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Character movement and the representation of space during narrative comprehension

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Traditional research on situation models has examined the accessibility of locations and objects during narrative experiences. These studies have described a ubiquitous gradient effect: Spatial locations and objects in reader focus are more accessible than locations farther from this focus, with accessibility decreasing as a function of distance. How might readers' expectations about character movement, beyond information about spatial locations, additionally affect this accessibility gradient? In two experiments, we investigated whether reader expectations for character movement impact the accessibility of spatial information from memory. In Experiment 1, participants read stories that described characters moving in either a unidirectional or a random pattern through a learned environment. In Experiment 2, characters moved forward in a unidirectional way or backtracked through previously explored rooms. The results suggest that reader expectations for character movement can influence the accessibility of spatial information. Such expectations play a critical role in processes of narrative comprehension.

In the novel *Harry Potter and the Prisoner of Azkaban* (Rowling, 1999), wizard-in-training Harry Potter attends Hogwart's School of Wizardry and Witchcraft. The enormous castle housing the school is, perhaps not surprisingly, difficult to navigate until Harry receives a special map:

> It was a map showing every detail of the Hogwart's castle and grounds. But the truly remarkable thing were the tiny ink dots moving around it, each labeled with a name in minuscule writing. Astounded, Harry bent over it. A labeled dot in the top left corner showed that Professor Dumbledore was pacing his study; the caretaker's cat, Mrs. Norris, was prowling the second floor; and Peeves the Poltergeist was currently bouncing around the trophy room. And as Harry's eyes traveled up and down the familiar corridors, he noticed something else. This map showed a set of passages that he had never entered. (p. 193)

In this scene, Harry's eyes move from one location to the next as he studies various school locations. He discovers new passageways that will allow him to explore rooms in novel ways, using tunnels that violate standard school paths. The spatial representations that readers build for narrative locations such as Hogwart's Castle are a function of the learned relationships between room descriptions, objects in those rooms, and the characters exploring those rooms (see, e.g., Bower & Morrow, 1990). Thus, any model of such a layout (both Harry's and the reader's) would need updating based on the new information provided by the map. In addition, readers' expectations for how Harry might travel between castle locations should change as a function of the secrets contained in the map. Whereas before, Harry needed to travel through sequential, adjacent hallways and stairwells to get to his destinations, now readers can expect that Harry might skip hallways entirely and move in what appears to be a more random fashion around the castle, using the information he has learned.

Readers' representations of texts are a function of prior knowledge, goals, expectations, and attentional focus in the narrative (e.g., Linderholm & van den Broek, 2002; McNamara & Kintsch, 1996; Morrow, 1994; Rapp & Gerrig, 2002, 2006; Rapp & Taylor, 2004; van den Broek, Rapp, & Kendeou, 2005). In the preceding example, readers may expect that Harry will visit school grounds by using nonlinear paths, rather than adhering to the adja-

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cent paths normally required for traveling around environments. How might these expectations influence reader representations of spatial locations? Traditional work on spatial models of text has focused on characters moving in a unidirectional fashion through narrative environments. Yet little attention has been given to the importance of readers' expectations for such movement in empirical assessments of spatial models. The goal of the present study was to evaluate how reader expectations for character movement influence the accessibility of spatial information from memory for text.

Research on text comprehension attempts to describe the types of information that readers encode into memory during text experiences. The tripartite theory of text representation (van Dijk & Kintsch, 1983) suggests that readers may encode a text's surface characteristics (e.g., the exact words in a sentence), the text's meaning (e.g., the propositional idea units), and the information conveyed but not necessarily explicitly described in a text (e.g., inferences and details suggested by descriptions; Graesser, Singer, & Trabasso, 1994). Depending on task demands, reader goals, and text complexity, to name but a few variables, readers may construct some, all, or none of these representations (Schmalhofer & Glavanov, 1986). Even taking into account the diverse nature of reading experiences and potential individual differences among readers, researchers have argued that adequate comprehension necessitates the construction of the third representational level, the situation model (Zwaan & Radvansky, 1998).

Situation models are memory representations constructed as readers connect ongoing text information with prior knowledge. When readers successfully make these connections, they build richer, more elaborate representations that facilitate memory for and comprehension of text. Thus, work on situation models has focused on the types of information readers encode and on the processes by which that information is accessed from memory. With respect to what readers encode, the event-indexing model outlines some of the dimensions that readers focus on during text experiences (Zwaan, Langston, & Graesser, 1995; Zwaan, Magliano, & Graesser, 1995). According to the model, readers can track information about space, time, characters' attributes and intentions, objects, and causality (Zwaan & Radvansky, 1998; Zwaan & Rapp, in press). Thus, to return to the tripartite model, a text's surface structure conveys meaningful units of plot and story. Readers can focus on those aspects or events that they consider most critical (on the basis, perhaps, of textual cues or their own beliefs), relying on prior knowledge to help "fill in" information and build a deeper understanding of the material.

Each of the dimensions described by the event-indexing model has been assessed with respect to processes of dynamic updating and application during reading. Nonetheless, much of this work has focused specifically on the spatial features of texts and readers' resulting spatial situation models. Spatial situation models represent the spatial qualities described by a text, including locations described in a narrative (e.g., Hakala, 1999; Levine & Klin, 2001), the movement of characters between locations (e.g., Rapp & Taylor, 2004), the placement of objects in environments (e.g., Bower & Morrow, 1990; de Vega, 1995), the causal relations derived from spatial relationships (Jahn, 2004), and the accessibility of information as a function of the spatial orientations of protagonists (e.g., Franklin & Tversky, 1990; Franklin, Tversky, & Coon, 1992). Spatial situation models represent the spatial relations described explicitly or implicitly in a text.

A significant portion of this work has evaluated the contents of and processes associated with spatial situation models by assessing the *spatial distance effect* (Morrow, Bower, & Greenspan, 1989; Morrow, Greenspan, & Bower, 1987). The underlying premise of this effect is that readers track the relationships between characters, objects, and locations as they read. This tracking process has a direct impact on the accessibility of those characters, objects, and locations from memory. In a classic set of experiments, Morrow et al. (1987) demonstrated that reader focus on character positions in particular locations (e.g., rooms in a building) resulted in decreased accessibility for objects in adjacent, nearby locations. In this experiment, readers memorized a map of an environment, with each room in the environment containing four objects. Following memorization, the participants read stories that described characters moving through the environment. At particular points in the text, two objects from the map were probed, and the participants identified whether the objects were located in the same or in different rooms. Morrow et al.'s (1987) results showed that the participants took longer to identify object pairs farther from the character's current location. They argued that as readers focus on specific locations and protagonists, objects from adjacent locations decrease in accessibility as a function of spatial distance. In several follow-up experiments, object accessibility was more generally demonstrated to be a function of not only a character's current physical location, but also locations a character was thinking about, the character's intended goals, and the locations implied (and not explicitly described by) character movement (Bower & Morrow, 1990; Morrow et al., 1989). Therefore, reader focus on characters and on characters' goals and intentions directly influences the accessibility of location information from memory.

An impressive number of studies have corroborated these original effects. These studies have obtained converging results, using anaphor resolution tasks, tasks without explicit map memorization, tasks involving different narrative scenarios, and stories in different languages (e.g., Bower & Rinck, 2001; Rinck & Bower, 1995; Rinck, Bower, & Wolf, 1998; Rinck, Williams, Bower, & Becker, 1996). Other recent studies have further elaborated this work, demonstrating the implications of spatial layouts for memory as a function of distance conveyed by both absolute and relative spatial relations (Rinck & Bower, 2000; Rinck et al., 1998; Rinck, Hähnel, Bower, & Glowalla, 1997). Finally, research has addressed how readers track spatial relationships as they encode multidimensional descriptions detailing both temporal and spatial relationships (Morrow, 1994;

Rapp & Taylor, 2004; Rinck & Bower, 2000). Such findings demonstrate that accessibility from situation models is due to shifts in reader attention as a function of the perceived relationships between narrative events. These events, in line with the event-indexing model, can be broadly defined as activities, settings, characters, and locations (A. Anderson, Garrod, & Sanford, 1983; Carreiras, Carriedo, Alonso, & Fernández, 1997; Rapp & Gerrig, 2002; Rapp, Gerrig, & Prentice, 2001; Rich & Taylor, 2000; Zwaan, 1996; Zwaan & Radvansky, 1998).

Whereas this research has considered some of the ways in which reader focus can influence accessibility from spatial situation models, much less work has focused on the role played by reader expectations. That is, although we know that character activity can influence accessibility (e.g., "She walked from the library into the storage room" leads to the belief that the character will end up, if she has not already arrived, in the storage room, with an accompanying increase in accessibility for information related to the storage room), we know less about how more global reader expectations influence these processes. How do reader expectations about character movement through environments (e.g., expectations that characters will travel in unidirectional or random paths, or beliefs that characters might backtrack through previously explored locations) influence accessibility?

The primary goal of this project was to consider this question by assessing whether previous findings on spatial situation models may, to some degree, be a function of reader beliefs about the movement described in narratives, in addition to the more general function of text cues instantiating spatial distance effects. In published experiments, narratives have traditionally described consistent, unidirectional movement through environments. The characters in these stories move through their environments in a sequential order, from room to room (and at times through implied rooms), using available doorways that are lined up one after the other. At no point can characters pass through walls to shift from, say, one wing of a building to the opposite wing. This makes sense of course, since in reality, we similarly know that individuals cannot simply walk through walls. In addition, though, the characters in these stories (and usually across multiple stories in a single experiment) travel in strictly clockwise or counterclockwise paths. At no point do characters retrace their steps and move into previously explored rooms (presumably, because the aforementioned studies do not intend to confound the effects of multiple visits on object accessibility).

Given that previous studies have examined unidirectional movement along entirely clockwise or counterclockwise paths, readers in those studies could conceivably develop expectations about the likelihood of characters visiting narrative locations. Readers may come to believe that adjacent rooms are likely to be visited next, influencing the degree to which objects in those rooms are accessible. Hence, activation patterns obtained in these studies may largely be a function of the readers' beliefs about where characters will plausibly go, rather than a function of the invariant accessibility of objects and locations during narrative comprehension. Thus, we attempted to test whether spatial distance effects are a function of the general properties of reader focus and spatial situation models, as suggested by previous findings, or might also be a function of the expectations readers build for character movement. Previous work has suggested the latter possibility, but it has remained untested. Bower and Morrow (1990), indeed, reported that their results may have been a function of readers' overarching expectations for movement: "Our ABC experiment apparently induced continuous scanning in our readers because this scanning was an important part of building the mental model" (p. 47). In other words, readers may construct spatial models as a function of what they consider important or plausible. Consistent, unidirectional movement may, therefore, establish expectations in readers about where to scan or focus next in the text. We examined whether expectations for other types of movement can influence accessibility patterns that modify traditionally reported gradient effects.

In the following experiments, participants memorized maps similar to those used by Morrow et al. (1987). Following this task, the participants read a series of narratives describing characters moving through the map environment. In two experiments, we evaluated whether expectations about character movement influence accessibility from spatial situation models. In Experiment 1, characters explored the environment by (1) walking through rooms in a unidirectional fashion, (2) using surveillance video cameras located in each room and accessing them in a similarly unidirectional fashion, or (3) using the video cameras and accessing them in a nondirectional, random pattern. Comparisons between both *unidirectional conditions* and the *nondirectional video condition* permitted us to evaluate patterns of accessibility on the basis of whether readers would have strong or weak expectations for the rooms that characters would visit next. The results of this manipulation, though, may suggest more about the particular narrative circumstances we set up than about the general effects of reader expectations on narrative comprehension. To address this concern, we implemented a second type of movement in our narratives, designed to set up a different set of reader expectations. In Experiment 2, characters always walked through the environment, but unlike in Experiment 1 (and unlike in previous published studies), characters either explored rooms in a purely unidirectional fashion or retraced their movements through previously explored rooms by backtracking along their path. Comparisons between these *forward* and *backtracking conditions* provided an additional test of the generalizability of our proposed expectation effects.

With these experiments, we assessed two hypotheses with respect to the accessibility of information from spatial situation models. The first hypothesis, which we label the *dominant gradient hypothesis*, suggests that accessibility from spatial situation models is invariant. That is, map features that are close to a character's (and hence, the reader's) focus of attention are easily accessible; features that are farther from this focus are less accessible. This hypothesis is congruent with the findings from studies of the type described by Morrow et al. (1989) and Rinck et al. (1996). It suggests that across spatial situations, accessibility for nonfocused rooms decreases in a linear fashion as a function of distance. Evidence for this hypothesis would be obtained if similar accessibility effects were found across both the unidirectional and the random movement conditions in Experiment 1, as well as across forward and backtracking conditions in Experiment 2.

In contrast, accessibility from spatial situation models may be a function not only of spatial distance, but also of expectations that readers have for character movement. We will call this the *reader expectation hypothesis*. According to this view, when characters are expected to move in a unidirectional fashion, accessibility should be consistent with traditionally reported spatial gradients as a function of distance. Consider four locations to be visited in sequential order: Room A, Room B, Room C, and Room D. If a character is located in or thinking about Room A, objects from Room A should be more accessible than objects in Room B. On the basis of gradient effects, objects in Rooms C and D should also be less accessible from Room A and, potentially, less accessible from B. This pattern of results could reflect spatial distance or could reflect constraints due to expectations of unidirectional movement from Room A to Room D. However, when expectations are modified or unavailable—as, for example, with characters hopping randomly from Room C to Room A to Room D, or with characters backtracking to Room A after reaching Room C—it may be less effective for readers to structure their representations in the aforementioned manner. Thus, the reader expectation hypothesis is based on more global expectations for character movement. According to this view, accessibility of information from situation models is, in large part, grounded in the ways in which characters can or will travel through environments.

Clearly not up for debate is the notion that character (and reader) focus directly influences accessibility; such an argument would be untenable, given the large body of research on spatial models and narrative comprehension. Rather, in this study, we assessed whether the findings on spatial situation models are attributable to focus strictly as a function of specific text cues (e.g., the location of protagonists or protagonist intentions and goals, as described by a dominant gradient hypothesis), or also as a function of readers' expectations for character movement (a reader expectation hypothesis). We examined whether the type of movement that characters completed in stories would influence the accessibility of map features from memory and, if so, whether accessibility patterns differed as a function of that path movement. Our results demonstrate that reader expectations for movement influence the accessibility of information from spatial situation models.

EXPERIMENT 1
Expectations for Unidirectional Versus Random Movement

In the first experiment, we compared expectations for unidirectional versus random movement through the environment. Participants read stories that described characters moving through a building. The characters walked in a single direction through the rooms, explored the rooms in a single direction using a camera surveillance system, or moved randomly through the rooms, using the camera system. If readers indeed represent narrative environments as a function of expectations for character movement, we should obtain different accessibility patterns for probes as a function of unidirectional versus random movement. This would support the view that reader expectations guide retrieval from spatial situation models during narrative experiences.

Method

Participants

Forty-two Tufts University undergraduates participated for partial course credit. Data from 2 participants were eliminated from all the analyses because of error rates greater than 25% on postnarrative comprehension questions.

Materials

Map. Participants memorized a map depicting a fictitious research center (as shown in Figure 1), identical to that used in Rinck and Bower (1995). The map contained 10 labeled rooms, and each room contained four labeled items. Each item had a weak association to the room's label (e.g., a rug in the reception room; a couch in the library). The map measured 20×15.5 cm and was printed on standard A4 paper.

Narratives. Participants read stories describing character movement through the map environment. Each participant read 13 narratives (1 practice and 12 experimental) based on those from Rinck and Bower (1995). Each narrative was 23 sentences long and described the movement and actions of a character working in the research center. Sample narratives are provided in Appendix A. Each experimental narrative contained five critical motion sentences detailing a character's moving from one room to a second room. Each narrative began and ended in the same room.

We constructed three sets of narratives. Prior to reading the narratives, the participants learned that the research center contained a video surveillance system. For narratives in the *walking condition*, characters were always described as walking in a unidirectional fashion through the research center. Participants in this condition were told that the video surveillance system was currently being repaired. Half of the narratives presented clockwise movement, and half presented counterclockwise movement. Motion sentences always described characters as moving from one room to the next (e.g., "Judy walked from the laboratory into the storage area"). For narratives in the two video conditions, characters explored rooms by using the video surveillance system. In these conditions, motion sentences described characters as moving their focus of attention, via the camera, from one room to the next (e.g., "Judy switched from the laboratory camera to the office camera"). In the *unidirectional video condition*, characters explored rooms in the same order as that in the walking condition. Again, half of the narratives described clockwise movement, and half described counterclockwise movement. In the *random video condition*, characters explored the rooms in a random order. In this condition, each room examined was at least two rooms away from the previously examined room. Critical motion sentences in all three narrative sets were followed by a pair of object probes.

Probes. Probes consisted of two objects from the map. Half of the probes were *same probes*, for which the named items were located in the same room, and half were *different probes*, for which the named items were located in different rooms. There were five types of same probes: *current*, *previous adjacent*, *previous random*, *next adjacent*, and *far room* probes. *Current room* probes paired objects located at the character's current location based on the criti-

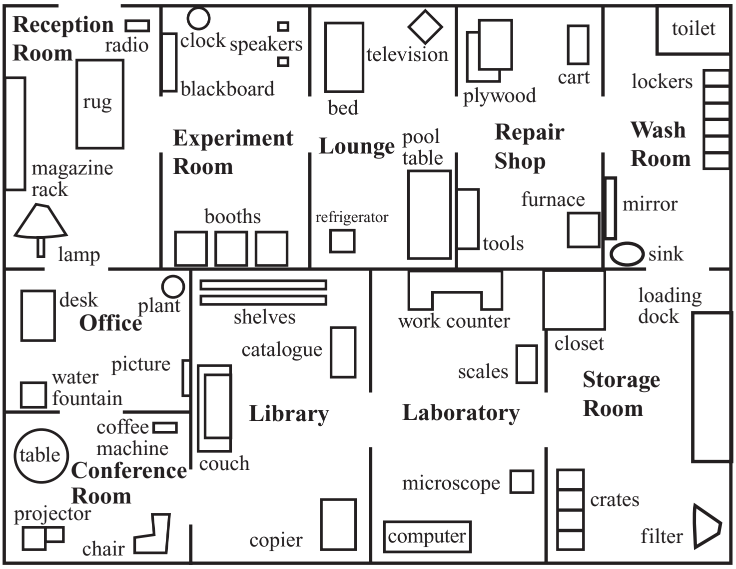

Figure 1. Map layout memorized by the participants.

cal motion sentence. *Previous adjacent room* probes paired objects from the character's immediately preceding location as a function of unidirectional movement through the environment. Thus, for the random video condition, the previous adjacent room was a room neighboring the character's current room, although the character had not recently explored that room. *Previous random room* probes paired objects from the character's immediately preceding location as a function of random movement. Thus, for the walking and unidirectional video conditions, this room was at least two rooms away from the character's current location and therefore had not just been visited by the character (and thus was not adjacent). *Next adjacent room* probes paired objects from the next room to be encountered by the character as a function of unidirectional movement. Thus, in the random video condition, the next adjacent room was also a room neighboring the character's current room, but not the next room actually visited in that narrative. *Far room* probes paired objects that were located at least three rooms away from the character's current location. Across the 12 narratives, participants saw six of each type of same room probe. Across all narratives, each room was probed the same number of times, and each item was probed approximately the same number of times. Different probes consisted of pairwise combinations of the five probe types defined above, using probes from different rooms (e.g., a current room object and a far room object). Taken together, each narrative contained either three same and two different probes or three different and two same probes. In addition, each narrative contained a single *protagonist* probe, pairing one item from the map and the name of the current narrative's character (see Wilson, Rinck, McNamara, Bower, & Morrow, 1993, for a discussion of the importance of using such probes to ensure that readers keep track of character movement). These protagonist probes did not follow movement sentences.

We note that although our stimuli were based on Rinck and Bower (1995), that project focused on anaphor resolution for spatial narratives. Our project was intended to replicate the procedures of Morrow et al. (1987), Morrow et al. (1989), and Rinck et al. (1996), which looked at object accessibility. In line with those studies, we did not completely counterbalance the probes by stories. That is, each story had a subset of potential probes (although across the entire set of narratives, each room and item was probed a statistically equivalent number of times). Also in line with the aforementioned studies, we will not report items analyses, since individual stories did not contain all the probe types (thus, an items analysis would have resulted in empty cell means across items).

Comprehension questions. After each narrative, participants answered three comprehension questions testing their knowledge of the preceding narrative. These questions were identical across narrative conditions, testing general, rather than location-specific, information (e.g., "Did Mark want to replace the doors in the research center?").

Design and Procedure

The study used a mixed design, with narrative condition as a between-participants variable and probe type as a within-participants variable. Participants were randomly assigned to a narrative condition. Narratives were presented in one of four different orders. Dependent measures for probes included accuracy and response times (RTs) for correct responses.

Map memorization. In the first part of the experiment, participants memorized the research center map. They studied the map for 2 min, after which they were given a blank map (detailing only the research center's walls and doorways). Participants then filled in room and object names in their correct locations. After they had filled in as much as they could recall, participants compared their maps with the original for another 2 min. After this 2-min study period, they again completed the blank map. This continued until participants had correctly filled in the entire map. When participants believed that their map was correct, the experimenter checked it for accuracy. If it was correct, participants answered five questions about item locations (in line with Morrow et al., 1989, and Morrow et al., 1987). These questions were of the form "When you walk from the laboratory into the library, what is in front of you?" Answers listing any item from the room were considered correct, since knowledge of the item's global location was considered more important than that of the item's exact location (e.g., closer to the doorway) in the room. After completing the memorization phase, participants moved on to the reading portion of the study.

Reading task. In the second part of the experiment, participants read the narratives and completed the probe recognition and comprehension question tasks. The participants viewed the narratives, presented one sentence at a time on a computer screen, pressing the space bar to advance to the next sentence. At six points in each narrative (following each motion sentence for the critical probes and once following a nonmotion sentence for the protagonist probe), the participants had to decide whether two probes were located in the same or different rooms. The participants pressed either the SAME or DIFF key (labeled as such on the keyboard) to indicate their choice. No feedback was given. After reading each narrative, participants answered three comprehension questions by pressing YES or NO keys. The participants received feedback on their response to the comprehension question. Following each narrative, the participants pressed a key labeled NEXT to advance to the next narrative.

Results and Discussion

Participants, on average, took 4.2 trials and 30 min to memorize and reconstruct the map. On average, participants took 24 min to read the entire set of narratives. Participants also, on average, correctly answered 89.6% of the comprehension questions. None of these measures differed as a function of narrative condition.

Probe task data were analyzed using a 5 (probe type: current, previous adjacent, previous random, next adjacent, or far room) × 3 (narrative condition: walking, unidirectional video, or random video) repeated measures ANOVA with mixed design for both accuracy and RTs. Narrative condition served as a between-participants factor, and probe type served as a within-participants factor. Responses for same- and different-probe data were analyzed separately. Mean RTs and accuracy rates for each probe type are presented in Table 1.

We will begin with the same-probe analysis. We obtained a significant effect of probe type for accuracy [$F(4,152) = 2.97$, $MS_e = 0.012$, $p < .05$] and for RT [$F(4,152) = 4.42$, $MS_e = 260{,}222$, $p < .05$]. For the accuracy results, planned contrasts comparing responses for current room probes with those for the other probe types revealed that previous adjacent probes led to less accurate responses ($p < .05$) and far room probes led to marginally less accurate responses ($p = .06$) than did current room probes. For RT, the contrasts showed that the participants provided slower responses for previous adjacent ($p = .06$) and previous random ($p < .01$) probes. In other words, probes associated with the current focus of the protagonist were generally more accessible than other probe types.

The accuracy results also showed a significant narrative condition × probe interaction [$F(8,152) = 3.72$, $MS_e = 0.011$, $p < .005$]. Follow-up analyses revealed that the random video condition differed from both the walking and the unidirectional video conditions. To guard against experiment-wide Type I errors for these analyses, a Bonferroni-corrected alpha was used ($\alpha = .017$). Accuracy did not differ across probe type ($p > .15$) for the participants in the random video condition, whereas the participants in both the walking and the unidirectional video conditions obtained the main effect of probe type described above ($ps < .01$). In contrast, the narrative condition × probe interaction was not significant for the RT data. We additionally ran a doubly multivariate analysis combining both accuracy and RT measures into a single analysis as a further test of the effects. This analysis showed a signifi-

Table 1
Mean Response Times (RTs, in Milliseconds), Accuracy, and Standard Deviations for Probe Types As a Function of Narrative Condition in Experiment 1

	Narratives							
	Walking		Unidirectional Video		Random Video		Marginal Means	
Probe Type	*M*	*SD*	*M*	*SD*	*M*	*SD*	*M*	*SD*
				Same Probes				
Current room								
RT	2,753.1	671.8	2,279.9	989.0	2,158.1	481.2	2,388.3	771.0
Accuracy	.97	.06	.94	.11	.88	.08	.93	.09
Previous adjacent								
RT	2,993.8	1,139.4	2,422.9	795.9	2,610.3	1,186.4	2,667.9	1,053.3
Accuracy	.83	.18	.84	.12	.95	.08	.87	.14
Previous random								
RT	3,217.5	864.9	2,395.8	806.5	2,600.7	948.6	2,726.3	922.2
Accuracy	.89	.15	.94	.08	.90	.11	.91	.11
Next adjacent								
RT	2,507.4	651.1	2,071.0	611.6	2,498.8	776.0	2,355.5	698.2
Accuracy	.97	.06	.95	.10	.90	.11	.94	.10
Far room								
RT	2,720.7	500.8	2,260.7	1,033.8	2,516.4	888.4	2,493.8	845.6
Accuracy	.93	.11	.83	.15	.89	.11	.88	.13
				Different Probes				
Current–other								
RT	2,471.7	462.4	2,186.0	755.8	2,409.3	834.4	2,352.8	722.7
Accuracy	.89	.07	.82	.09	.84	.06	.85	.08
Other–other								
RT	2,761.0	892.6	2,454.8	892.6	3,114.2	390.7	2,777.03	2,047.7
Accuracy	.83	.19	.73	.21	.79	.19	.78	.20

cant narrative condition × probe interaction [$F(16,64) = 2.074$, $p < .05$] for the combined measure. Overall, these interactions suggest that the participants in the random movement condition failed to demonstrate decreasing accessibility for objects as a function of spatial distance. This contrasts with the results from the unidirectional walking and video conditions, for which the participants' responses were more in line with traditional spatial gradient effects; that is, participants were more accurate to identify objects from current and next to be visited rooms than those from previously visited rooms.

For the different-probe analyses, we collapsed the probes into two categories: current–other probes (for which one of the items was located in the character's current room) and other–other probes (for which neither item was located in the character's current room). Analyses showed a significant probe category effect for accuracy [$F(1,38) = 7.57$, $MS_e = 0.013$, $p < .01$]. The participants responded more accurately when one of the probe items was in the character's current room ($M = .85$ proportion accuracy) than when both probe items were in other rooms ($M = .78$). The RT data showed a similar trend, with shorter RTs if a probe item was in the character's current room, but this trend did not reach significance ($p = .10$).

The final analyses examined correlations between measures of studying the map environment and measures of accessing it after study. More specifically, we examined correlations between the participants' mean RT to correct responses, percentage of comprehension questions answered correctly, number of trials needed to memorize the map, time taken to memorize the map, and time taken to read all of the narratives. Significant correlations were found between the mean RT and narrative-reading time ($r = .589$, $p < .001$) and between the mean RT and map-learning time ($r = .526$, $p < .001$). The participants who took longer to respond to probes also spent more time studying the map and reading the narratives.

Overall, this set of results replicates and expands upon existing research on spatial situation models. Participants were faster and more accurate in responding to probes for objects in a character's current location. This finding is consistent with work demonstrating that accessibility of information from situation models is a function of the character's current focus. More important for this set of experiments, we compared three different narrative conditions to assess whether objects farther from this focus always decrease in accessibility. The participants in unidirectional movement conditions (both physical exploration and camera-based surveillance) did indeed obtain this well-documented effect, on the basis of the accuracy rate data. However, the participants in the random movement condition did not. Instead, there was little difference in accuracy for locations outside of character focus. These results are in line with a *reader expectation hypothesis*: Readers' expectations about character behavior can guide accessibility from spatial situation models. However, we again note that the RT data did not support this hypothesis. The disconnect between the RT and accuracy data suggest that under some conditions reader expectations can exert an influence but that this influence does not overwhelmingly drive retrieval processes. This disconnect suggests that perhaps a combination of the dominant gradient and the reader expectation hypotheses may be at work. That is, the dominant gradient hypothesis may represent the natural accessibility patterns obtained as a function of author, character, and reader focus in a narrative; the reader expectation hypothesis additionally suggests that this gradient is malleable with respect to reader goals, preferences, expectations, and other standards of coherence for comprehension (van den Broek, Risden, & Husebye-Hartmann, 1995). Note that additional correlational analyses ruled out speed–accuracy trade-off interpretations of the disconnect between the RT and accuracy results. These results suggest, then, that expectations for character movement influence retrieval accuracy, in a pattern different than that suggested by traditional spatial gradient effects.

In addition, the participants appeared to respond more quickly to probes in both video conditions, as compared with the walking condition (see Table 1). Why might this have been the case? One possibility is that the instantaneous movement suggested by switching a video camera system on and off might have led to shorter RTs, as contrasted with the more laborious physical movement necessary for walking from room to room. Physical movement often suggests additional time passage as a function of that movement. In line with this view, Rapp and Taylor (2004) demonstrated that reader expectations for the amount of time necessary to complete various activities could directly influence the speed with which readers recognized probes for story locations. More generally, perceptions of time passage can influence the speed with which readers access information from memory (e.g., Zwaan, 1996). Thus, readers' knowledge of the method by which characters explored their environments may have contributed to the RTs obtained in Experiment 1.

This set of results provides only one circumstance under which character activity qualitatively differed from the unidirectional movement traditionally investigated in spatial model studies. One concern, of course, might be that these differential results are a function of the particular movement patterns employed in Experiment 1. For example, random movement might be a privileged case for which readers specifically build strong expectations for viable narrative events. This view would contend that the effects described in Experiment 1, on their own, might fail to provide a generalizable account of how reader expectations influence the construction and application of situation models. To assess the generalizability of these findings, we conducted a second experiment involving character movement different from that described in Experiment 1. In Experiment 2, we evaluated whether backtracking (revisiting previously explored locations) also influences accessibility. Backtracking provides an additional situation for which readers might develop expectations for the locations that characters can visit. Differences in accessibility as a function of movement type would provide a conceptual replication of, and thus further support for, the *reader expectation hypothesis*.

EXPERIMENT 2
Expectations for Forward Versus Backtracking Movement

To further examine the potential influence of reader expectations, we conducted a second experiment involving a different type of movement. In Experiment 2, participants read stories in which characters moved forward in a single-minded fashion or eventually backtracked to revisit previously explored locations. This experiment allowed us to test the generalizability of reader expectations across different movement-based narratives.

Method

Participants

Fifty-two Stony Brook University undergraduates participated in partial fulfillment of a course requirement. Three participants were eliminated from the analyses. One had only a 27% accuracy rate on same probes; another participant was a nonnative English speaker; a third participant objected to learning the map. Of the remaining participants, 26 participated in the forward condition, and 23 in the backtracking condition.

Materials

Maps. The map was identical to that used in Experiment 1 (see Figure 1).

Narratives. We used the walking condition narratives from Experiment 1 (*forward condition*) and also wrote narratives in which characters backtracked to revisit one or more rooms (*backtracking condition*). Constructing the backtracking condition necessitated modifying the sentence order in three of the narratives to avoid inconsistencies when the characters reentered rooms. To maintain consistency across the two conditions, these changes were made to both the forward and the backtracking narratives. Sample narratives are provided in Appendix B.

The motion sentences matched those from the walking condition in Experiment 1. Across both the forward and the backtracking narratives, the characters began in the same room and initiated movement in the same direction (either clockwise or counterclockwise). Six stories described characters moving clockwise, and six stories described counterclockwise movement. In the forward condition, the characters moved from room to room in a consistent direction. In the backtracking condition, the characters moved forward and eventually reversed their movement once, moving in the opposite direction. Across stories, the characters reversed direction after two motion sentences in four of the narratives (twice clockwise and twice counterclockwise), after three motion sentences in four of the narratives (twice clockwise and twice counterclockwise), and after four motion sentences in four of the narratives (twice clockwise and twice counterclockwise).

Probes. The probes were constructed in the same manner as in Experiment 1. Across all the narratives, the participants responded to 60 *same* probes and 60 *different* probes. There were four types of same probes: *current*, *previous*, *next*, and *far room* probes. The *current room* probes paired objects located at the character's current location. The *previous room* probes paired objects located in the room that the character had just left. The *next room* probes paired objects located in the next room the character would visit if moving in a forward pattern (i.e., without backtracking). Finally, the *far room* probes paired objects that were located at least three rooms away from the character's current location. Since backtracking sentences could occur at three different points in the backtracking narratives, we also examined responses to probes located *before* and *after* those backtracking sentences.

Different probes were pairwise combinations of objects from the probe types described above (e.g., an object from the current room and an object from the next room). Across all the narratives, each room was visited approximately the same number of times, and each item appeared as a probe approximately the same number of times. In addition, as in Experiment 1, the participants also responded to one *protagonist* probe per narrative. Finally, as in Experiment 1, because the items were not completely counterbalanced across stories, we will report analyses by participants only.

Comprehension questions. Comprehension questions were identical to those used in Experiment 1.

Design

A mixed design was used, with narrative condition as a between-participants variable and probe type and probe location (specific to the backtracking condition only) as within-participants variables. The narratives were presented in one of four different orders.

Procedure

The map memorization and narrative-reading tasks were identical to those used in Experiment 1.

Results and Discussion

Participants took, on average, 4.8 trials and 34 min to memorize and reconstruct the map. They took, on average, 21 min to read the entire set of narratives. Participants also, on average, correctly answered 82.82% of the comprehension questions. None of these measures differed as a function of narrative condition ($ps > .20$).

Same probes were analyzed using a 4 (probe: current, previous, next, or far) $\times$ 2 (narrative condition: forward or backtracking) repeated measures ANOVA with mixed design for both accuracy and RT. As in Experiment 1, probe type served as the within-participants factor, and narrative condition as the between-participants factor. Mean RT and accuracy rates for each probe type are presented in Table 2.

The results showed an effect of probe type for accuracy [$F(3,141) = 7.871$, $MS_e = 0.02$, $p < .001$] and for RT [$F(3,141) = 4.868$, $MS_e = 231{,}258$, $p < .005$]. Planned contrasts compared current room probes with the other probe types. Participants responded more quickly and more accurately to current room probes than to all other probe types ($ps < .05$). These results support existing work demonstrating increased accessibility for objects located in rooms currently under character focus.

The RT data also showed a marginally significant interaction of probe type and narrative condition [$F(3,141) = 2.366$, $MS_e = 231{,}258$, $p = .074$]. This interaction, however, was not significant for the accuracy data. For the backtracking narratives, responses to current room probes were faster than those to any other probe type. For the forward narratives, RT did not differ as a function of probe type. In other words, participants with forward narratives had consistent RT patterns to object probes, but participants with backtracking narratives took longer to respond to object probes from rooms other than the current room.

We followed this analysis by examining probe responses located before and after backtracking sentences in the backtracking condition. This analysis showed a marginally significant interaction [$F(3,66) = 2.351$, $MS_e = 570{,}263$, $p = .08$]. Specifically, before backtracking, participants responded more quickly to next room than

Table 2
Mean Response Times (RTs, in Milliseconds), Accuracy, and Standard Deviations for Probe Types As a Function of Narrative Condition in Experiment 2

	Narratives					
	Forward		Backtracking		Marginal Means	
Probe Type	*M*	*SD*	*M*	*SD*	*M*	*SD*
Same Probes						
Current room						
RT	2,498.2	907.2	2,480.6	682.9	2,491.3	807.4
Accuracy	.95	.11	.96	.08	.95	.09
Previous room						
RT	2,656.1	769.9	2,979.3	903.4	2,801.2	849.6
Accuracy	.89	.14	.90	.14	.89	.14
Next room						
RT	2,518.9	758.0	2,930.6	1,101.1	2,717.0	961.4
Accuracy	.87	.22	.78	.27	.82	.25
Far room						
RT	2,591.0	901.9	3,008.9	1,110.8	2,800.9	1,031.7
Accuracy	.86	.25	.84	.25	.85	.25
Different Probes						
Current–other						
RT	2,732.8	853.4	2,714.7	714.4	2,724.3	783.2
Accuracy	.79	.13	.85	.13	.82	.13
Other–other						
RT	2,602.1	964.1	2,780.6	853.3	2,685.9	908.8
Accuracy	.70	.27	.74	.23	.72	.25

to previous room probes. After backtracking, the reverse was true; participants responded more quickly to previous room than to next room probes. For backtracking cases, then, participants maintained differential accessibility for objects as a function of expectations for where the character might travel next. When moving forward, next room information was more accessible than previous room information; following backtracking, this pattern was reversed.

We additionally assessed whether these effects became more pronounced over the course of the experiment, which would be indicative of readers' becoming more familiar with a particular movement type (and therefore, building stronger expectations for such movement). However, the obtained effects did not become more pronounced as participants read more stories (*p*s $> .05$). One possibility is that the practice item preceding the experimental stories may have successfully instantiated readers' expectations for forward or backtracking movement for the duration of the experiment.

Different probes were collapsed into two categories, as in Experiment 1: current–other and other–other probes. Analyses showed a significant effect of probe for accuracy [$F(1,47) = 14.825$, $MS_e = 0.015$, $p < .001$]. Participants responded more accurately when one of the probed items was in the current room ($M = .82$) than if both were in other rooms ($M = .72$).

Final analyses examined correlations between study and retrieval measures, including mean RT to correct responses, percentage of comprehension questions answered correctly, number of trials needed to memorize the map, time taken to memorize the map, and time taken to read all of the narratives. Significant correlations were found between the mean RT and narrative-reading time ($r = .287$, $p < .05$) and between the mean RT and map-learning time ($r = .373$, $p < .01$). Participants who took longer to respond to probes also spent more time studying the map and reading the narratives.

Overall, this set of results replicates and expands upon Experiment 1. As in Experiment 1, participants were faster and more accurate in responding to probes for objects located in the character's current room. This was true both when the objects were in the same room and when they were located in different rooms (with only one object in the current room). More important, reader expectations about movement within the narrative affected accessibility. Participants in the backtracking condition seemed to keep previous rooms more accessible (with respect to RTs) than did participants in the forward movement condition.

We note that expectations did not seem to affect accuracy rates, unlike in Experiment 1, in which effects were obtained for accuracy but not for RTs. Although the ideal would be to obtain convergence between RT and accuracy, it is not uncommon to see effects in one, but not the other, measure. Different narrative factors often have a variety of effects on accessibility (Rinck et al., 1996). For movement expectations, these effects might impact accuracy, response latencies, or both. Since RT and accuracy can separately provide evidence of accessibility, we contend that our results provide an indication that movement expectations indeed influence accessibility.

In addition, we note that the RT pattern for forward movement, although different from that for backtracking, did not obtain a pure version of the traditional spatial distance effect. Participants were not systematically faster in responding to current room probes than to other probes. We believe that despite this, the main point of our hypothesis, that accessibility patterns are a function of reader expectations, can still be derived from the findings. Nevertheless, we have no ready explanation for the failure to replicate the standard accessibility effect. We believed that a between-participants manipulation of narrative condition, as compared with a within-participants manipulation, would increase the likelihood of replicating traditional spatial gradient effects. Indeed, visual inspection of the means in Table 2 indeed suggests that a pattern of RTs resembling the traditional spatial gradient effect was emerging in Experiment 2, although that pattern was not statistically reliable. Our stories were constructed in a manner similar to that of the stories in traditional spatial comprehension studies (e.g., Morrow et al., 1987), although they were not identical. Future work intended to examine the role of expectations for spatial situation models may need to more closely model the methods and stimuli of previous studies (e.g., Morrow et al., 1989; Morrow et al., 1987) to sufficiently replicate those spatial gradient effects (i.e., in terms of number of participants, the causal structure of narratives, etc.).

Overall, our main contention, that readers' expectations about movement directly impacts the accessibility of location information, is supported by the difference in response patterns between forward and backtracking narratives, as well as by the patterns obtained both before and after backtracking took place in the stories. We take these results as evidence for the influence of expectations on spatial situation models.

GENERAL DISCUSSION

In the present experiments, we set out to assess whether reader expectations influence the accessibility of spatial information from situation models. We constructed narratives for which readers could develop different expectations about future character movement. In previous studies, characters have always moved through environments in a unidirectional clockwise or counterclockwise manner. Our experiments extended this work by investigating a variety of movement patterns (i.e., unidirectional forward movement, random movement, and backtracking) and the accessibility resulting from such movement. In Experiment 1, the participants read stories that described either unidirectional or random movement. Our results replicated earlier work in unidirectional movement scenarios: The accessibility of objects from memory was a function of character focus, and locations farther from this focus were less accessible (as measured through accuracy rates). The random scenarios, however, did not obtain this same gradient of accessibility. Instead, the readers' expectations that any room could serve as a viable next location resulted in more uniform accessibility patterns. In Experiment 2, this finding was extended to circumstances describing linear but nonsequential movement involving backtracking. Readers' recognition of object probes again reflected expectations for where characters might go next (in this case, potentially back to a previously visited room), rather than as a function of distance (as measured by response latencies). These results point to the importance of expectations during narrative comprehension.

Our results suggest that the *dominant gradient hypothesis* does not sufficiently describe the diverse circumstances involved in the application of spatial situation models. Recall that this hypothesis proposes that a decreasing gradient of accessibility should be obtained across a variety of narrative scenarios, regardless of the underlying nature of those narratives. Instead, we believe our results support a view that combines the *dominant gradient hypothesis* with a *reader expectation hypothesis*. This view suggests that reader beliefs about the locations characters may visit and the processes by which they may get there can guide the traditional activation and accessibility of information. In fact, we wish to suggest that previous findings showing gradients of accessibility may have been, at least partially, a function of such expectations (e.g., expectations that were based on the descriptions of character movement or, perhaps, were a function of the structure of the memorized map). That is, readers may have come to expect that characters would move in a unidirectional, linear pattern and, thus, may have set up a situation model that facilitated ready access to current and next room probes as compared with previous room probes. Therefore, our findings provide an additional framework for considering research on spatial situation models. This framework stresses the importance of taking reader expectations into account in models of narrative comprehension.

It is perhaps not surprising that expectations can guide the use of spatial situation models during narrative comprehension. Previous work has described the role of expectations in the retrieval of locations from memory. Rapp and Taylor (2004) demonstrated that expectations about the amount of time it takes to complete specific actions influenced readers' recognition of story locations. In that experiment, participants read stories describing a character's traveling from one location to the next (e.g., from the library to the diner). Along the route, the character engaged in an activity that could take a long time (e.g., "He carved the stick into a flute") or a short time (e.g., "He carved his initials right on the stick") to complete. Start locations were less accessible after characters completed long, as opposed to short, activities. Readers' knowledge about the passage of time and the viability of movement through space impacted the accessibility of locations from situation models. Other studies have similarly shown that expectations about genre (Zwaan, 1994), characters (Rapp et al., 2001), and reading goals (Linderholm & van den Broek, 2002) can influence text comprehension. The point we wish to make here is that outlining the role of expectations can only enhance research on spatial situation models.

The data collected in the present experiments do not allow for claims about the time course of reader expectations. Readers might develop expectations about the likelihood of events early on in narratives (e.g., after being told that characters will move in particular ways, such as using surveillance cameras), as a narrative unfolds (e.g., after actually reading instances of unidirectional or random movement), or, perhaps, only at test (consistent with views of backward updating of situation models; de Vega, 1995). We argue that likely none of these possibilities (or any other potential frameworks) can adequately serve as a single explanation for all the cases involving reader expectations. That is, we could readily imagine situations in which readers might build expectations early on or wait until test to make such decisions (Gerrig & O'Brien, 2005; van den Broek et al., 2005). Nevertheless, for all of these circumstances, reader expectations can exert an influence on memory and comprehension for stories.

We note, though, that any potential differences as a function of reader expectations for movement in this study were likely an effect at retrieval (during reading), rather than at encoding (during map memorization). Across both experiments and all conditions, participants memorized the maps without awareness of how movement would be described in the narratives. Patterns of probe recognition latencies should, therefore, be due to retrieval processes from situation models (e.g., R. C. Anderson & Pichert, 1978), rather than to encoding strategies during map study. In fact, previous research has shown that the order of presentation during map memorization has little effect on patterns of accessibility, further suggesting little influence of encoding on these processes (Rinck & Bower, 1995).

Although the question of *when* readers build expectations is a critical one, equally important is an account of the factors that influence the *types* of expectations that readers generate and apply as they read. Often, texts provide sufficient context to lead readers to believe that certain events are more or less likely. Some studies have sought to determine the constraints that inform readers' expectations (and resulting inferences) during narrative comprehension (e.g., Linderholm, 2002; Weingartner, Guzmán, Levine, & Klin, 2003). Beyond the text, readers bring a diverse set of experiences on which they base the likelihood of an event's occurrence. Thus, expectations are often grounded in personal experience (e.g., Barsalou, 1999a, 1999b; Barsalou, Huttenlocher, & Lamberts, 1998; Horton & Rapp, 2003; Kaschak & Glenberg, 2000; Rapp & Gerrig, 1999, 2002; Rapp & Taylor, 2004; Zwaan, 1996, 1999). These personal experiences can help readers determine what should happen as a character moves in a particular pattern or explores a particular environment. That is, these experiences may set up constraints that influence inference construction and the structure of situation models. Reader expectations are thus a natural by-product of prior knowledge, as well as of the unfolding text (see Rapp & Gerrig, 2002, for a discussion of reader-driven and plot-driven factors that drive expectations for events).

In addition, other reader-based factors could influence expectations during text processing. For example, working memory limitations might restrict how much information can remain accessible at any given time (e.g., Estevez & Calvo, 2000; Linderholm, 2002; St. George, Mannes, & Hoffman, 1997; Whitney, Ritchie, & Crane, 1992). Thus, readers with reduced memory resources may have more difficulty dealing with character movement that necessitates the simultaneous activation of multiple locations. If readers lack the resources to actively maintain that information, they may rely on other cues or resort to maintaining information that is available only in current character focus. These strategies would keep the narrative material in a manageable state and even obtain traditionally reported decreasing gradients. Beyond working memory, readers' decisions that certain objects are important and need to be tracked (e.g., a ticking bomb in a spy novel) can directly influence activation patterns. In this case, activation of these objects could override a decreasing gradient pattern. Thus, under a variety of circumstances, the processes that guide activation in memory are influenced by text cues (e.g., descriptions of characters in environments) and reader-driven processes. Our work presents one attempt to describe how such influences interact during narrative comprehension.

We intended our opening excerpt with Harry Potter's map to exemplify a narrative for which readers can expect that traditional patterns of movement will be violated. Often, narratives do not just suggest such violations but explicitly describe characters traversing locations in novel, multidirectional ways (e.g., via magic spells, teleportation, or time travel). The distances and locations described in these narratives can be malleable, as characters learn new ways to get from one point to the next, perhaps retracing their steps or skipping steps completely. Readers' models of narratives are informed by expectations associated with such movement. These expectations have a direct impact on the accessibility of information from spatial situation models. Were readers not to develop such expectations, we might expect them to remain focused only on the here and now, rather than considering the diverse narrative circumstances that can occur as the plot unfolds.

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APPENDIX A
Sample Stories From Experiment 1

Walking Condition

Paul was one of the research center's top researchers.
He was often receiving important packages.
Today he couldn't find a small package he received earlier.
He was sure he left it at the center.
He walked from the office into the reception room.
He had seen a package here earlier.
But now it appeared the room had been cleaned out.
Someone must have moved the package.
He walked from the reception room into the experiment room.
He hoped someone hadn't already opened the package.
There were some people working at the center who might do that.
He didn't have much patience for those people.
He walked from the experiment room into the lounge.
He saw an empty box on the floor.
He briefly felt that his search was over.
Then he realized that the box was much larger than the one he had received.
He walked from the lounge into the repair shop.
He was just about ready to give up his search.
Maybe he had already brought the package home.
He hoped that wasn't the case.
He walked from the repair shop into the wash room.
There in the corner was his unopened package.
He sighed with relief that the ordeal was over.

Unidirectional Video Condition

Paul was one of the research center's top researchers.
He was often receiving important packages.
Today he couldn't find a small package he received earlier.
He was sure he left it at the center.
He turned off the office camera, and turned on the conference room camera.
He had seen a package here earlier.
But now it appeared the room had been cleaned out.
Someone must have moved the package.
He turned off the conference room camera, and turned on the library camera.
He hoped someone hadn't already opened the package.
There were some people working at the center who might do that.
He didn't have much patience for those people.
He turned off the library camera, and turned on the laboratory camera.
He saw an empty box on the floor.
He briefly felt that his search was over.
Then he realized that the box was much larger than the one he had received.
He turned off the laboratory camera, and turned on the storage room camera.
He was just about ready to give up his search.
Maybe he had already brought the package home.
He hoped that wasn't the case.
He turned off the storage area camera, and turned on the wash room camera.
There in the corner was his unopened package.
He sighed with relief that the ordeal was over.

Random Video Condition

Paul was one of the research center's top researchers.
He was often receiving important packages.
Today he couldn't find a small package he received earlier.
He was sure he left it at the center.
He turned off the office camera, and turned on the lounge camera.
He had seen a package here earlier.
But now it appeared the room had been cleaned out.
Someone must have moved the package.
He turned off the lounge camera, and turned on the laboratory camera.
He hoped someone hadn't already opened the package.
There were some people working at the center who might do that.
He didn't have much patience for those people.

APPENDIX A (Continued)

He turned off the laboratory camera, and turned on the experiment room camera.
He saw an empty box on the floor.
He briefly felt that his search was over.
Then he realized that the box was much larger than the one he had received.
He turned off the experiment room camera, and turned on the library camera.
He was just about ready to give up his search.
Maybe he had already brought the package home.
He hoped that wasn't the case.
He turned off the library camera, and turned on the wash room camera.
There in the corner was his unopened package.
He sighed with relief that the ordeal was over.

Note—Probe pairs were presented after each italicized statement. Five of these statements were movement statements, followed by object probes. The remaining nonmovement statement was followed by a protagonist probe.

APPENDIX B
Sample Stories From Experiment 2

Forward Condition

Paul was one of the research center's top researchers.
He was often receiving important packages.
Today he couldn't find a small package he received earlier.
He was sure he left it at the center.
He walked from the office into the conference room.
He had seen a package here earlier.
But now it appeared the room had been cleaned out.
Someone must have moved the package.
He walked from the conference room into the library.
He saw an empty box on the floor.
He briefly felt that his search was over.
Then he realized that the box was much larger than the one he had received.
He walked from the library into the laboratory.
He hoped someone hadn't already opened the package.
There were some people working at the center who might do that.
He didn't have much patience for those people.
He walked from the laboratory into the storage room.
He was just about ready to give up his search.
Maybe he had already brought the package home.
He hoped that wasn't the case.
He walked from the storage room into the wash room.
There in the corner was his unopened package.
He sighed with relief that the ordeal was over.

Backtracking Condition

Paul was one of the research center's top researchers.
He was often receiving important packages.
Today he couldn't find a small package he received earlier.
He was sure he left it at the center.
He walked from the office into the reception room.
He had seen a package here earlier.
But now it appeared the room had been cleaned out.
Someone must have moved the package.
He walked from the reception room into the experiment room.
He saw an empty box on the floor.
He briefly felt that his search was over.
Then he realized that the box was much larger than the one he had received.
He walked from the experiment room into the lounge.
He hoped someone hadn't already opened the package.
There were some people working at the center who might do that.

APPENDIX B (Continued)

He didn't have much patience for those people.
He walked from the lounge into the repair shop.
He was just about ready to give up his search.
Maybe he had already brought the package home.
He hoped that wasn't the case.
He walked from the repair shop into the lounge.
There in the corner was his unopened package.
He sighed with relief that the ordeal was over.

Note—Probe pairs were presented after each italicized statement. Five of these statements were movement statements, followed by object probes. The remaining nonmovement statement was followed by a protagonist probe.

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