Foregrounding Effects During Reading, Revisited

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Previous researchers have argued that objects associated with a protagonist may be foregrounded, or held active, in memory. This study expanded on previous work by using an inconsistency paradigm to investigate the effects of protagonist association on object accessibility. Readers experienced more processing difficulty when a target sentence contradicted previously presented information about protagonist-associated objects than when the contradiction pertained to protagonist-dissociated objects. However, the results of a naming time study demonstrated that this effect was due to increases in accessibility of protagonist-associated objects, not continued increases in availability. A final experiment demonstrated that degree of association between the object and the protagonist does not influence object accessibility. The results provide additional evidence for, and a more refined explanation of, foregrounding effects during reading.

A primary goal of models of discourse comprehension is to capture how text is represented in memory and the processes that lead to that representation (e.g., Graesser, Singer, & Trabasso, 1994; Kintsch & van Dijk, 1978). Most researchers
agree that there are at least two levels of representation that evolve during reading: a text-base level, and a situation model (e.g., Graesser, Millis, & Zwaan, 1997; Kintsch, 1988; Sanford & Garrod, 1981, 1998, 2005). The text base is a transformation of the surface information into a representation of the text itself, whereas the situation model is a representation of what the text is about; it contains an integration of information explicitly stated in the text as well as information the reader has brought to bear to flesh in the meaning (e.g., Zwaan & Radvansky, 1998). As such, it reflects the reader's ongoing understanding (i.e., comprehension) of a text, and it is at this level that many of the complex processes involved in comprehension are presumed to occur (e.g., Bower & Morrow, 1990; Singer, Graesser, & Trabasso, 1994).

Several views have been developed to explain how readers construct situation models such as Sanford and Garrod's (1998, 2005) focus model; Glenberg, Meyer, and Lindem's (1987) mental model perspective; as well as considerable work by Zwaan and colleagues (e.g., Graesser et al., 1997; Zwaan, Langston, & Graesser, 1995; Zwaan & Radvansky, 1998). A common thread throughout these views is that readers continually map onto the developing situation model information that is relevant to the situation currently in focus. Zwaan et al. (1995; Zwaan & Radvansky, 1998) suggested that there are five dimensions along which relevant information may be mapped onto the current situation model: time, space, causation, motivation, and protagonist. In the Zwaan et al. event-indexing model, information that is relevant to these dimensions is foregrounded, or kept active in memory; whereas information that is not relevant is backgrounded, or dropped from the active portion of the situation model.

Another way to conceptualize this view of situation models is that they are snapshots of what the text is depicting at a specific point in time. This snapshot would include the five dimensions identified by Zwaan and Radvansky (1998); information represented in the snapshot should be more accessible than information that is not. When the reader encounters new information—for example, when the protagonist moves to a new location—the snapshot changes and the availability of information in the narrative would shift to reflect this change. On the protagonist dimension, this would mean that information associated with the protagonist would be foregrounded and information no longer associated with the protagonist would be backgrounded.

Glenberg et al. (1987) provided the first clear test of the availability of information associated with the protagonist in a narrative. They presented readers with passages in which objects were either spatially associated with or dissociated from a protagonist. For example, in one passage, Warren is shopping and either picks up his bag (i.e., object is associated with him) or puts down his bag and walks away (i.e., object is dissociated from him). Following a sentence that shifted the topic of the passage away from the object, the availability of the target object in memory was tested. Both reading times on a sentence that contained a pronominal reference to the target object and recognition times for the target object indicated that objects were more available in memory when they were spatially associated with the protagonist than when they were spatially dissociated. Glenberg et al. suggested that because the situation model is continually updated to reflect any changes in what the text is currently about, when the protagonist (Warren) moves away from his shopping bag, the model is updated so that the bag is no longer part of the active portion of the situation model. Consider the snapshot analogy presented earlier. When Warren moves away from his bag, the picture is updated so that it no longer includes the bag.

Glenberg et al.'s (1987) finding that concepts associated with the protagonist are foregrounded in memory has been influential in reading research (e.g., Carreiras, Carriedo, Alonso, & Fernandez, 1997; Glenberg & Langston, 1992; Morrow, Greenspan, & Bower, 1987; Zwaan et al., 1995; Zwaan & Madden, 2004). It should be noted, however, that Glenberg et al. showed differences in availability (i.e., activation levels) of the target object only after a single sentence delay; after a two-sentence delay target objects trended toward greater availability, but the difference was not reliable. This availability advantage for protagonist-associated objects may have decayed quickly because there was only one prior mention of the object and its association with respect to the protagonist in Glenberg et al.'s materials. In addition, Glenberg et al.'s target sentences used pronominal references, which do not prime their antecedents as strongly as direct nominal references (Green, McKoon, & Ratcliff, 1992). Thus, it is also possible that after two intervening sentences, the pronominal reference in the target sentence may not have sufficiently primed the target object, making it difficult to detect any lasting advantages due to association.

According to theories concerning the development of the situation model (e.g., Carreiras, Carriedo, Alonso, & Fernandez, 1997; Glenberg & Langston, 1992; Morrow, Greenspan, & Bower, 1987; Zwaan et al., 1995; Zwaan & Radvansky, 1998), it is not assumed that foregrounded concepts must be maintained in active memory; instead, they need only remain more accessible to the reader. This view of foregrounding effects makes a distinction between availability and accessibility in which availability refers to a concept's active status in working memory, and accessibility refers to a concept maintaining a special status in the situation model, such that subsequent integration of information about that concept is facilitated. With respect to Glenberg et al.'s (1987) study, protagonist-associated objects may no longer have been available in memory after two sentences, but there may have been a longer lasting accessibility advantage for these concepts. To test this hypothesis, and to distinguish between the availability and accessibility accounts of foregrounding, it is necessary to measure the relative

\footnote{In Glenberg, Meyer, and Lindem's (1987) work and in the work reported here, object association was operationalized as the object being currently in the possession of, and thus the physical proximity of, the protagonist.}
availability (i.e., activation) and accessibility (i.e., integration) of protagonist-associated and protagonist-dissociated objects that have been mentioned multiple times, after several topic-shifting sentences of text.

Thus, the first goal of our study was to replicate and extend Glenberg et al.'s (1987) original findings with longer materials and different methodologies. In each of our passages, several sentences intervened between the last mention of the target object and any measure of the accessibility or availability in memory of that object. In Experiment 1, we used the inconsistency paradigm (e.g., Albrecht & O'Brien, 1993; Cook, Halleran, & O'Brien, 1998; Guéraud, Harmon, & Peracchi, 2005; O'Brien & Albrecht, 1992; O'Brien, Rizzella, Albrecht, & Halleran, 1998) to measure the accessibility of target objects associated with or dissociated from the protagonist. In Experiments 2a and 2b, we used time to name target objects to test for availability advantages for protagonist-associated objects.

The second goal of this study was to examine whether object accessibility is also affected by degree or importance of association with the protagonist. Consider the snapshot metaphor mentioned earlier. If the snapshot includes both Warren and his shopping bag, does it matter whether the bag is prominent or peripheral in the scene? We attempted to answer this question in Experiment 3 by varying the degree of association of the object to the protagonist while holding the number of mentions of the target object constant. Although discussions of situation model representations have been quiet with respect to effects of degree of association and importance, a prediction that is consistent with the situation model perspective would be that as long as an object is clearly associated with a protagonist, it should remain accessible in memory; information about the degree of association should not matter.

EXPERIMENT 1

The goal of this experiment was to replicate Glenberg et al.'s (1987) original results with a new set of materials and to determine whether foregrounded concepts are more accessible to the reader than non-foregrounded concepts. An example of the materials used is presented in the appendix. Each passage began with a brief introductory section followed by a description of an object that was either highly associated or highly dissociated with respect to the protagonist. For example, in the sample passage in the appendix, Dorothy either loves her skates and always brings them to the park (associated condition) or never brings her skates with her (dissociated condition). Several sentences of text then shifted the topic of the passage away from the target object, and then two sentences were presented—one critical sentence and one spillover sentence. The critical sentence was either consistent or inconsistent with the information previously presented about the object. Critical sentences that were consistent with information in the associated condition (e.g., Dorothy eagerly put on her ice skates.) were inconsistent with the information in the dissociated condition, and critical sentences that were consistent with information in the dissociated condition (e.g., Dorothy wished she had a pair of skates.) were inconsistent with the information in the associated condition.

In each case, the critical sentence contained an anaphoric reference to the target object. If protagonist-associated objects are more accessible in memory than protagonist-dissociated objects, even after several sentences of intervening text, information about these objects should be integrated more readily upon encoding of the critical sentence. If correct, then any slow down in reading when the critical sentence is inconsistent should be larger and more immediate in the protagonist-associated condition than in the protagonist-dissociated condition; that is, the inconsistency effect (i.e., the difference in reading times for the consistent and inconsistent critical sentences) should be larger in the associated condition than in the dissociated condition. In contrast, if objects associated with the protagonist do not remain foregrounded beyond one or two sentences, there should be no difference in the accessibility of target objects in the protagonist-associated and protagonist-dissociated conditions; the size of the inconsistency effect across conditions should not differ.

Method

Participants. Forty University of New Hampshire undergraduates enrolled in introductory psychology courses received course credit for their participation in the experiment.

Materials. The materials were 20 experimental passages. An example is presented in the appendix. Each experimental passage began with two to three introductory sentences that served to introduce the main character and the theme of the story. Then a section was presented in which a target object was described. One half of the passages described the object as being highly associated with the protagonist (associated condition), and the remaining one half described the object as being highly dissociated from the protagonist (dissociated condition). For all experimental passages, the target object was mentioned twice explicitly and once implicitly. Following this section, there were several filler sentences (range = 4-6 sentences; M = 65 words) that shifted the focus of the passage away from the object but continued the storyline developed in the introductory sentences. This filler section was followed by two sentences (critical and spillover sentences). One half of the passages contained critical and spillover sentences that indicated that the target object was in the possession of the protagonist (i.e., associated consistent and dissociated inconsistent conditions), whereas the other half contained critical and spillover sentences that indicated that the target object was not in the possession of the protagonist (i.e., associated
inconsistent and dissociated consistent conditions). Both the critical and spillover sentences ranged from 38 to 40 characters in length. Each passage ended with a brief closing section and a comprehension question that addressed information from the passage irrelevant to the target object. Across all passages, there were equal numbers of yes and no comprehension questions.

Four sets of materials were constructed; each set contained five experimental passages in each of the four conditions. Across the four sets, each passage appeared once in each of the four conditions.

**Procedure.** Participants were assigned to one of the four stimulus sets. Each participant was run individually in a session that lasted approximately 45 minutes. All materials were presented on a video monitor controlled by a Micron 500 MHz microcomputer. Participants were instructed to rest their right thumbs on a line advance key and their right and left index fingers on a “yes” key and “no” key, respectively. Each trial began with the word “READY” at the center of the display. When participants were ready to read a passage, they pressed the line advance key. Each press of the key erased the current line of the passage and presented the next line. Comprehension time was the time between key presses. Each participant was instructed to read at a normal, comfortable pace. At the end of each passage, a press of the line-advance key presented the cue “QUESTIONS” for 2,000 msec. This was followed by a comprehension question. Participants were instructed to respond to the question by pressing either the “yes” or “no” key. Participants were told that answering the questions was the most important part of their task and that they should be prepared to answer as quickly and as accurately as possible. On those trials in which participants made errors, the response was followed by the word “ERROR” for 750 msec. Each session began with three practice passages to ensure that participants understood the procedure.

**Results and Discussion**

In all experiments reported, scores that were 2.5 SDs beyond the mean for a participant were eliminated, resulting in the loss of less than 3% of the data. Also, $F_1$ always refers to tests against an error term based on participant variability, and $F_2$ always refers to tests against an error term based on item variability. All analyses reported are significant at the .05 alpha level unless otherwise indicated. In addition, all planned comparisons used a family-wise alpha level of .05 to protect against an increased probability of Type I errors.

The mean reading times for both the critical and spillover sentences in Experiment 1 are presented in Table 1. Separate analyses of variance were conducted on the critical and spillover sentences. For the critical sentence, reading times were longer when the critical sentence was inconsistent than when it was consistent, reported are significant at the .05 alpha level unless otherwise indicated. In addition, 1 are presented in Table 1. Separate analyses of variance were conducted on the critical and spillover sentences. For the critical sentence, reading times were longer when the critical sentence was inconsistent than when it was consistent.

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<th>Passage Condition</th>
<th>Sentence Condition</th>
<th>Associated</th>
<th>Dissociated</th>
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<td>Critical sentence</td>
<td>Consistent</td>
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<td>Spillover sentence</td>
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$F_1(1, 36) = 34.15, MSE = 171,095.31$ and $F_2(1, 16) = 39.94, MSE = 73,148.76$; this was true for both the protagonist-associated conditions, $F_1(1, 36) = 51.59, MSE = 250,813.74$ and $F_2(1, 16) = 83.66, MSE = 75,444.56$, and the protagonist-dissociated conditions, $F_1(1, 36) = 6.80, MSE = 225,059.73$ and $F_2(1, 16) = 4.58, MSE = 179,416.18$. More important, the size of the inconsistency effect was larger for the protagonist-associated conditions than for the protagonist-dissociated conditions, $F_1(1, 36) = 20.83, MSE = 66,841.43$ and $F_2(1, 16) = 11.88, MSE = 54,281.61$.

For the spillover sentence, reading times were also longer when the spillover sentence was inconsistent than when it was consistent, $F_1(1, 36) = 29.51, MSE = 66,620.85$ and $F_2(1, 16) = 15.19, MSE = 57,009.07$. This remained true for the protagonist-associated conditions, $F_1(1, 36) = 33.19, MSE = 114,546.13$ and $F_2(1, 16) = 14.89, MSE = 119,791.50$. For the protagonist-dissociated conditions, this difference was reliable when tested against participant variability, $F_1(1, 36) = 5.17, MSE = 141,238.69$; but failed to reach significance when tested against item variability, $F_2(1, 16) = 1.69, MSE = 163,767.25, p = .21$. The size of the inconsistency effect remained larger for the protagonist-associated conditions than for the protagonist-dissociated conditions. However, this difference was only reliable when tested against participant variability, $F_1(1, 36) = 4.90, MSE = 61,271.56$; and failed to reach significance when tested against item variability, $F_2(1, 16) = 1.93, MSE = 84,770.30, p = .18$.

Reading times for the critical sentences were slower when they contained information that was inconsistent with previously presented information about the target object; this was true for both the protagonist-associated and protagonist-dissociated conditions. More interesting, however, this inconsistency effect was larger when the target object was associated with the protagonist than when it was dissociated. Thus, objects that are connected to the protagonist appear to have a status in the representation that is greater than that of objects not connected to the protagonist. As noted earlier, this advantage could be due to increases in concept availability, or to increases in concept accessibility. One explanation, consistent with Glenberg et al. (1987), is that this finding reflects differences in the continued...
availability levels of the concepts representing these objects; those objects associated with the protagonist are foregrounded in the discourse model and are held in a more active state in memory. They are, therefore, more readily available for integration and more likely to lead to immediate processing difficulty in the presence of inconsistent information. Alternatively, it may be that the different inconsistency effect sizes reflect differences in the accessibility of the target object—that is, it is possible that the target objects were no longer available in memory prior to the critical sentence in either the associated or dissociated conditions; instead, the protagonist-associated objects held a special status in the discourse representation, making them more accessible to the reader, such that subsequent integration of information about them was facilitated.

The reading time measures used in this experiment do not provide a direct measure of availability, and therefore do not allow us to distinguish between these two alternatives. As a result, naming time probes were used in Experiments 2a and 2b.

**EXPERIMENTS 2a and 2b**

To provide a more direct test of whether protagonist-associated objects remain more available in memory than protagonist-dissociated objects, even after several sentences of text, a naming procedure was employed. For each passage, a probe word was selected to reflect the target object mentioned in the elaboration section (e.g., skates). Participants were required to name this word aloud either immediately after the elaboration section or immediately after the filler section. Along with the associated- and dissociated-elaboration conditions, a neutral-elaboration condition was created in which the target object was mentioned, but it was not specifically related to the protagonist. This allowed for a direct comparison of object availability against a control condition. In Experiment 2a, passages appeared in the associated condition and neutral condition, whereas in Experiment 2b they appeared in either the dissociated condition or neutral condition.

In all three elaboration conditions—associated, dissociated, or neutral—the object was expected to be highly available immediately after the elaboration section. The issue explored in these experiments was whether the association of the target object to the protagonist influences the availability of the object later in the passage—after the filler section (i.e., we were interested in whether the decreases in object availability from the end of the elaboration section to the end of the filler section were comparable for protagonist-associated and protagonist-dissociated objects).

Consider the protagonist-associated conditions first (Experiment 2a). If protagonist-associated objects are held active in memory, any change in availability—as measured by naming time—from the end of the elaboration to the end of the filler section should be smaller in the associated condition than in the neutral condition.

In the protagonist-dissociated conditions (Experiment 2b), target objects should not be held active in memory; naming times to probes presented after the filler section should be slower than for those presented after the elaboration section, and this difference should be equivalent for both the dissociation and neutral conditions. Because object association and dissociation was manipulated as a between-subject variable, the test for differential decreases in object availability as a function of association or dissociation was the Experiment x Elaboration Condition x Probe Position interaction.

In contrast, if the results of Experiment 1 reflect differences in object accessibility rather than object availability, then object availability should decrease equally in both the protagonist-associated and protagonist-dissociated conditions. Naming times should be shorter when probes are presented after the elaboration than when they are presented after the filler section, and this should occur independent of elaboration condition. If the results of Experiment 1 reflect differences in object accessibility and not object availability, the three-way interaction described in the previous paragraph should not be significant.

**Method**

**Participants.** Participants were 64 University of New Hampshire undergraduates enrolled in introductory psychology courses. They received partial course credit for their involvement in the experiment. Thirty-two participated in Experiment 2a, and 32 participated in Experiment 2b.

**Materials.** The materials were the 20 passages used in Experiment 1. The neutral elaboration condition was created by altering the passages so that the object had no direct association with the protagonist. This neutral elaboration was equivalent in length to the associated and dissociated elaborations, and the target object was mentioned the same number of times (twice explicitly and once implicitly). For each passage, a probe word that referred to the target object was selected. The probe words were presented either immediately after the elaboration section or immediately after the filler section. The portion of the passage that would have followed the probe word was not presented. For each passage, the probe word was followed by the same comprehension questions that were used in Experiment 1.

For each experiment, four materials sets were constructed. Each set contained 10 experimental passages in each of the two elaboration conditions (i.e., associated and neutral elaborations in Experiment 2a and dissociated and neutral elaborations in Experiment 2b). For one half of the passages within each elaboration condition, the probe appeared immediately after the elaboration section; for the remaining half, the probe was presented immediately after the filler section. Across the four sets, the probe appeared once in each of the two probe positions in each passage condition.
Procedure. The procedure for reading passages was the same as in the first experiment. Either immediately after the elaboration section or immediately after the filler section, the passage was stopped by a probe word that was to be named aloud. The probe word was preceded by a cue, XXXX, which appeared for 500 milliseconds in the middle of the screen. Participants were instructed to name the probe word aloud as quickly as possible. When the probe word was named, a voice key was triggered; the probe word was erased from the screen, and naming time for the word was recorded. After the probe word disappeared, participants responded to a comprehension question by pressing either a yes or no key.

Results and Discussion

The mean naming times for the probe words in both Experiments 2a and 2b are presented in Table 2. As can be seen, the time to name a probe word was faster when it followed the elaboration section than when it followed the filler section in both Experiment 2a, $F(1, 28) = 8.67, MSE = 760.99$; and Experiment 2b, $F(1, 28) = 9.71, MSE = 620.59$. In Experiment 2a, planned comparisons confirmed that this was true for the both association condition, $F(1, 28) = 8.67, MSE = 1,019.35$ and $F(1, 28) = 6.76, MSE = 760.99$; and the neutral condition, $F(1, 28) = 20.11, MSE = 1,125.20$ and $F(1, 16) = 5.28, MSE = 2,464.80$. In Experiment 2b, the difference was also reliable for both the dissociation condition, $F(1, 28) = 16.56, MSE = 962.53$ and $F(1, 16) = 5.44, MSE = 1,479.44$. The Elaboration x Probe Position interaction was not significant in Experiment 2a, $F(1, 28) = 1.16, MSE = 795.50$ and $F(1, 16) = 1.33, MSE = 741.47$ and $F_2 < 1$; or in Experiment 2b, both $Fs < 1$. Also, the Experiment x Elaboration x Probe Position interaction failed to approach significance, $F(1, 56) = 1.33, MSE = 741.47$ and $F_2 < 1$.

The naming time results of Experiments 2a and 2b demonstrated that the target objects were less available following the filler section than following the elaboration section. This was true independent of whether the target object was associated or dissociated from the protagonist.

That naming times tended to be faster in the associated conditions than in the dissociated conditions could be taken as evidence that objects associated with the protagonist maintained a higher level of availability. However, this difference did not approach statistical significance. More important, naming times in both the associated and dissociated conditions were similar to naming times in their respective neutral conditions, suggesting that there was no availability advantage–disadvantage of association–dissociation when compared against a neutral baseline.

In Experiment 3, the protagonist decreased in availability to the same degree as objects dissociated from the protagonist suggests that the increased availability levels for protagonist-associated objects found by Glenberg et al. (1987) may be short lived. Also, that there were no differences in the availability levels of the target object in the associated, dissociated, or neutral conditions following the filler sections confirms that the foregrounding (i.e., larger contradiction effect when objects were associated with the protagonist) results of Experiment 1 were due to factors that affected integration (i.e., accessibility) and were not due to underlying differences in object activation levels (i.e., availability). Further discussion of the distinction between the availability and accessibility accounts of foregrounding is postponed until after presenting the results of Experiment 3.

### EXPERIMENT 3

Experiments 1 through 2b demonstrated that protagonist-associated objects are more accessible than protagonist-dissociated objects. The goal of Experiment 3 was to determine whether the degree or importance of association of a target object with the protagonist further influences subsequent accessibility and integration of that object. Theories of text comprehension have been relatively quiet with respect to the influences of degree of association, as long as other factors (distance, number of mentions, etc.) are held constant. Thus, in Experiment 3, the protagonists association with the target object was either high, low, or neutral; but the object was mentioned the same number of times in each condition (see sample passage in the appendix). In the high-associated condition, the sentences elaborated on Dorothy’s customized ice skates and how she always took them with her when she went to the park. In the low-associated condition, Dorothy’s skates were mentioned the same number of times, but that they were in her possession was not as strongly emphasized. The neutral condition was created by mentioning the target object the same number of times, but was neutral with respect to the protagonist’s possession of it. The information in the critical sentence was inconsistent with the information in
both the high- and low-associated elaborations, and neutral with respect to the neutral elaboration.

If readers develop a situation model in which objects associated with the protagonist are maintained in the discourse representation in memory, and they only check the consistency of the critical sentence against that representation, the relative importance or salience of the association should not influence subsequent processing. Consider the snapshot metaphor presented earlier. As long as the reader understands that Dorothy has her skates, it should not matter whether Dorothy’s skates are important to her or not; either way, skates become part of the discourse model and are accessible to the reader. Thus, degree of association should not influence later integration of the target object. According to this view, reading times on the critical sentences in the high- and low-associated conditions should not differ reliably from one another, but both should yield longer reading times on the critical sentence than the neutral condition. On the other hand, if the strength or importance of the association between the protagonist and the target object does influence later accessibility of the object, the inconsistency in the critical sentence may result in more processing difficulty in the high associated condition than in the low associated condition.

Method

Participants. Thirty University of Utah undergraduates who were enrolled in introductory educational psychology courses received course credit for their participation in the experiment.

Materials. The materials were 18 of the passages used in Experiment 1, modified for the purposes of this experiment, along with 18 neutral filler passages. An example is presented in the appendix. Each experimental passage began with two to three introductory sentences that served to introduce the main character and the theme of the story. Then one of three elaboration conditions was presented: high associated, low associated, or neutral. For all experimental passages, the target object was mentioned twice explicitly and once implicitly. In the high- and low-associated conditions, the target object was always described as being in the possession of the protagonist, but it was more strongly associated with the protagonist in the high-associated condition. Following the elaboration section, several sentences (range = 4–6 sentences; M = 65 words) shifted the focus of the passage away from the elaboration but continued the storyline developed in the introductory sentences. The filler section was followed by two critical sentences. The first critical sentence always stated that the target object was not in the possession of the protagonist. The second critical sentence was included to detect any spillover effects. Both the critical and spillover sentences ranged from 38 to 41 characters in length. Each passage ended with a concluding section, composed of two to three sentences. Finally, a comprehension question was included to ensure that participants were reading the passages carefully. There were an equal number of yes and no comprehension questions. The filler passages were similarly constructed to the experimental passages and served to disguise the purpose of the experiment.

Three sets of materials were constructed; each set contained six experimental passages in each of the three conditions. Across the three sets, each passage appeared once in each of the three conditions. The 18 filler passages appeared in each of the three sets.

Norming study. To ensure that we had appropriately manipulated the degree of the association between the protagonist and the target object across the three elaboration conditions, and that readers were sensitive to this manipulation, a norming study was conducted, with 21 University of Utah students as participants. Participants read each passage on a computer monitor in either the high-associated, low-associated, or neutral condition. Each passage was terminated just prior to the first critical sentence. Participants were instructed to read each passage carefully and then press a key to continue. When the key was pressed, the screen was erased and a question was presented asking participants to rate the likelihood of the protagonist being in possession of the target object (e.g., How likely is it that Dorothy had her skates with her?) on a scale ranging from 1 (extremely unlikely) to 7 (extremely likely). Three different materials sets were created; each set contained six passages in each of the three conditions. Across the three materials sets, each passage appeared in each condition an equal number of times. We expected higher ratings in the high-associated condition than in either the low-associated or neutral conditions. Our findings supported this prediction—ratings were significantly higher in the high-associated condition (M = 6.34) than in either the low-associated condition (M = 5.95), t(20) = 4.113; or the neutral condition (M = 4.91), t(20) = 7.299. Ratings were also significantly higher in the low-associated condition than in the neutral condition, t(20) = 4.808.

Procedure. Participants were randomly assigned to one of three stimulus sets. The rest of the procedure was the same as in Experiment 1.

Results and Discussion

The mean reading times for the critical and spillover sentences in Experiment 3 are presented in Table 3. Separate analyses of variance were conducted on the critical and spillover sentences. There was a significant main effect of association for the critical sentence, $F_1(2, 66) = 4.32, MSE = 54,807.04$ and $F_2(2, 30) = 4.54, MSE = 91,095.93$; but not for the spillover sentence. $F_1 < 1$ and $F_2(2, 30) = 1.92, MSE = 34,495.71, p = .17$. For the critical sentence, planned comparisons confirmed that reading times were
whether foregrounding effects are influenced by the degree of association (or importance) of an object to a protagonist.

Our second goal was to determine whether foregrounding effects are influenced by the degree of association (or importance) of an object to a protagonist. Our first goal of this study was to further test the foregrounding argument initially presented in the original Glenberg et al. study. Our second goal was to determine whether foregrounding effects are influenced by the degree of association (or importance) of an object to a protagonist.

Several researchers have assumed that objects associated with the protagonist are maintained in the foreground of a situation model. Those objects remain readily available in memory, whereas objects not associated with the protagonist are dropped from the model and become less available (e.g., Glenberg & Langston, 1992; Glenberg et al., 1987; Morrow et al., 1987; Zwaan & Madden, 2004). The first goal of this study was to further test the foregrounding argument initially presented in the original Glenberg et al. study. Our second goal was to determine whether foregrounding effects are influenced by the degree of association (or importance) of an object to a protagonist.

In Experiment 1, readers were presented with texts that described an object as being either associated or dissociated with respect to the protagonist. After several intervening sentences, they read a target sentence that was either consistent or inconsistent with the information presented earlier about the object. If the foregrounding effect that Glenberg et al. (1987) observed for associated objects was due to long-term increases in object availability, those concepts should have been more available for integration with incoming text than dissociated concepts. This led to a prediction that readers should experience more processing difficulty due to inconsistencies about associated objects in the critical sentence than for inconsistencies about dissociated objects. Previous studies have demonstrated that this processing difficulty in the presence of inconsistent information is the result of readers noticing and trying to resolve the inconsistency (Albrecht & O'Brien, 1993; Hakala & O'Brien, 1995; Johnson & Seifert, 1994, 1998). The reading time results from Experiment 1 were consistent with this view. However, the naming time results of Experiments 2a and 2b demonstrated that immediately prior to the presentation of the critical sentence, the associated object was not facilitated in memory compared to either a neutral control condition or the dissociated condition (nor was the dissociated object inhibited).

Taken together, the results from Experiments 1 through 2b indicate that the long-term foregrounding effect for the associated condition in Experiment 1 was due to underlying differences in object accessibility and not due to differences in object availability. Our results are consistent with those first demonstrated by Glenberg et al. (1987) but offer a further refinement: Objects associated with the protagonist do appear to hold a special status in the discourse representation in memory. Although this special status may result in accessibility (i.e., integration) advantages for protagonist-associated objects, it does not necessarily translate into increases in availability (i.e., activation levels). When information about a highly accessible concept is presented, that concept may be accessed from long-term memory and integrated more quickly than less accessible concepts. When the presented information is inconsistent, readers may detect and attempt to resolve the inconsistency more quickly. That backgrounded concepts may differ in terms of accessibility but not availability is consistent with Sanford and Garrod's (1981) implicit focus, which they described as, "... a partition of long-term memory which is simply currently privileged in terms of ease of access" (p. 162; see also, Sanford & Garrod, 1998, 2005) and with Ericsson and Kintsch's (1995) view of long-term working memory.

An alternative explanation for the results of Experiments 1 through 2b is that dissociated objects contain an extra negating proposition that makes them more difficult to integrate once reactivated and this may have impaired processing of the inconsistency in the critical sentence relative to the associated condition (e.g., Cook, Myers, & O'Brien, 2005; Kaup & Zwaan, 2003). However, dissociating an object from the protagonist does not negate the object, nor does it require an addi-

### GENERAL DISCUSSION

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### TABLE 3

<table>
<thead>
<tr>
<th>Passage Condition</th>
<th>High Associated</th>
<th>Low Associated</th>
<th>Neutral</th>
</tr>
</thead>
<tbody>
<tr>
<td>Critical sentence</td>
<td>2.048</td>
<td>2.142</td>
<td>1.914</td>
</tr>
<tr>
<td>Spillover sentence</td>
<td>2.065</td>
<td>2.016</td>
<td>2.021</td>
</tr>
</tbody>
</table>

significantly shorter in the neutral condition than in either the high-associated condition, $F_1(1, 33) = 4.35$, $MSE = 147,897.03$ and $F_2(1, 15) = 6.34$, $MSE = 209,031.71$; or the low-associated condition, $F_1(1, 33) = 9.46$, $MSE = 197,252.39$ and $F_2(1, 15) = 6.69$, $MSE = 202,278.41$. The difference between the high- and low-associated conditions did not approach significance, $F_1 = 1.03$ and $F_2 < 1$.

The results from Experiment 3 showed that the degree of association had no measurable impact on integration of the critical sentence. Readers experienced the same amount of difficulty processing the critical sentence when the importance of the target object to the protagonist was either high or low. It could be argued that readers did not notice or encode the difference in the degree of association. However, readers from the offline norming study confirmed that this was not true. Participants rated that the target object was in the possession of the protagonist as significantly more likely in the high-associated condition than in the low-associated conditions, indicating that the high- and low-associated objects were represented differently in memory. The results of the online reading task demonstrated that these encoded differences did not appear to impact the accessibility of the object, as measured by time to read the target sentence.

### GENERAL DISCUSSION

Several researchers have assumed that objects associated with the protagonist are maintained in the foreground of a situation model. Those objects remain readily available in memory, whereas objects not associated with the protagonist are dropped from the model and become less available (e.g., Glenberg & Langston, 1992; Glenberg et al., 1987; Morrow et al., 1987; Zwaan & Madden, 2004). The first goal of this study was to further test the foregrounding argument initially presented in the original Glenberg et al. study. Our second goal was to determine whether foregrounding effects are influenced by the degree of association (or importance) of an object to a protagonist.
tional proposition (or idea unit) to express. Indeed at the surface level, it is no more 
complex to convey that "Sally took her skates with her" than it is to convey that 
"Sally left her skates behind." The results of all three experiments are consistent 
with the view that the reader pays special attention to not only the protagonist, but 
objects associated with the protagonist.

In Experiment 3, we investigated whether object accessibility was further influ­
enced by degree or importance of an object's association with the protagonist. 
There was no evidence for an influence of degree of association; reading times for 
the target sentence did not differ for the high- and low-association conditions. 
However, it is certainly the case that if the text contained sufficient emphasis on an 
object, it could alter the degree to which a reader focused on that object and thus in­
fluence its accessibility. These results suggest that within a reasonably wide range, 
degree of emphasis does not influence whether an object associated with the pro­
tagont is incorporated into the situation model. This finding fits well within the 
assumptions of the situation model perspective (e.g., Sanford & Garrod, 1981, 
1998, 2005; Zwaan et al., 1995; Zwaan & Radvansky, 1998). Once an object is as­
associated with a protagonist, it is guaranteed a place in the discourse representation, 
or in the snapshot of the situation described by the text. Subsequent integration of 
the object appears to be dependent on its existence in the snapshot, and not on more 
specific details encoded therein. This is consistent with the view that not all infor­
mation that is encoded in memory, or even reactivated from memory, automati­
cally affects integration processes (Cook et al., 1998; Long & Chong, 2001; Long 
& Lea, 2005).

A possible limitation of this work is that it is based on laboratory-constructed 
narrative texts. One reason for using such texts in this type of research is that they 
can mimic passages from naturalistic narrative texts, yet they allow researchers to 
maintain high levels of control over relevant variables (e.g., number of mentions, 
length, etc.). Indeed, most theories of discourse comprehension have been based 
on such texts and may be subject to the same limitations. Thus, it remains a neces­
sary step to determine whether the findings observed with these researcher-
constructed narratives generalize to pre-existing—and likely more natural—
fictional and expository texts.

In addition, the use of inconsistencies always raises the issue of whether the 
Gricean maxim of quality (Grice, 1975) has been violated. However, the purpose of 
this study (or any study using the inconsistency paradigm) was to investigate the 
accessibility of information in a passage. If readers are sensitive to an inconsist­
tency, that can be taken as evidence that targeted information from earlier in the pas­
sage became accessible and disrupted comprehension. Once this information is 
available, the question of whether the degree of processing difficulty is sufficient 
to be considered a violation of a Gricean maxim is a separate question. The slow­
downs in reading for inconsistent target sentences indicate that readers were sensi­
tive to these violations in both the associated and dissociated conditions. Previous 
research suggests that slowdowns in reading time for this type of inconsistency in­
dicate that readers are attempting to resolve the inconsistencies (e.g., Albrecht 
clear that the inconsistencies did not detract from readers' overall comprehension 
of the passages. Participants had very high accuracy rates to comprehension ques­
tions (all Ms > 90%), and these rates did not vary significantly across conditions, 
F5 < 1.

In conclusion, the results of these experiments extend previous research on 
foregrounding effects. These results demonstrate that foregrounded concepts do 
not necessarily remain at a heightened state of activation, but they do remain more 
accessible to the reader than backgrounded concepts. This distinction between a 
concept's accessibility and a concept's availability is important, and has not been 
clear in previous work on foregrounding effects, especially where evidence for 
foregrounding has been based on measures of availability (e.g., Myers & O'Brien, 
1998; O'Brien & Myers, 1999). Accessibility refers to the representation of infor­
mation in the reader's updated discourse representation in memory (i.e., situation 
model); availability refers to whether or not a concept is currently active in work­
ing memory. The distinction between accessibility and availability demonstrated 
in these results supports the assumptions made by Zwaan and colleagues (Graesser 
et al., 1997; Zwaan et al., 1995; Zwaan & Radvansky, 1998; see also, Ericsson & 
tion maintained in readers' situation models, and about the processing advantages 
associated with these representations.

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Discourse Processes, 39,101–120.

211–245.


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Psychology, 48, 163–189.
Sample Passage for Experiments 1 through 2b

Introduction

Dorothy loved the winter season in New England. One morning she woke up to find that there was a fresh blanket of snow on the ground. She decided to go to the local park to enjoy the winter weather.

Associated Elaboration

Her boyfriend had recently given her a pair of customized ice skates that Dorothy always took to the park with her. Dorothy got the skates from her closet and tossed them over her shoulder on her way out the door.

Dissociated Elaboration

She decided to leave behind her customized ice skates that her boyfriend gave her. Dorothy had never taken these skates to the park because she did not want them to be damaged by the uneven ice on the outdoor rink.

Neutral Elaboration (Experiments 2a and 2b only)

She had been going to the park since she was a very young girl and her parents had given her her first pair of ice skates. She had loved those old skates and had become very skilled at using them.

Filler

She trudged through the snow covered streets on her way to the park. She was amazed at how beautiful the trees looked as their branches glistened in the sun. Dorothy noticed that there were quite a few people already enjoying the winter wonderland when she arrived. She spotted some friends who were having fun at the frozen pond. They called Dorothy over to join them.
Dissociated–Consistent/Associated–Inconsistent Critical and Spillover Sentences

Dorothy wished she had a pair of skates.
She decided to go to the rental booth.

Associated–Consistent/Dissociated–Inconsistent Critical and Spillover Sentences

Dorothy eagerly put on her ice skates. She tied her laces and went to the rink.

Closing

She asked the lady at the counter for her size. Dorothy laced up the skates and stepped onto the ice.

Probe (Experiments 2a and 2b only):

skates

Sample Passage for Experiment 3

Introduction

Dorothy loved the winter season in New England. One morning she woke up to find that there was a fresh blanket of snow on the ground. She decided to go to the local park to enjoy the winter weather.

High-Associated Elaboration

Her boyfriend had recently given her a pair of customized ice skates that Dorothy always took to the park with her. Dorothy got the skates from her closet and tossed them over her shoulder on her way out the door.

Low-Associated Elaboration

Dorothy put on her boots and a heavy coat before leaving. She saw her ice skates and decided to take them with her. She picked up the skates along with a pair of insulated mittens to keep her hands warm.

Neutral Elaboration

She had been going to the park since she was a very young girl and her parents had given her her first pair of ice skates. She had loved those old skates and had become very skillful at using them.

Filler

She trudged through the snow covered streets on her way to the park. She was amazed at how beautiful the trees looked as their branches glistened in the sun. Dorothy noticed that there were quite a few people already enjoying the winter wonderland when she arrived. She spotted some friends who were having fun at the frozen pond. They called Dorothy over to join them.

Critical and Spillover Sentences

Dorothy wished she had a pair of skates. She decided to go to the rental booth.

Closing

She asked the lady at the counter for her size. Dorothy laced up the skates and stepped onto the ice.