will not try to distinguish among these representational theories in the present study, but rather investigate the more general issue of how accessibility is influenced by distance from the Here/Now point in the situation model.

**Experiment 1**

Experiment 1 examined the location and distance hypotheses in situation models constructed from goal sentences. As noted earlier, goal sentences such as Wilbur walked from the conference room into the laboratory update the model by locating the protagonist in the goal room. If accessibility depends on the location of the protagonist in the model, information about the goal (the laboratory in the example) should be more accessible than information about the source (the conference room) or other rooms in the building.

**Method**

**Layout.** Subjects learned diagrams of a research center and a warehouse. Each diagram was 17 × 17 cm in size; they were...
mounted next to each other on a 41 × 66-cm sheet of paper. The diagrams contained four rooms with four objects in each room. To avoid pre-experimental associations between rooms and objects (e.g., kitchen—toaster), most objects had weak associations to the room in which they were located. Figure 1 presents the research center.

Narratives and Probes. Subjects read eight narratives, four taking place in the research center and four in the warehouse. A sample narrative is presented in Table 1. Each narrative contained 19 sentences and described the actions of a worker, which always involved his or her moving through the rooms of one of the buildings. The character was introduced in the first seven sentences. Throughout the narrative, he or she was usually pronominalized and mentioned in the grammatical subject position, thus signaling that he or she was the narrative protagonist (e.g., Francik, 1985; Karmiloff-Smith, 1981; Marslen-Wilson et al., 1982). The protagonist was also given a reason for moving through the building (e.g., to inspect the building, to look for a burglar).

The protagonist's tour was described by four critical motion sentences in the second part of the narrative. Each critical sentence located the character in one of the four rooms as the goal of a completed motion event (e.g., Wilbur walked from the conference room into the laboratory). Each of the first three critical goal sentences was followed by two sentences describing the protagonist's actions in the goal room. The fourth critical sentence was followed by a concluding sentence.

A probe occurred after each critical sentence. The probe named two objects from

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Fig. 1. Example of building layout used in Exp. 1 (Research Center).
the building layouts. The objects could be from the same or from different rooms. There were four types of Same room probes, illustrated in Table 2. In the location (goal) room probe, the objects came from the goal room where the character was currently located (the laboratory). In the mentioned (source) room probe, the objects came from the previously occupied room, which was also mentioned in the motion sentence (conference room). In the near room probe, the objects came from a room that was in the same building but hadn’t been mentioned in the previous sentence (e.g., the library). Finally, in the far room, or unmentioned building probe, the objects came from a room in the other building, not mentioned in the narrative (e.g., an office in the warehouse). In Different room probes, objects could come from different rooms in the mentioned building, different rooms in the other building, or from a room in each building. Probe objects were randomly selected from these types to serve as Different probes.

Some probes named the protagonist and an object (Protagonist–object probes) that was either from the room where the protagonist was currently located (Same probe) or another room (Different probe). These probes were included to insure that subjects were comprehending the narratives.

Procedure and design. The experiment had two parts. In the first, subjects memorized the diagrams one at a time. They learned the exact names and locations of the rooms and objects. After studying the diagram for 1 min, they were given a diagram with only the room walls and they tried to fill in room and object names in the correct locations. After writing down all they could remember, they had 2 min to compare their version with the original and study the original again if they had not correctly reproduced the diagram. Then they were given another blank to fill in. They repeated these study–test trials until they had correctly reproduced the diagram. Then they memorized the second diagram in the same manner. After learning both buildings, they answered six questions that...

| TABLE I |
| EXAMPLE OF NARRATIVES IN EXPERIMENT 1 |

Wilbur regretted the day he had ever become the head of the research center.
He had just found out that the board of directors was coming for a surprise visit the next day.
He called all of the employees together in the library and told them the center was a complete mess.
He told them to start cleaning up the building immediately.
He said he wanted the directors to see a spotless, organized center.
He told everybody to spread out and clean every room.
He made sure the library was being cleaned and then left to supervise the rest.
First he walked from the library into the reception room.

_**Lamp Clock**_
He told the secretary to cancel all appointments for the day.
He looked for reports on the current projects.
Then he walked from the reception room into the conference room.

_**Wilbur Coffee**_
He made sure everything was arranged for his presentation.
He spread out the reports and glanced through them.
Then he walked from the conference room into the laboratory.

_**Bench Bed**_
Technicians were sorting papers into piles.
He told them to be as neat as possible.
Then he walked from the laboratory into the library.

_**Copier Catalogue**_
He felt the center was beginning to look respectable.
described locations in the buildings, three in the warehouse and three in the research center. Subjects wrote down the name of the object at the described location (e.g., As you enter the laboratory from the conference room, what is to the left? Closet). They took about 15 min to learn the layouts.

In the second part, subjects read the narratives, which were presented one sentence at a time on a CRT screen connected to a personal computer. The experiment began with the word READY presented in the middle of the screen. Subjects pressed the space bar to begin the narrative and to advance from sentence to sentence. When a probe appeared, they responded same room or different room by pressing keys labeled SAME and DIFFERENT, respectively. They responded same to Protagonist-object probes if the character was in the same room as the object at that point in the narrative, and different if the character was in any other room. They were told to read the narratives carefully and to respond to the probes as quickly as possible without making errors. If they made an error in a narrative, a message to answer more carefully appeared at the end of that narrative. Reaction time (RT) and errors were recorded by the computer. A practice narrative was presented before the eight experimental narratives. It took subjects about 30 min to read the narratives and answer the probes.

The eight experimental narratives were divided into two groups and their order was counterbalanced across subjects. Each narrative contained four probes, one after each of the four critical motion sentences. Two of the probes were Same room object-object probes, and narratives were paired so that one instance of each of the four Same room probes occurred across the two narratives. The remaining two probes in four of the eight narratives were Different room object-object probes. One of the remaining probes was a Different room object-object probe and the other was a Protagonist-object probe (half of the time it was same and half of the time it was different) in the other four narratives. Thus, roughly the same number of Same and Different room probes, and an equal number of each Same room probe type, occurred across the eight narratives. Each subject saw four instances of each Same room probe type, twelve Different probes, and two Same and two Different Protagonist-object probes. Across all narratives, each probe type appeared equally often after the four critical motion sentence positions within a narrative.

Objects were randomly assigned to probe conditions with the following constraints: Objects were not probed if they had been previously mentioned in the narrative; they were not repeated as a probe within a narrative; and no pair of objects was repeated across the set of narratives. To examine whether some objects were more salient than others, two lists of objects serving as probes were constructed, so that each narrative had two versions based on the objects serving as probes. Different groups of subjects saw the narrative versions (object list factor).

Subjects. Forty Stanford University undergraduates served in the experiment to fulfill a requirement for a psychology course.

Results

Subjects required 2.30 and 2.35 trials before they correctly reproduced the research center and the warehouse, respectively.
They answered 5.34 of the six memory test items correctly.

Analyses were performed on reaction times for correct probes only. Reaction times greater than three standard deviations above the mean reaction time for each subject (less than 1% of the responses) were excluded from the analyses. Several factors (e.g., object list factor) were included in the experimental design for the purpose of counterbalancing. Since none of these factors had a significant effect on probe RTs in the experiments of the present study, these results will not be presented.

For probes pairing the protagonist name with an object name, readers took 2.70 s to respond that the protagonist was in the room containing the object, and made 3% errors. For probes with two objects, the mean reaction time for Same and Different room probes did not differ significantly (Same: 2.72 s; Different: 2.70 s; t(39) < 1.00).

Our primary interest was in the reaction times to Same room probes. The mean reaction time and percent errors for the four types of Same room probes are presented in Table 3. These scores were analyzed by a repeated measures ANOVA with probe type as factor. The table shows that RT depended on probe type (F(3,117) = 4.64, p < .01). Errors were less than 10% and increased with RT, so speed-accuracy trade-offs introduce no problems of interpretation. The location hypothesis was supported by the data since the location room probe RT was faster than the mentioned, near, and far room probes (Location vs. mentioned: F(1,39) = 9.15, p < .01). The distance hypothesis was also supported since a trend analysis over the mentioned, near, and far room probes (excluding the location room) revealed a significant linear trend (F(1,117) = 9.02, p < .01). However, the differences in RT between the mentioned room and near room probes, and between the near room and far room (unmentioned building) probes were not significant, although they were in the predicted direction (F(1,39) < 1.00, for the first comparison; F(1,39) = 3.02, n.s., for the second comparison.

Both accuracy and RT data provide evidence for a location effect. Readers focused on protagonists as they constructed the situation model, so that information about the room containing the protagonist was more accessible from the unfolding model. The prepositions and motion verbs in the goal sentences specified the location of the protagonist and thus helped determine the focus of attention in the model. Each sentence clearly advanced the narrative Here/Now associated with the protagonist location in order to update the situation model.

The results also provide evidence for a distance effect. Thus, readers not only focus on the location of the protagonist in the situation model, they also represent the distance between the location room and the other rooms of the building. Recent work suggests that mental models of layouts can preserve distance information defined either in terms of Euclidean relations, that is,
distance "as the crow flies", or in terms of distance along the route, depending on the form in which the information is presented and how it is learned (e.g., Thorndyke & Hayes-Roth, 1982; McNamara et al., 1984). In addition to further examining the location effect, Experiments 2 and 3 also investigated the importance of these two kinds of information to situation models constructed from narratives.

**EXPERIMENT 2**

Experiment 1 showed that after a goal sentence, information about the goal room is more accessible than information about other parts of the situation model. However, this finding can be interpreted in two ways. On the one hand, accessibility may be due to textual factors such as recency of mention of information in the text, as suggested by several theories of discourse processing (e.g., Clark & Sengul, 1979; Lesgold, Roth, & Curtis, 1979). On the other hand, the present approach argues that accessibility is determined by properties of the described situations (e.g., whether a character is protagonist, or an event is part of the plot, or foreground). Experiment 1 does not distinguish between the text-based and situation-based accounts. The goal room may have been accessible because it was always mentioned last in the critical sentence and just before the probe, or because the protagonist was located in it as the outcome of a completed motion event. Experiment 2 distinguished these two approaches by varying the order of mention of the source and goal rooms in the goal sentences (Wilbur walked from the conference room into the library vs. Wilbur walked into the library from the conference room). If character location determines accessibility, the goal room will be more accessible in both order versions. If recency determines accessibility, then the last mentioned room will be more readily accessed, whether it is the goal (into) or source (from) room. When the goal room is mentioned before the source room, order of mention does not match the flow of action in the described situation (i.e., motion beginning at the source and ending at the goal). This order of mention is more linguistically marked, and less common than the order that matches the flow of action (e.g., Delancey, 1981). Although readers may take longer to understand the more marked into/from order, the goal room should still be most accessible in either order version if protagonist location in the situation model determines accessibility.

Experiment 2 also examined the kind of distance information preserved in the situation model. In order to probe the accessibility of spatial information in more detail, the number of rooms in the building was increased. The two layouts in Experiment 1 were combined and two more rooms were added to form a single building containing ten rooms (See Fig. 2). As in Experiment 1, location, mentioned, near, and far rooms were probed. In Experiment 2, the far room was in the same building as the location room, with as many rooms separating them as possible. This condition contrasts with the far room probes in Experiment 1, which referred to a room in the unmentioned building. Moreover, because several rooms were near to the location room, two kinds of near rooms were probed. First, we probed a room that was both Euclidean-and route-near to the current location room. This was the next room on the route after the location room. It had not been mentioned in the narrative prior to the probe. Second, we probed a room that was physically adjacent to the location room, but not involved in the current event. This room tended to be far from the location room on the route since no door connected the location and adjacent room, and at least one room always separated the two rooms. For example, for the following sentence, Wilbur walked from the conference room into the library, the next room on the route
would be the laboratory, and the adjacent room would be the experiment room (See Fig. 2). Distance in the situation model may be defined by route rather than Euclidean relations since the situations are in part organized around the route that the protagonist takes in order to accomplish the described goal. If so, the adjacent room probe should be slower than either the next room or the mentioned room, which are close to the location room by both a route and Euclidean metric. Moreover, the mentioned room may be faster than the next room on the route since the former had been previously mentioned in the narrative, which may make it more accessible.

Finally, half of the Different room probes contained one object from the character location room and one object from another room, while the other half of the probes contained objects from rooms other than the location room. If reaction time for the Different probes is determined by the proximity of the objects in the two rooms to the location room, the first type should be faster than the second.

Method

Layout. The building layout was $27.5 \times 23$ cm in size and contained all of the rooms from the previous two layouts as well as a wash room and an experiment room (see Fig. 2). The objects from the previous two layouts were used, although the locations of some were changed. New objects were added to the two new rooms so that every room contained four objects.

Narratives. Twelve narratives were used, and eight of them were adapted from the narratives in Experiment 1. To increase the number of instances of each probe type that each subject say, every narrative contained one instance of each probe type. Since there were six probe types (four Same room probe types, the Different room probe, and the Protagonist-object probe), six probes occurred in each narrative. This in turn required six critical mo-
sion sentences. As in Experiment 1, each critical sentence described a completed motion event locating the protagonist inside the goal room. After this sentence, a sentence described what the character did in the goal room, and then the next sentence moved the character to the next room, which became the source room for the following critical sentence. Because there were six critical sentences, each narrative mentioned six critical source and goal rooms. Since the building only had ten rooms, the sixth critical sentence repeated the first sentence. Three of the critical sentences in each narrative mentioned the source room first and the goal last (from/into sentences), and three sentences mentioned the goal first and source last (into/from sentences). The two sentence types alternated within the narrative. The first critical sentence was from/into in half of the narratives and into/from in the other half. Another set of twelve narratives were constructed that differed from the first set only in the order of mention of the source and goal rooms in the critical sentences. Different subjects saw the two narrative sets.

As in the previous experiment, the location, mentioned, near, and far rooms were probed after the critical sentences. The near room probes were divided into two types: A room that was physically adjacent to, but route-far from the location room, and a room that was next on the route from the location room. Half of the Different room probes contained an object from the location room, and half of the probes did not.

Procedure and design. The procedure was the same as in Experiment 1 except subjects learned a single layout and answered five rather than six location questions. Subjects took about 30 min to memorize the layout. In addition, they began the second part of the experiment with two practice narratives rather than one. Four presentation sets of the twelve experimental narratives were produced by reversing the order of mention of the rooms in the critical sentences, and by changing the identity of the objects serving as probes. The narratives in each set were divided into three groups of four and the order of the groups was rotated across subjects. Within each narrative, one instance of each Same probe type, one Different probe, and one Protagonist-object probe occurred. Therefore, each subject saw six instances of each Same probe type (three instances of each near room probe type), six Different probes, and three same and three different Protagonist-object probes after each type of critical sentence. Across narratives, each probe type was equally likely to occur at each critical sentence position. In addition to these probes, each narrative contained an additional Different room object-object probe. This probe occurred after a noncritical sentence in different positions across narratives. It was included to increase the ratio of Same to Different room probes, and RTs to the probe were not analyzed. Objects were assigned to probe types with the same constraints as in Experiment 1.

Subjects. Sixty Stanford University undergraduate students served in the experiment to fulfill a requirement for a psychology course.

Results and Discussion

The data were analyzed as in the previous experiment. Subjects required a mean of 4.78 trials to correctly reproduce the layout, and answered 4.75 of the five location test questions correctly.

Probe RTs greater than three standard deviations above the mean for each subject (3% of the responses) were excluded from the analyses. Readers took longer to respond to Same Protagonist-object probes after the linguistically marked into/from sentences than after the unmarked from/into sentences (into/from: 2.19 s, from/into: 1.94 s; \( t(59) = 2.85, p < .005 \), but they an-
answered the probes accurately after both kinds of sentences (into/from: 1% errors; from/into: 3% errors). Thus, readers kept track of character location in both order of mention conditions.

Table 4 presents the mean RT and percentage errors for the Same room probes. Errors were less than 10% in all conditions and did not vary systematically with RT. Probe RTs were analyzed by a repeated measures ANOVA with sentence type and probe type as factors. The location hypothesis predicts that the location room should be more accessible than the other rooms in both order of mention conditions. The results clearly support this prediction since the location room probe was faster than the other probes after sentences with both order versions. This is shown by the fact that probe type influenced RT ($F(3,177) = 12.85, p < .001$), and this influence did not depend on order of mention of the source and goal rooms in the critical sentence (probe type did not interact with order: $F(3,177) < 1.00$). For the from/into sentences, location room probes were faster than mentioned and near room probes, although the differences between location and mentioned, and location and near probes did not reach significance (location vs. mentioned: $(F(1,59) = 3.31, p = .07$; location vs. near: $(F(1,59) = 3.73, p = .06$). The location room probe was reliably faster than the far room probe $(F(1,59) = 7.59, p < .01$). The results for the into/from sentences were the same: The location probe was reliably faster than the other probe types (location vs. near: $(F(1,59) = 4.12, p < .05$). Unlike the Protagonist-object probes, order of mention of the rooms did not significantly affect object-object probe RTs $(F(1,59) < 1.00$).

### TABLE 4
**MEAN REACTION TIME AND PERCENTAGE ERRORS FOR THE SAME ROOM PROBES IN EXPERIMENT 2**

<table>
<thead>
<tr>
<th>Probe type</th>
<th>Location room</th>
<th>Mentioned room</th>
<th>Near room</th>
<th>Far room</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>From/into sentences</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.21</td>
<td>2.35</td>
<td>2.36</td>
<td>2.43</td>
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<tr>
<td>SD</td>
<td>(0.58)</td>
<td>(0.60)</td>
<td>(0.80)</td>
<td>(0.66)</td>
</tr>
<tr>
<td>Errors</td>
<td>4.0</td>
<td>3.0</td>
<td>6.0</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Into/from sentences</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.16</td>
<td>2.44</td>
<td>2.34</td>
<td>2.46</td>
</tr>
<tr>
<td>SD</td>
<td>(0.63)</td>
<td>(0.77)</td>
<td>(0.73)</td>
<td>(0.64)</td>
</tr>
<tr>
<td>Errors</td>
<td>4.0</td>
<td>6.0</td>
<td>4.0</td>
<td>5.0</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Probe type</th>
<th>Near-next room</th>
<th>Near-adjacent room</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>From/into sentences</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.36</td>
<td>2.36</td>
<td>2.36</td>
</tr>
<tr>
<td>SD</td>
<td>(0.69)</td>
<td>(0.87)</td>
<td>(0.80)</td>
</tr>
<tr>
<td>Errors</td>
<td>8.0</td>
<td>4.0</td>
<td>6.0</td>
</tr>
<tr>
<td><strong>Into/from sentences</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.32</td>
<td>2.37</td>
<td>2.34</td>
</tr>
<tr>
<td>SD</td>
<td>(0.64)</td>
<td>(0.81)</td>
<td>(0.70)</td>
</tr>
<tr>
<td>Errors</td>
<td>4.0</td>
<td>3.0</td>
<td>3.5</td>
</tr>
</tbody>
</table>
The distance hypothesis predicts an increase in RT across the mentioned, near, and far room probes. Experiment 2 does not provide strong evidence for this prediction because trend analyses after the two kinds of sentences were not reliable, although the RTs were in the right direction (linear trend for from/into sentences: $F(1,177) = 1.17$, n.s.; linear trend for into/from sentences: $F(1,177) < 1.00$). However, it should be noted that Experiments 1 and 3 provide stronger evidence for the distance hypothesis. Finally, Table 4 (Part B) presents the mean RTs for the two types of near room probes in Experiment 2 and shows that they did not differ from one another after either sentence order.2

Table 5 presents the mean RTs and percentage errors for the Different room probes. The Different room probes took longer to answer than the Same room probes (Different: 2.48 s; Same: 2.35 s; $t(59) = 1.81$, $p < .05$). The Different room probe RTs were analyzed by a repeated measures ANOVA with sentence type and probe type as factors. The location hypothesis was supported by the Different as well as Same room probes. Different room probe type influenced RTs ($F(1,59) = 42.71$, $p < .001$), and did not interact with sentence type ($F(1,59) < 1.00$). After both kinds of sentences, probes that contained an object from the location room were faster than those that did not (from/into: $F(1,59) = 16.00$, $p < .001$; into/from: $F(1,59) = 14.44$, $p < .001$). Finally, like the Protagonist–object probes, Different room object–object probe RTs were slower after into/from sentences than after the reverse order of mention $F(1,59) = 28.64$, $p < .001$).

The results for both Same and Different

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2 The first critical sentence of each narrative was repeated in order to balance probe types across narratives. Repeating this sentence did not affect probe responses since the overall pattern of Same room probe RTs was still present when the RTs after the repeated sentences were analyzed separately.

### Table 5

<table>
<thead>
<tr>
<th>Probe type</th>
<th>One object from Location room</th>
<th>Neither object from Location room</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>From/into sentence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.15</td>
<td>2.48</td>
</tr>
<tr>
<td>SD</td>
<td>1.65</td>
<td>1.92</td>
</tr>
<tr>
<td>Errors</td>
<td>1.0</td>
<td>2.0</td>
</tr>
<tr>
<td><strong>Into/from sentence</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.49</td>
<td>2.80</td>
</tr>
<tr>
<td>SD</td>
<td>1.98</td>
<td>1.18</td>
</tr>
<tr>
<td>Errors</td>
<td>3.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

Room probes help clarify the location effect found in Experiment 1. Objects from the room serving as the current location of the protagonist are more accessible than objects from other rooms in the building, even when the location room is not most recently mentioned before the probe. Thus, Experiment 2 provides strong evidence that accessibility is determined by the structure of the situations described by the narrative and not simply by recency of mention in the text. Experiment 3 explores other aspects of situations that affect accessibility.

The Different room probes and the Protagonist–object probes suggest that readers had more difficulty understanding into/from sentences, which may reflect the uncommon order of mention in the same sentence, where the order of mention of the source and goal rooms does not match the order of the action in the situation. Readers usually understand more easily sentences in which the order of mention of events coincides with the order of occurrence of the events (e.g., Clark & Clark, 1968). Despite slower comprehension of the marked sentences, subjects' correct answers to the Protagonist–object probes show that they were not confused about the location of the character after these sentences. Notably, the same pattern of accessibility was estab-
lished by the two types of sentences because they both described the same situation.

Evidence for a distance effect was stronger in Experiment 1 than in the present experiment. In Experiment 1, the far room was from the building that was not mentioned in the narrative. Therefore, distance was between as well as within buildings, and was reinforced by mention in text. However, the pattern of RTs after both sentence types in the present experiment suggests that distance within a single building may also be preserved in the situation model (also see Experiment 3). The scant evidence for the distance effect in Experiment 2 hampers an investigation of the kind of distance information preserved in the model. Moreover, interpreting RTs to the near room probes is complicated by the fact that these means are more variable since they are based on half the number of observations as the other Same room probe types. Therefore, possible differences in accessibility between the near rooms may not have been detected in the present experiment. Experiment 3 further investigated distance information preserved in the situation model. However, the primary aim of Experiment 3 was to investigate the influence of different kinds of situation structure on accessibility.

**Experiment 3**

The first two experiments showed that accessibility is determined more by protagonist location in the described situations than by order of mention of rooms in the text. The present experiment investigated whether temporal properties of described situations also influence accessibility. The experiment contrasted goal sentences (such as those in Experiments 1 and 2) with path sentences. In path sentences, the protagonist is located on the path of a motion event heading toward the goal room (While Wilbur was walking through the conference room toward the library, he looked under the table). The two sentences may affect accessibility in different ways. Goal sentences locate the protagonist in the goal room as the outcome of a completed event. They advance the Here/Now point of the narrative to the goal room, thereby making it most accessible. On the other hand, path sentences express an incomplete event, leaving the protagonist still on the path. The path room will be most accessible if the current location of the character determines accessibility. However, both goal and path rooms may be highly accessible after a path sentence because they are part of the narrative Here/Now and thus are relevant to the narrative: The path is the current location of the protagonist, and the goal is the protagonist's intended location. Thus, focus of attention may be more encompassing after path than after goal sentences, which only focus attention on the goal room.

Experiment 3 also further examined the kind of distance information in the model by probing two kinds of near rooms. Table 6 presents examples of the Same room probes for both goal and path sentences. As in Experiment 2, a near room that was adjacent to, but route-far from, the location room was probed. It was adjacent to the goal room for goal sentences and adjacent to the path room for path sentences. In addition, the room that served as the goal of the critical sentence preceding the current probed critical sentence was probed. In terms of the described route, this room occurred just before the source room of the current motion sentence in goal narratives, and before the current path room for path narratives. If Euclidean distance is preserved, the two near rooms should be equally accessible. If route distance is preserved, the physically adjacent room should be less accessible than the previous goal room.

**Method**

**Layout and narratives.** The building
TABLE 6
SAME ROOM PROBE TYPES IN EXPERIMENT 3

<table>
<thead>
<tr>
<th>Probe type</th>
<th>Probed room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location room</td>
<td>Library</td>
</tr>
<tr>
<td>Mentioned room</td>
<td>Conference room</td>
</tr>
<tr>
<td>Near room (previous goal)</td>
<td>Office</td>
</tr>
<tr>
<td>Near room (adjacent room)</td>
<td>Experiment room</td>
</tr>
<tr>
<td>Far room</td>
<td>Wash room</td>
</tr>
</tbody>
</table>

Path sentence: While Wilbur was walking through the conference room toward the library, he drank some coffee.

<table>
<thead>
<tr>
<th>Probe type</th>
<th>Probed room</th>
</tr>
</thead>
<tbody>
<tr>
<td>Location room</td>
<td>Conference room</td>
</tr>
<tr>
<td>Mentioned room</td>
<td>Library</td>
</tr>
<tr>
<td>Near room (previous goal)</td>
<td>Office</td>
</tr>
<tr>
<td>Near room (adjacent room)</td>
<td>Experiment room</td>
</tr>
<tr>
<td>Far room</td>
<td>Wash room</td>
</tr>
</tbody>
</table>

layout was the same as in Experiment 2. Nine goal narratives and nine path narratives were used. The goal narratives were adapted from Experiment 1 and nine new path narratives were constructed (see Table 7 for a sample goal and path narrative). For path narratives, critical sentences clearly located the protagonist on the path by means of a subordinate clause introduced by while and containing a progressive motion verb. The main clause described what the protagonist did in the path room as he or she headed toward the goal room (e.g., While Judy was walking through the storage area toward the wash room, she glanced nervously behind the crates). The sentence after the path sentence described the protagonist’s actions in the goal room. The following sentence moved the character to the next room on the route, which then became the path for the next critical sentence (see Table 7). For goal narratives, the sentence after each critical goal sentence described the protagonist’s actions in the goal room. The following sentence moved the protagonist to the next room on the route, which became the source room that was mentioned in the following critical sentence. As in Experiment 2, each narrative contained six critical sentences, so each goal narrative mentioned six critical source and goal rooms, and each path narrative mentioned six critical path and goal rooms.

As in the previous experiments, location, mentioned, near, and far rooms were probed. For goal sentences, the location room was the goal of the event and the mentioned room was the source; for path sentences the location room was the path and the mentioned room was the goal (see Table 6). The near room was either the previous goal room or a room physically adjacent to the location room. As in Experiment 2, half of the Different room probes contained an object from the location room, and half of the probes did not.

Procedure and design. The procedure was the same as in Experiment 2. Path and goal narratives were presented in blocked fashion and the order of the blocks was counterbalanced across subjects. The nine narratives within a block were divided into three groups and the order of the groups was also counterbalanced across subjects. Six probes occurred after the critical sentences of each narrative, one from each of the four Same room probe types, one Different room probe, and one Protagonist-object probe. Four path and four goal narratives probed the previous goal as the near room, and five of each type probed an adjacent room. Thus, for each type of narrative, a subject saw nine instances of each Same room probe type and nine Different room probes. Across the eighteen experimental narratives, each probe type occurred equally often at the six probe positions within a narrative. An additional Different room probe occurred in the first part of the narrative in order to increase the number of Different room probes in each narrative. Objects were assigned to probe types with the same constraints as in Experiment 1. Again, two lists of object-probe assignments were constructed,
A. Example of goal narratives
Wilbur regretted the day he had ever become the head of the research center.
He had just found out that the board of directors was coming for a surprise visit the next day.
He called all of the employees together in the library and told them the center was a complete mess.

- **Closet Blackboard**
  - He ordered them to start cleaning up the building immediately.
  - He said he wanted the directors to see a spotless, organized center.
  - He told everybody to spread out and clean every room.
  - He made sure the library was being cleaned and then went to supervise the rest.
  - First he walked from the library into the laboratory.

- **Microscope Catalogue**
  - He noticed some technicians sorting papers into piles and told them to be neat.
  - He strode to the storage area and told the workers to stack the crates carefully.
  - Then he walked from the storage area into the wash room.

- **Closet Dock**
  - He was pleased to see the sparkling tile floor since he knew the board of directors was more impressed by cleanliness than by good research.
  - Next he entered the repair shop and snapped at the shop foreman for leaving greasy machine parts laying around.
  - Then he walked from the repair shop into the lounge.

- **Counter Computer**
  - When he ordered the ping pong table removed, he began to feel that he was overreacting to the visit.
  - So he tried to calm down as he went into the experiment room and looked around.
  - Then he walked from the experiment room into the reception room.

- **Tools Cart**
  - He thought the flowers his secretary had placed in the room were a nice touch.
  - He went into the office and gathered his notes for the presentation to the board.
  - Then he walked from the office into the conference room.

- **Chair Projector**
  - He spread out his notes on the table and made sure everything was set up for the presentation.
  - He went to the library to find a report he needed and then was pestered by an assistant who needed help with a project.
  - Then he walked from the library into the laboratory.

- **Wilbur Plant**
  - He was beginning to feel that despite all odds, the research center would be ready by tomorrow.

B. Example of path narratives
Judy had received several threatening notes in her mailbox at the research center, but she dismissed them as a joke.
She was trying to finish up a project so she worked late one night in the laboratory.
Her concentration was broken by the sound of a slamming door.

- **Mirror Clock**
  - Then she heard footsteps in the distance.
  - She looked around the laboratory but didn’t see anyone.
  - Suddenly she remembered the threatening notes and became frightened.
  - She decided to see if anyone else was in the building.
  - While she was walking through the storage area toward the wash room, she glanced nervously behind the crates.

- **Judy Lifter**
  - Once in the wash room, she grabbed a paring knife that was by the sink.
  - She gathered her courage and slipped out of the room quietly.
  - While she was walking through the repair shop toward the lounge, she stifled a scream when she slipped on some oil.

- **Bed Projector**
  - Reaching the lounge, she switched on the lights, but no one was there.
  - She switched off the lights as she crept out of the room.
  - As she was walking through the experiment room toward the reception room, she made sure no one was hiding in the booths.
Subjects. Forty-eight Stanford University undergraduates served in the experiment to fulfill a requirement for a psychology course.

Results and Discussion

The data were analyzed as in the previous experiments. Subjects required a mean of 4.6 trials to reproduce the layout, and answered 4.6 out of the five location test questions correctly.

Subjects took longer to respond to Protagonist–object probes after path than after goal sentences (Path: 2.58 s, Goal: 2.35 s; t(47) = 2.67, p < .01), but error rates after the two kinds of sentences did not differ (8% for both). Therefore, even though readers may have had more difficulty with the path sentences, they understood path sentences just as well as goal sentences.

Table 8 presents the mean RT and percent errors for the Same room probes after goal and path sentences. Error rates were 10% or less in all conditions. The probe RTs were analyzed by a repeated measures ANOVA with sentence type and probe type as factors. Similar to the results of the protagonist–object probes, probe RTs were slower after path than after goal sentences (F(1,47) = 11.83, p < .005). Also, RTs depended on probe type (F(3,141) = 31.40, p < .001). As predicted, accessibility reflected the structure of the motion event, since the pattern of RTs differed after goal and path sentences (probe type interacted with sentence type: F(3,141) = 8.51, p < .001). Probe RTs after goal sentences were similar to the first two experiments: The location room probe was faster than the mentioned (source), near, and far room probes (Location vs. mentioned: F(1,47) = 9.67, p < .01). The distance hypothesis was supported by a trend analysis across mentioned, near and far rooms, which showed a significant linear trend (F(1,141) = 8.75, p < .001). Errors also increased with RT. Moreover, RT to the mentioned room was faster than to the far room (F(1,47) = 11.23, p < .001). However, differences in RT between mentioned versus near, and near versus far rooms were not significant, although they were in the predicted direction (mentioned vs. near: F(1,47) = 3.65, n.s.; near vs. far: F(1,47) = 1.82, n.s.). In addition, when the near room probes were divided into previous goal and adjacent rooms, RTs to these probe types did not fit the overall pattern (see Table 8, Part B). The previous goal room was not different from either the location room (F(1,47) = 2.71, n.s.) or the mentioned room (F(1,47) = 1.13, n.s.)
TABLE 8
MEAN REACTION TIME AND PERCENTAGE ERRORS FOR THE SAME ROOM PROBES IN EXPERIMENT 3

A. All same room probes

<table>
<thead>
<tr>
<th>Probe type</th>
<th>Location (goal) room</th>
<th>Mentioned (source) room</th>
<th>Near room</th>
<th>Far room</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal sentence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.08</td>
<td>2.25</td>
<td>2.35</td>
<td>2.43</td>
</tr>
<tr>
<td>SD</td>
<td>(0.63)</td>
<td>(0.66)</td>
<td>(0.69)</td>
<td>(0.62)</td>
</tr>
<tr>
<td>Errors</td>
<td>4.0</td>
<td>5.0</td>
<td>9.0</td>
<td>7.0</td>
</tr>
<tr>
<td><strong>Path Sentence</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.39</td>
<td>2.35</td>
<td>2.41</td>
<td>2.82</td>
</tr>
<tr>
<td>SD</td>
<td>(0.62)</td>
<td>(0.66)</td>
<td>(0.70)</td>
<td>(0.74)</td>
</tr>
<tr>
<td>Errors</td>
<td>8.0</td>
<td>4.0</td>
<td>7.0</td>
<td>5.0</td>
</tr>
</tbody>
</table>

B. Near-same room probes

<table>
<thead>
<tr>
<th>Probe type</th>
<th>Near-previous goal</th>
<th>Near-adjacent room</th>
<th>Mean</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Goal sentence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.17</td>
<td>2.54</td>
<td>2.35</td>
</tr>
<tr>
<td>SD</td>
<td>(0.63)</td>
<td>(0.74)</td>
<td>(0.69)</td>
</tr>
<tr>
<td>Errors</td>
<td>4.0</td>
<td>13.0</td>
<td>9.0</td>
</tr>
<tr>
<td><strong>Path sentence</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>RT</td>
<td>2.45</td>
<td>2.38</td>
<td>2.41</td>
</tr>
<tr>
<td>SD</td>
<td>(0.73)</td>
<td>(0.67)</td>
<td>(0.70)</td>
</tr>
<tr>
<td>Errors</td>
<td>10.0</td>
<td>4.0</td>
<td>7.0</td>
</tr>
</tbody>
</table>

= 2.14, n.s.), whereas the adjacent room was slower than even the far room ($F(1,47) = 4.14, p < .05$). This somewhat surprising result may reflect the fact that the adjacent room was sometimes further from the location room than the far room on the route.

In contrast to the goal-sentence results, RT to probes after path sentences did not increase linearly with distance from the location room. Reaction time to location (path), mentioned (goal), and near room probes did not differ from one another, but all were faster than the far room probe ($F(1,141) = 92.79, p < .001$). In general, errors were not systematically related to RT for probes after path sentences, although readers made more errors for location than mentioned room probes ($t(47) = 2.62, p < .05$). These findings suggest that after goal sentences readers focus on character location (the goal room), but after path sentences they focus on both the character location (the path room) and the character's intended location (the goal room).

Table 9 presents the mean RT for the different room probes. Mean RTs for Same and Different room probes were not significantly different (Same probes: 2.38 s; Different probes: 2.39 s; $t(46) < 1.00$). A repeated measures ANOVA with sentence and probe type as factors was performed on the correct RTs for the Different room probes. As with the Same room probes, RTs after path sentences were longer than after goal sentences ($F(1,47) = 4.80, p < .05$). Different room probe type also in-

3 Although the ratio of Same room to Different room probes was higher in Experiment 1 than in Experiments 2 and 3 (roughly 4:3 for Experiment 1 and 4:2 in the other experiments), only Experiment 2 found a difference in RT between the two kinds of probes. Therefore, any differences in Same and Different room probe RTs is not due to different ratios of the two kinds of probes across the experiments.
fluenced RT ($F(1,47) = 5.70, p < .001$), but like the Same room probes, the pattern of RTs differed after goal and path sentences (probe type interacted with sentence type: $F(1,47) = 6.78, p < .001$). For goal sentences, Different room probes with one object from the location room were faster than probes with neither object from the location room ($F(1,47) = 25.39, p < .001$). This difference was not significant for the probes after path sentences. Thus, the results for the Different room probes provide further evidence that the scope of accessibility was more encompassing after path sentences.

Experiment 3 showed that path and goal sentences established different patterns of information accessibility in the situation model. The overall pattern of results for both Same and Different room probes after the goal sentences provides further evidence that protagonist location in the goal room makes this room more accessible than other rooms in the situation model. On the other hand, location, mentioned, and near rooms were equally accessible after path sentences. This difference suggests that accessibility is influenced by more than protagonist location. Readers knew that the protagonist was on the path in the situation described by the path sentence, yet the path room was no more accessible than the goal room. The difference in accessibility appears to reflect differences in the temporal structure of path and goal events. When a motion event is incomplete, the narrative Here/Now includes both path and goal rooms. Because the two rooms are relevant to the narrative, information about them is readily accessible following path sentences. Therefore, the region of high accessibility is more encompassing after path than after goal sentences. This region also includes rooms that are near to the path and goal. Moreover, information is less accessible from the incomplete event model than from the complete event model because readers must focus attention on more information (both the goal and path rooms rather than just the goal room). This would explain the longer RT to all probes after path than after goal sentences. It should be noted that this result does not simply reflect the greater length and syntactic complexity of the path sentences. We know this from a pilot study that examined Same room probe types after path sentences that were the same length as the goal sentences (e.g., Peter walked through the conference room toward the library vs. Peter walked from the conference room into the library). In this study, the Protagonist–object probes were reliably slower after the path sentences than after goal sentences despite equating the length of the two sentences. Same room probes were also slower (although not reliably). Finally, the fact that the far room probe was slower than the other probes after the path sentences of the present experiment shows that proximity to character location had some effect on the accessibility of information from models constructed during path narratives.

The overall pattern of results for probes after goal sentences provides some additional evidence for a distance effect. Information that is more distant from the protagonist’s location is less relevant to the current situation, and this is reflected in its
reduced accessibility. However, RTs to the near room probes in Experiments 2 and 3 do not allow us to infer the kind of distance information that is preserved. The two near room probes after path sentences did not differ from each other, suggesting that readers accessed information about objects in terms of Euclidean distance. However, the near room probes after goal sentences suggest that route distance may be important. The unexpectedly long RT for the near adjacent room may reflect the fact that this room was far from the location room on the route, often even farther away than the far room. In addition, the previous goal and the mentioned room were route-close to the location room, so information about them could be accessed more quickly. However, the data from the goal sentences can not be interpreted as unequivocal evidence that readers accessed information by shifting attention along the route. The previous goal room may have been accessible because of textual factors as well as because it was route-close to the current goal room. It was mentioned both in the previous critical sentence and in the sentence following that sentence, so recency and frequency of mention may have contributed to its accessibility. An additional complication is the fact that the near adjacent room should have been less accessible after path as well as goal sentences since the route is as important to the path narratives, but this was not the case.

Thus, the present experiments do not determine whether situation models contain Euclidean or route distance information. The lack of a consistent pattern in RT to the near room probes in Experiments 2 and 3 may be due in part to the small number of observations in each condition. Moreover, neither experiment produced strong evidence for any distance effect. This may reflect the difficulty of the present experiments to detect differences in accessibility of information produced by the small distances in the experimental layout.

Most notably, Experiment 3 further supported the location effect, and provided new information about how situation structure influences accessibility. The reader's focus of attention depended on the temporal development of the motion event, as well as the protagonist's current location. Moreover, the accessibility of distance information depended on this temporal structure. After goal sentences, the mentioned room tended to be more accessible than the near room, and there was a slight tendency for the near room to be more accessible than the far room. After path sentences, the location, mentioned, and near rooms were equally accessible, and these rooms were clearly more accessible than the far room. The fact that the location and distance effects depended on the described situations shows that information about the spatial relations between the location room and other rooms in the building was part of the reader's model of the narrated situations, and not just part of the representation of the layout that was acquired when they memorized the diagram. Readers constructed a situation model by integrating information from the narrative with knowledge of the layout, and they used this representation to answer the probe questions.

General Discussion

The present study provides evidence that dynamic changes in accessibility to information during narrative comprehension occur as a consequence of constructing and updating a situation model. Accessibility is determined more by properties of the described situations than by recency of mention of information in the text. In our experiments, readers constructed situation models by combining prior knowledge of the building layout with information about the described situations provided by the narrative. In doing so, they focused on the most relevant parts of the described situations, and relevance was defined by the experience, actions, and goals of the protago-
nist. Previous research shows that readers tend to interpret narratives from the perspective of protagonists rather than non-protagonists (Anderson et al., 1983; Morrow, 1985a). Moreover, the location of this character determines how readers interpret sentences, since they choose objects located near the protagonist as referents for ambiguous referring expressions (Morrow, 1985b). Our study shows that protagonist location and the temporal development of the protagonist’s actions help organize understanding by governing the accessibility of information from the developing situation model.

The location effect is an example of the importance of topical information during narrative processing: Information relevant to protagonists (i.e., characters important to the narrative topic) is more accessible than less relevant information. This finding extends previous work showing that after reading a narrative, topical information is better remembered than other information (e.g., Kintsch & van Dijk, 1978). Relationships between accessibility and situation properties relevant to narrative topic need to be further explored. For example, when reading narratives with a protagonist and nonprotagonist at different locations, do readers focus more on the protagonist’s location? Also, Experiment 2 showed that in path sentences, the goal room is as accessible as the path room in which the character is located. This suggests that if a protagonist is in one room but thinking about another room, the latter room should be at least as accessible as the physical location room.

Our study also suggests that information about spatial distance is preserved by models constructed during narrative understanding. Previous work has shown the importance of spatial distance in mental maps formed by subjects studying maps or by traversing the actual layout (McNamara et al., 1984; Thorndyke & Hayes-Roth, 1982). This kind of information also organizes descriptions of routes through layouts (Klein, 1982; Linde & Labov, 1975), and is retained in the memory representation of the route description (Perrig & Kintsch, 1985). The present study suggests that this kind of information is also important to the situation model as it develops during narrative understanding, although it does not distinguish whether Euclidean or route distance is more important to the model.

The study also suggests that words specifying character location and the temporal contour of situations help guide the construction of the situation model. Linguistic research has analyzed the spatial and temporal information conveyed by prepositions, verb aspect markers, and other grammatical morphemes (e.g., Almeida & Shapiro, 1983; Jackendoff, 1983; Morrow, 1986; Talmy, 1975; 1983). We have shown that readers use these units to update the model. Prepositions and completive verb aspect markers (-ed) in goal sentences specify an advance of the Here/Now point usually associated with the protagonist in the current foreground event. Therefore, goal sentences clearly indicate where readers should focus to update the model. Conjunctions, prepositions and progressive aspect markers (-ing) in path sentences signal a temporally extended, incomplete event. These units emphasize the whole event as it unfolds over time and not just its outcome. Therefore, readers must keep track of more parts of the incomplete event that are potentially relevant to the narrative. Thus, when a path sentence occurs in a narrative, the situation model has a more diffuse pattern of accessibility than when a goal sentence occurs in the narrative.

Finally, we can anticipate several objections to our results and interpretations. First, because subjects memorized a layout diagram and answered questions about objects from the layout while reading the narrative, our technique may have encouraged them to keep track of spatial information in the narratives to an extraordinary degree.
Therefore, if we had given all the spatial information in the text instead of requiring subjects to memorize a map, or if we had asked fewer location questions during the narratives, subjects might have been less likely to construct a spatially organized situation model. However, our study is only an initial investigation designed to maximize our chances of obtaining evidence for the process of constructing and updating a situation model during narrative comprehension. Had we failed to find a location effect, then experiments designed to tease out subtler effects would surely have failed.

Moreover, by using the layout diagram we have partly reproduced in a more controlled situation a common type of natural discourse, where speakers and listeners share knowledge about the setting of the discourse. Consider the example of two students attending the same university and who therefore share knowledge about the campus. If one of the students tells the other about an incident on campus, the listener, like the readers in our experiments, will use his or her knowledge about the spatial setting in order to interpret the new information in the study.

A second objection to our study would argue that the study has not demonstrated that the effects necessarily reflect the process of constructing and updating a situation model. The results may simply reflect priming due to naming the location room, so that the objects associated with that room are made more accessible. In other words, our results do not reflect discourse understanding since similar effects would be obtained from any list of items that are organized into clusters, where one tests for whether two items belong to the same cluster shortly after the cluster has been named. The clusters could be instances of a taxonomic category or objects associated with the same location.

This alternative explanation ("clustered list hypothesis") is an extreme version of the theory that explains accessibility by recency of mention in the text, and it predicts some of our results. It predicts the distance effect if one assumes that associative paths are longer between clusters representing rooms that are spatially further apart. It also predicts a temporal gradient, in that objects in a cluster would be accessed more rapidly the more recently that cluster was mentioned and primed.

However, the clustered list hypothesis cannot account for two main findings of the study. It predicts a strict recency effect in Experiment 2, which compared from/into and into/from sentences. But in fact RT to the goal (into) room was faster than RT to the source (from) room in both orders of mention. Therefore, accessibility reflected the structure of the motion situation, not the order of mention of the rooms. Furthermore, the clustered list hypothesis cannot explain the difference in accessibility after goal versus path sentences that was found in Experiment 3. This difference appears to reflect different spatial and temporal properties of the two kinds of motion situations.

In conclusion, the present study provides evidence against the clustered list hypothesis and supports the hypothesis that readers focus on parts of situations relevant to the narrative as part of constructing and updating situation models.

REFERENCES


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