Readers' sensitivity to linguistic cues in narratives: How salience influences anaphor resolution

CELIA M. KLIN, KRISTIN M. WEINGARTNER, and ALEXANDRIA E. GUZMÁN
State University of New York, Binghamton, New York

and

WILLIAM H. LEVINE
University of Arkansas, Fayetteville, Arkansas

Despite the general assumption that anaphoric inferences are necessary inferences, Levine, Guzmán, and Klin (2000) concluded that the probability of resolving noun phrase anaphors depends both on the degree of accessibility in memory of the antecedent concepts and the extent to which resolution is necessary to create a coherent discourse representation. Four experiments are presented in which the factors that influence readers' standard of coherence are investigated. We examine the hypothesis that readers are more likely to resolve anaphors that are perceived as salient; salience was manipulated both with a syntactic focusing structure (*wh*-clefts) and with the addition of prenominal adjectival modifiers. The results of a probe recognition time task provide support for the hypothesis that a variety of linguistic cues serve as *mental processing instructions* (Givón, 1992), which instruct readers as to how much attention to devote to processing.

A central aspect of reading comprehension involves making connections between currently read text and information from earlier in the passage. These connections are often signaled by *anaphors*, which are words or phrases that refer to some earlier mentioned concept. Although research on anaphoric inferences has tended to start with the assumption that these are necessary inferences and therefore must be drawn for comprehension to be complete, Levine, Guzmán, and Klin (2000) hypothesized that the probability of identifying the antecedent for a noun anaphor should be a function of two factors: (1) the degree of accessibility in memory of the antecedent concept and (2) the extent to which resolution is necessary to create a coherent discourse representation. More specifically, when an anaphor is encountered, if the antecedent is not sufficiently accessible to be automatically reactivated from memory and readers' *standard of coherence* (van den Broek, Risden, & Husebye-Hartmann, 1995) is met without this information, it should be inefficient for them to devote attentional resources to retrieving the antecedent.

In the present article, we ask what factors influence readers' standard of coherence. We hypothesize that a va-

riety of sources of text information—pragmatic, semantic, and syntactic—influence the amount of processing a text input receives. This is consistent with Givón's (1992) idea that different types of linguistic cues influence comprehension by functioning as *mental processing instructions*, informing the reader (or listener) as to the importance of concepts and the amount of attention to allocate to them. More specifically, Givón argued that the thematic importance of definite referents influences their activation. This suggests that anaphoric concepts that have been conveyed as being central, rather than peripheral, to a narrative should be processed more thoroughly, and readers should be less likely to read on without identifying the antecedents.

In support of these ideas, there is evidence that the accessibility of information is influenced by a variety of lexical and syntactic factors. For example, McKoon, Ward, Ratcliff, and Sproat (1993; see also Almor, 1999) found that readers resolved anaphors more quickly when the antecedent was introduced in a focused position in a prior sentence, suggesting that it had been maintained at a higher level of activation. In addition, several studies in which the processing of single sentences were examined have demonstrated that subtle structural changes in the grammatical form of the sentence alter the salience of text information; this has been found with the use of *wh*-questions (e.g., Birch & Rayner, 1997; Cutler & Fodor, 1979), *it* cleft constructions (e.g., Birch & Garnsey, 1995; Morris & Folk, 1998), and subordinate versus main clauses (e.g., Baker & Wagner, 1987). These linguistic focusing devices lead to better memory for the focused portion of the sentence (e.g., Gernsbacher & Jescheniak, 1995),

This research was supported by National Institute of Mental Health Grant R03 MH61839. Portions of this research were presented at the 41st Annual Meeting of the Psychonomic Society (November 2000, New Orleans). We thank Sarah Burt, Heather Christy, Tara Jans, Jaclyn Levy, Mandi Marsh, Jeralyn Mastroianni, Dawn Melzer, Jordhanys Pereyra, Shannon Sowle, Anna Taran, and Rebecca Zucker for their assistance in data collection. Correspondence concerning this article should be addressed to C. M. Klin, Department of Psychology, State University of New York, Binghamton, NY 13902-6000 (e-mail: cklin@binghamton.edu).

longer reading times (e.g., Birch & Rayner, 1997; Carpenter & Just, 1977), and better error detection (e.g., Bredart & Docquier, 1989).

Before discussing the details of the present set of experiments, we will review a recent series of studies (Levine et al., 2000) that demonstrate that there are conditions under which readers fail to resolve noun phrase anaphors, even when an antecedent is accessible in memory, without any disruption to comprehension. Consider the distractor–anaphor version of the sample passage in Table 1.

When a salient distractor (e.g., *cake*) intervened between a noun phrase anaphor (e.g., *the dessert*) and its antecedent (e.g., *tart*), readers failed to reinstate the antecedent. This occurred despite the fact that reading was self-paced and that the antecedent *was* accessible in memory. Support for this latter claim came from a study in which asterisks were placed around the anaphor line (e.g., ***Wanda said to save room for the dessert***) and readers were told that comprehension questions were likely to address information found in this line; under these conditions, resolution occurred. On the basis of this, Levine et al. (2000) concluded that in the version without the asterisks, additional processing would have been

sufficient to lead to resolution. However, because it was not necessary to know that the dessert was a tart, readers did not invest the additional resources. That is, although comprehension may have been enhanced by drawing the anaphoric inference, the proposition containing the anaphor was both locally and globally coherent even without identifying the antecedent; it was easily integrated with the previous sentence as well as with the rest of the passage. Thus, there was no reason for readers to engage in the additional processing needed for resolution. In addition to demonstrating that there are conditions under which readers do not resolve noun phrase anaphors, Levine et al. systematically examined a number of factors that influence the accessibility of the antecedent, such as the distance between the anaphor and the antecedent, the presence of a same-category distractor, and the salience of that same-category distractor. In contrast with these factors, Levine et al. did not examine the influence of readers' assessment of the coherence of the unresolved anaphor. However, we assume that the probability of resolving an anaphor is dependent in part on the need to do so. More specifically, we hypothesize that the perceived salience of an anaphor influences the probability of resolution.

How might this occur? One possibility is that there is a general mechanism such that readers continually adjust the amount of processing devoted to each text input on the basis of its perceived importance, or *salience*. This is consistent with the findings that text in the focused portion of a sentence is remembered better (e.g., Gernsbacher & Jescheniak, 1995) and that readers are more likely to detect errors in text that is linguistically focused (e.g., Bredart & Docquier, 1989). These findings suggest that linguistic focus serves as a cue to readers to process the information more thoroughly.

A second possibility is that salience has its influence at a later stage—after a comprehension failure occurs. For example, according to Myers and O'Brien's (1998) resonance model, each text input automatically initiates the activation of related traces in memory. However, readers can continue processing a text input, resampling long-term memory with the current contents of working memory when processing fails—for example, “when an anaphoric reference fails to produce an appropriate antecedent” (p. 133). Furthermore, the decision of whether to continue processing depends in part on the reader's motivation, or *standard of coherence* (van den Broek et al., 1995). Thus, if the anaphors in the Levine et al. (2000) passages had been perceived as more central to the passage, readers' standard of coherence may not have been met without resolution. This in turn might have encouraged readers to continue processing the anaphor.

Levine et al. (2000) provided initial support for the hypothesis that readers will engage in additional processing if an anaphor is salient. In their Experiment 6 (the asterisks experiment described above), simply instructing readers that the anaphor line was important was sufficient to lead to resolution. Clearly, the instructions did not directly increase the antecedents' accessibility in

Table 1
Sample Passage from Experiment 1

Introduction

Wanda was throwing a surprise party for her best friend John. John had just been promoted to Vice President of the company and some of his close friends wanted to congratulate him.

Backgrounding

Distractor–anaphor/Distractor–no-anaphor versions. Wanda even made him a *tart*. She felt a little pressured because her daughter's graduation was the next day and she needed to prepare for that occasion as well. She also still had to get decorations and stop at the bakery for a *cake*. Her daughter loved their chocolate *cakes*. They were filled with a very rich cream and had gooey dark chocolate frosting on them. Wanda decided to have the *cake* decorated with white flowers and a white border.

No-distractor–anaphor version. Meanwhile John was rushing around preparing for his daughter's graduation the next day. He still had to stop at the store for decorations. Wanda was working hard preparing for the evening. She had bought flowers for the table and even made a *tart*.

Conclusion

Wanda hoped the evening would be fun. The guests arrived right on time. As everyone sat down to eat, Wanda

Last Line

Distractor–anaphor/No-distractor–anaphor version. said to save room for the dessert.

Distractor–no-anaphor version. congratulated John on the promotion.

Recognition Probe

TART

Comprehension Question

Was John recently fired?

memory; instead, they caused readers to engage in additional processing, leading to a greater probability of recovering the referent from memory.

In the present set of experiments, we asked whether making the anaphor more salient through linguistic emphasis also increases the probability of resolution. To answer this question, we first replicated the finding (Levine et al., 2000) that readers do not always resolve noun phrase anaphors. Next, we manipulated the salience of the anaphor in two ways: In Experiment 2, we used a syntactic focusing manipulation, and in Experiments 3 and 4 we added an adjective modifier to the anaphoric noun phrase.

EXPERIMENT 1

The goal of Experiment 1 was to replicate the finding from Levine et al. (2000) that readers do not always resolve categorical anaphors, even when they are free to read at any rate and an antecedent is available. As in Experiment 1 from Levine et al., passages appeared in three versions (see Table 1). The first was a distractor–anaphor version, in which passages ended with a line that contained a categorical anaphor in a definite noun phrase (e.g., *the dessert*) that referred to an antecedent (e.g., *tart*) that had been mentioned earlier in the passage. The antecedent was mentioned once early in the passage and then was followed by backgrounding material that included a topic shift in which a same-category distractor (e.g., *cake*) was introduced. To make reinstatement of the antecedent difficult, the distractor was a more typical member of the anaphoric category than the antecedent (Battig & Montague, 1969). In addition, there were several lines of elaboration about the distractor. Assuming that the distractor is activated when the anaphor is processed (e.g., Corbett, 1984), both the extensive elaboration and the high typicality manipulations should increase the distractor's level of activation and consequently decrease the level of activation of the antecedent. Immediately after the anaphor line, a probe word (i.e., the antecedent) was presented for recognition. If the anaphor is resolved, the antecedent should be highly active, leading to facilitation when it is presented as a test probe (e.g., Dell, McKoon, & Ratcliff, 1983). In contrast, if readers fail to resolve the anaphor, responding to the antecedent probe should not be facilitated.

The second version, distractor–no-anaphor, was identical to the distractor–anaphor version except that the last line did not contain an anaphor. Instead, it continued with the theme of the passage (e.g., “Wanda congratulated John on the promotion”) and in no way made reference to the antecedent concept. This version served as a control. If readers resolve the anaphor in the distractor–anaphor version, recognition decisions should be faster and more accurate than those in the distractor–no-anaphor version. On the other hand, if they fail to resolve the anaphor, there should be no difference between the two versions.

Finally, in the third version, no-distractor–anaphor, the last line contained the categorical anaphor, as it did

in the distractor–anaphor version, but the passages were written so that the antecedent should be easily accessible. There was less intervening material between the anaphor and the antecedent, and there was no same-category distractor. The lengthy elaboration about the cake, for example, was removed and replaced with a shorter section of material that was unrelated to the anaphor. Given the findings from several prior studies (e.g., Dell et al., 1983; O'Brien, Raney, Albrecht, & Rayner, 1997), the anaphor should be easily resolved in this version; the anaphor is unambiguous and the antecedent is backgrounded by only two or three lines of text. This version was included as an additional baseline. If the anaphor is not resolved in the distractor–anaphor version, latencies and error rates should be the same as those in the distractor–no-anaphor version, leading to a null result. In contrast, latencies should be faster and error rates should be lower in the no-distractor–anaphor version. This version was also included to control for semantic priming; any priming from the anaphor (e.g., *dessert*) to the antecedent (e.g., *tart*) should be equal in the distractor–anaphor and no-distractor–anaphor versions.

Method

Participants. Fifty undergraduates at the State University of New York at Binghamton participated as part of the requirement for an introductory psychology course. The data were eliminated for 11 participants who made more than 25% probe or comprehension question errors. Therefore, the analyses were based on 39 participants.

Materials. There were 18 experimental passages, with three versions of each: distractor–anaphor, distractor–no-anaphor, and no-distractor–anaphor. A sample passage can be found in Table 1. The distractor–anaphor and distractor–no-anaphor versions were identical until the last line. The antecedent was mentioned once early in the passage and then was followed by a topic shift in which the distractor was introduced. The distractor was a member of the same category as the antecedent but was a more typical exemplar of that category (Battig & Montague, 1969). In addition, there were four to eight lines of elaboration about the distractor. Whereas in the distractor–anaphor version the last line of the passage included a categorical anaphor that referred to the antecedent (e.g., *the dessert*), in the distractor–no-anaphor version the last line mentioned some other concept (e.g., *John's promotion*). The last lines were equated for length by number of characters in the two versions.

The third version was the no-distractor–anaphor version, which was identical to the distractor–anaphor version except that instead of elaborating on a same-category distractor (e.g., *cake*), the backgrounding section was replaced with information that was unrelated to the anaphor. The neutral backgrounding was as similar as possible to the distractor elaboration section, being similar in content and introducing a topic change. However, the antecedent appeared an average of only three lines before the anaphor, in comparison with the two distractor versions in which the antecedents appeared an average of 10 lines before the anaphor. See the Appendix for a complete set of the antecedents, distractors, and anaphors used.

All three versions of the passage were followed by a recognition probe, which was the target antecedent. There were also 22 filler passages that varied in length. One recognition probe was generated for each filler passage. Fifteen filler passages were followed by a probe word that required a “no” response. Of the no probes, approximately 40% were related to the passages, and 60% were unrelated. Over the course of the experiment, the participants read a total of 40 passages, 25 of which required a “yes” probe response. A yes/no comprehension question was generated for each experi-

mental and filler passage to encourage the participants to read carefully. These questions never referred to the anaphor, and the numbers of the “yes” and the “no” responses were equated.

Design. For each participant, experimental passages were randomly assigned to the distractor–anaphor, distractor–no-anaphor, and no-distractor–anaphor versions, with two constraints: (1) Each participant saw one third of the passages in each version, and (2) each version of each passage was presented to one third of the participants. The order of presentation was the same for all the participants. Filler passages were interspersed among the experimental passages.

Procedure. The participants were tested individually in an experimental session lasting approximately 45 min. The passages were presented one line at a time on a computer monitor. The participants were instructed to read each passage for comprehension at their own pace. Each trial began with the presentation of the phrase “Ready for the next story” in the center of the screen. The participants controlled the presentation of the text with a line advance key. Each keypress caused the current line of text to be erased and the next to be presented. Immediately after the final line of the passage was presented, pressing the line advance key caused the final line to be erased and the string “XXX” to be presented for 500 msec. The participants did not know they were at the end of the passage until this cue appeared. This cue was replaced by a recognition probe word in capital letters. The participants were instructed to indicate, as quickly and accurately as possible, whether the probe word had been in the preceding passage by pressing a yes or a no key on a response box. Following the response, the probe word was erased from the screen, and the participants received feedback about the response time. On trials on which the participants took longer than 1,500 msec to respond, the phrase “Please try to respond to probes more quickly” was presented for 1,500 msec. Following the probe task, the string “???” appeared on the screen for 750 msec and was followed by a yes/no comprehension question. The participants responded by pressing the yes or the no key on the response box. On trials on which the participants responded incorrectly, the word “Error” appeared in the center of the screen for 1 sec. If the participants responded incorrectly on three or more comprehension questions, the phrase “Please try to be more accurate on questions” was presented for 2 sec. The participants were given two breaks during the experiment. To familiarize the participants with the procedure, they completed three practice passages before starting the experiment.

Results and Discussion

In all experiments, t_1 and F_1 refer to analyses in which the error term was based on subject variability, and t_2 and F_2 refer to analyses in which the error term was based on item variability. An alpha level of .05 was used across all experiments. Correct recognition probe response times, error rates, and last line reading times are presented in Table 2. Note that last line reading times will be discussed after all four experiments have been presented.

Probe recognition times. The mean recognition times were computed after discarding outliers; this eliminated 3.8% of the data. The pattern of recognition times and error rates replicated those found by Levine et al. (2000). Not surprisingly, in the no-distractor–anaphor version, in which passages were short and there was no same-category distractor, readers drew an anaphoric inference. Probe reaction times were 42 msec faster than those in the distractor–no-anaphor control. This difference was reliable by subjects [$t_1(38) = 2.76$, $SEM = 15.14$], although it failed to reach significance by items

Table 2
Probe Response Times (in Milliseconds), Error Rates (in Percentages), and Last Line Reading Times (in Milliseconds) in Experiments 1 and 2

Version	Response Time	Error Rate	Reading Time
Experiment 1			
Distractor–no-anaphor	775	17.5	1,504
No-distractor–anaphor	734	7.7	1,560
Distractor–anaphor	766	19.7	1,653
Experiment 2: <i>wh</i> -clefts			
Distractor–no-anaphor	882	14.1	2,076
No-distractor–anaphor	808	7.5	2,073
Distractor–anaphor	847	14.1	2,188

[$t_2(17) = 1.29$, $SEM = 28.02$, $p = .14$].¹ In contrast to the facilitation found in the no-distractor–anaphor version, there was no facilitation when an elaborated, same-category distractor was included in the passage [contrasting the distractor–anaphor and distractor–no-anaphor versions, $t_1(38) = 0.64$, $SEM = 13.85$, $p = .52$, and $t_2(17) = .11$, $SEM = 21.79$, $p = .91$]. Despite all the previous findings demonstrating that anaphoric inferences are reliably drawn, there was no evidence that readers resolved the anaphor in the distractor–anaphor version. After reading “save room for the dessert,” the concept *tart* was no more accessible in memory than after reading “congratulated John on the promotion,” despite the fact that it had been explicitly stated that Wanda was making a tart for dessert. The signal from the anaphor was clearly not strong enough to reactivate the intended antecedent. In addition, because the inference was not necessary for comprehension (i.e., the readers did not need to know that the dessert was a tart), the readers seem to have been willing to leave the referent unresolved. Furthermore, note that there was no measurable lexical priming from the anaphor to the probe word, which is evidence against such an explanation of the results of Experiments 2, 3, and 4.

Error rates. The pattern of error rates tells the same story as the probe reaction times. In the distractor–anaphor and distractor–no-anaphor versions, in which readers did not draw an inference, the numbers of probe errors were almost identical ($p = .6$). However, in the no-distractor–anaphor version, in which an inference was drawn, there were significantly fewer errors [no-distractor–anaphor vs. distractor–no anaphor, $t_2(17) = 2.68$, $SEM = 0.48$].

EXPERIMENT 2

On the basis of the results of Experiment 6 in Levine et al. (2000), in which an instructional manipulation led to reinstatement of the antecedent in the distractor–anaphor version, we hypothesized that text factors that increase the salience of an anaphor should also serve to increase the probability of resolution. To test this hypothesis, we asked whether readers would have resolved the anaphors in the distractor–anaphor version of Experiment 1, despite

the relative inaccessibility of their antecedents, if the anaphor had been more salient.

More specifically, given that syntactic focus has been found to increase the perceived salience of entities (e.g., Almor, 1999; Birch, Albrecht, & Myers, 2000), we hypothesized that syntactically focused anaphors would be more effective retrieval cues. Previous experiments have demonstrated that syntactic focus serves to increase the salience of concepts, as well as to strengthen their memory trace. Syntactic focus has been manipulated with *wh*-questions (e.g., Birch & Rayner, 1997; Cutler & Fodor, 1979), *it* cleft constructions (e.g., Birch & Garnsey, 1995; Morris & Folk, 1998), and subordinate versus main clauses (e.g., Baker & Wagner, 1987). These linguistic focusing devices have been found to lead to better memory for the focused portion of the sentence (e.g., Gernsbacher & Jescheniak, 1995) and longer reading times (e.g., Birch & Rayner, 1997; Carpenter & Just, 1977). Moreover, in a story continuation task, Birch et al. (2000) found that readers were more likely to refer to concepts from earlier in the story if they had been syntactically focused than if they had not, suggesting that syntactic focus serves to increase the accessibility of the focused concepts as well as to increase readers' expectations that these concepts will continue to be prominent in the story.

In this experiment, we attempted to increase the salience of the anaphors by placing them in a focused position in the sentence. Because manipulating an anaphor's syntactic focus does not influence the memory strength of the antecedent or the overlap between the anaphor and the antecedent, any increase in resolution can be attributed to the influence of the salience of the anaphor on processing. Passages appeared in the same three versions introduced in Experiment 1 (see Table 3). However, in the distractor-anaphor version, the anaphoric noun phrase appeared as the focused constituent of a *wh*-cleft (e.g., "what everyone asked about was the dessert"). Given the finding that some syntactic constructions increase the perceived salience of an entity or a proposition, we hypothesized that these syntactically focused anaphors should receive more attention (Birch & Rayner, 1997). If this is the case, anaphors in the focused position of a sentence will have a higher probability of reactivating their antecedents, even when those antecedents are not easily accessible in memory. This is in contrast with the materials used in Experiment 1 and Levine et al. (2000), in which each critical anaphor simply appeared in a definite noun phrase (e.g., "Wanda said to save room for *the dessert*"). Although the use of a definite noun phrase often presupposes a specific referent (Russell, 1905), readers seemed to be satisfied to read on without identifying the particular dessert. We hypothesize that the addition of the cleft structure to the anaphors should serve to make the concept *dessert* more salient, increasing the probability that the antecedent is identified.

There were two comparison conditions. The distractor-no-anaphor version was identical to the distractor-anaphor version except that the last line did not refer to the target antecedent. However, to make it as similar as possible to

Table 3
Sample Passage from Experiment 2

Introduction

Wanda was throwing a surprise party for her best friend John. John had just been promoted to Vice President of the company and some of his close friends wanted to congratulate him.

Backgrounding

Distractor-anaphor/Distractor-no-anaphor versions. Wanda even made him a *tart*. She felt a little pressured because her daughter's graduation was the next day and she needed to prepare for that occasion as well. She also still had to get decorations and stop at the bakery for a *cake*. Her daughter loved their chocolate *cakes*. They were filled with a very rich cream and had gooey dark chocolate frosting on them. Wanda decided to have the *cake* decorated with white flowers and a white border.

No-distractor-anaphor version. Meanwhile John was rushing around preparing for his daughter's graduation the next day. He still had to stop at the store for decorations. Wanda was working hard preparing for the evening. She had bought flowers for the table and even made a *tart*.

Conclusion

Wanda hoped the evening would be fun. The guests arrived right on time. After they finished eating,

Last Line

Distractor-anaphor/No-distractor-anaphor version. what everyone asked about was the dessert.

Distractor-no-anaphor version. what everyone asked about was John's promotion.

Recognition Probe

TART

Comprehension Question

Was John recently fired?

the distractor-anaphor version, the last line also contained a *wh*-cleft (e.g., "what everyone asked about was John's promotion"). If readers resolve the anaphor in the distractor-anaphor version, recognition decisions should be faster there than in the distractor-no-anaphor version. On the other hand, if readers fail to resolve the anaphor, as they did in Experiment 1, there should be no difference between the two versions. Finally, in the no-distractor-anaphor version, the last line contained the categorical anaphor (e.g., *the dessert*) in a *wh*-cleft, as in the distractor-anaphor version, but the passages were written so that the antecedent should be easily accessible. In the backgrounding section, the elaboration of the highly salient distractor was replaced by several sentences that were unrelated to the antecedent.

Method

Participants. Seventy-four undergraduates at the State University of New York at Binghamton participated as part of the requirement for an introductory psychology course. The data were eliminated for 12 participants who made more than 25% probe or comprehension question errors and from two participants who did not follow instructions. Therefore, the analyses were based on 60 participants.

Materials. There were 18 experimental passages, with three versions of each: distractor-anaphor, distractor-no-anaphor, and no-distractor-anaphor. A sample passage can be found in Table 3. Pas-

sages were identical to those used in Experiment 1, except for the last line. In all versions, the last sentence contained a *wh*- cleft. In the distractor–anaphor and no-distractor–anaphor versions, the anaphoric noun phrase appeared as the focused constituent at the end of the sentence. In the distractor–no-anaphor version, some other relevant concept appeared as the focused constituent at the end of the sentence. The last lines were equated for length by number of characters in the three versions. The 22 filler passages from Experiment 1 were used.

Design and Procedure. The design and procedure were identical to those in Experiment 1.

Results and Discussion

Correct recognition probe response times and error rates are presented in Table 2. The mean recognition times were computed after discarding outliers; this eliminated 4.3% of the data. Not surprisingly, readers again drew an inference in the no-distractor–anaphor version. Recognition times were reliably faster than those in the distractor–no anaphor control [$t_1(59) = 5.6$, $SEM = 13.22$; $t_2(17) = 3.80$, $SEM = 20.49$], and error rates were reliably lower [$t_2(17) = 2.36$, $SEM = 0.57$]. Most central to our hypotheses, the pattern of results for the distractor–anaphor version differed from that found in Experiment 1: Probe recognition times for this version were faster than those in the distractor–no-anaphor version. That is, even though an elaborated, same-category distractor intervened between the antecedent and the anaphor, readers were faster to respond to the probe word *tart* after reading “what everyone asked about was the dessert” than after reading “what everyone asked about was John’s promotion.” This difference was significant by subjects [$t_1(59) = 2.41$, $SEM = 14.45$] and marginally significant by items [$t_2(17) = 2.04$, $SEM = 25.14$, $p = .057$]. And finally, although an inference was drawn in both anaphor versions, reaction times were faster in the no-distractor–anaphor version than in the distractor–anaphor version [$t_1(59) = 3.03$, $SEM = 12.93$; $t_2(17) = 1.04$, $SEM = 25.58$, $p = .315$], and error rates were lower [$t_2(17) = 2.71$, $SEM = 0.49$]. These differences are not surprising given the shorter distance between the antecedent and the anaphor in the no-distractor–anaphor version and the absence of a same-category distractor.

In summary, in contrast to the findings in Experiment 1, we found that readers resolved the anaphor in the anaphor–distractor version. This is impressive given that a highly elaborated, highly typical, same-category distractor appeared between the anaphor and the antecedent. The only difference between Experiments 1 and 2 is that anaphors were introduced in a *wh*- cleft in the present experiment. It appears that this made the anaphoric concept more salient, leading to additional processing.

EXPERIMENT 3

Our primary goal in Experiment 3 was to expand our investigation of the influence of structural factors on anaphoric inferences. We selected a syntactic manipulation in Experiment 2, because such manipulations have been found to be a robust means of adding emphasis or

placing concepts in focus. In the present experiment, we selected a manipulation that was subtler in nature. Rather than placing the anaphor in a *wh*- cleft, which creates a relatively low-frequency syntactic construction, a single word was added to the anaphoric noun phrase. In this way, the materials were quite similar to those in Experiment 1, except for the addition of a prenominal adjectival modifier. For example, in the sample passage, the critical line in the anaphor version was “Wanda said to save room for the *sumptuous* dessert.” Adding elaboration in the form of an adjectival modifier has been shown to be an effective means of increasing the memory strength of concepts (e.g., Albrecht & Myers, 1995, 1998). Thus, the addition of an adjectival modifier should make the anaphor more salient, in turn increasing attention to it, and consequently increasing the probability of reactivating the antecedent.

The addition of a prenominal adjective may increase the salience of the anaphor in a number of ways. Most simply, it provides elaboration about the anaphoric concept. Although only a single word has been added to the noun phrase, this constitutes an additional proposition about the anaphoric concept: *<sumptuous, dessert>*. This elaboration should lead to a richer, more interconnected memory representation, making the anaphor a more effective retrieval cue to memory. Moreover, adjectives often serve a contrastive function and are used to distinguish between referents (Ni, Crain, & Shankweiler, 1996; Sedivy, Tanenhaus, Chambers, & Carlson, 1999). Thus, the prenominal adjectives in this experiment may serve as additional cues that there is a specific referent in the discourse model. Similarly, the inclusion of the adjective may serve to overspecify the anaphor, serving either to increase its salience or to suggest that there is more than one possible referent. However, regardless of the means by which the adjectives have their effect, if their addition increases the frequency of anaphor resolution, it should do so in much the same way as the syntactic focusing manipulation in Experiment 2: by increasing the salience of the anaphor concept, which in turn leads to an increase in attention devoted to processing the anaphor.

Method

Participants. Forty-seven undergraduates at the State University of New York at Binghamton participated for course credit. The data from 10 participants who made more than 25% probe or comprehension question errors were eliminated. Therefore, the data analyses were based on 37 participants.

Materials. There were 18 experimental passages, with two versions of each: anaphor and no-anaphor. A sample passage can be found in Table 4. These passages differed only in their final line. The anaphor version was similar to the anaphor–distractor version in Experiment 1 except that the anaphor was preceded by an adjective. The adjective was selected so that it did not provide information that would allow the reader to differentiate between the antecedent and the distractor (see the rating experiment, below). To ensure that this was the case, minor modifications were needed in some of the passages. For example, in the sample passage, information in the distractor elaboration section about *rich cream* and *goosey chocolate frosting* was replaced so that the adjective *sump-*

Table 4
Sample Passage for Experiments 3 and 4

Wanda was throwing a surprise party for her best friend John. John had just been promoted to Vice President of the company and some of his close friends wanted to congratulate him. Wanda even made him a *tart*. She felt a little pressured because her daughter's graduation was the next day and she needed to prepare for that occasion as well. She also still had to get decorations and stop at the bakery for a *cake*. Her daughter loved their chocolate *cakes*. They were made on-site and were works of art. The baker had been trained by his father in the art of *cake* decorating. Wanda hoped John's party would be fun. The guests arrived right on time. As everyone sat down to eat,

Last Line

Anaphor version (Experiment 3). Wanda said to save room for the sumptuous dessert.

Anaphor version (Experiment 4). Wanda said to save room for the good dessert.

Distractor–no-anaphor version. Wanda congratulated John on the unexpected promotion.

Recognition Probe TART

Comprehension Question Was John recently fired?

tious fit equally well with *tart* (the antecedent) and *cake* (the distractor). The no-anaphor version was identical to the anaphor version except for the last line, which did not refer to the targeted anaphor. Across the two versions, the last lines were equated for length. All passages were followed by a recognition probe, which was the antecedent. The same 22 filler passages from the previous experiments were used.

Design and Procedure. The design and procedure were identical to those in Experiment 2, except that there were only two versions of the experimental passages.

Rating experiment. The adjectives that were used to modify the anaphors were normed to ensure that they were not more descriptive of the antecedents than of the distractors. Fifty-two undergraduates at the State University of New York at Binghamton participated for course credit. Each participant was given a booklet containing 48 sentences and was asked to rate the degree to which each adjective–anaphor phrase was an appropriate description of the antecedent and of the distractor. For example, the participants were asked, “How would you rate the phrase *sumptuous dessert* as a description of a tart?” This was followed by a 7-point scale, ranging from 1 (*extremely poor*) to 7 (*extremely good*). All the participants rated the appropriateness of the adjective as a description of both the antecedent and the distractor. The order of presentation of the antecedent and distractor was counterbalanced. Thirty-four of the 48 rating questions were based on adjective–anaphor pairs from the experimental passages; the remainder were fillers in which the adjective clearly fit better with one of the concepts than the other.

On the average, the participants rated the adjectives as *good* descriptions. More important, ratings were almost identical, averaging 4.76 for the antecedents and 4.70 for the distractors.

Results and Discussion

Correct recognition probe response times and error rates are presented in Table 5.

Error rates. Error rates did not differ for the two versions [$t_2(17) = 0.46$, $SEM = 0.48$, $p = 0.65$].

Probe recognition times. The mean correct recognition times were computed after discarding outliers that composed 2.7% of the data. In contrast to the findings of

Experiment 1, and in agreement with the results of Experiment 2, readers resolved the anaphors in the anaphor version. Probe response times were 48 msec faster in the anaphor version than in the no-anaphor version—that is, 799 and 847 msec, respectively. This difference was significant [$t_1(36) = 3.28$, $SEM = 14.63$; $t_2(17) = 2.38$, $SEM = 19.98$].

The shorter probe recognition times in the anaphor version demonstrate that the addition of an adjective to the anaphoric noun phrase acted in the same way as did the *wh*- clefts, leading readers to resolve anaphors that were previously left unresolved. In contrast with the findings of Experiment 1, in the present experiment readers reactivated the antecedent despite the fact that a highly salient same-category distractor intervened between the antecedent and the anaphor. It is impressive that the simple addition of an adjectival modifier made such a significant difference in processing. One explanation for this finding is that the addition of an adjectival modifier serves to increase the salience of the anaphor. Elaboration of a concept has been shown in many contexts to increase its memory strength (e.g., Albrecht & Myers, 1998). This increased memory strength may be the result of increased attention to the anaphor at the time of encoding, which in turn increases the probability that concepts related to the anaphor, particularly the antecedent, are retrieved from memory. A second possibility is that it was the particular content of the adjectives, rather than simply their presence, that was critical. That is, many of the adjectives that were used in this experiment either were low-frequency words (e.g., *sumptuous*, *delectable*) or were words that created unusual phrases (e.g., *eye-catching car*). The uniqueness of the anaphoric noun phrases may have been necessary for the additional processing. This possibility was explored in Experiment 4.

EXPERIMENT 4

Our goals in Experiment 4 were (1) to further generalize the findings of Experiments 2 and 3 by examining the influence of a subtler text cue and (2) to determine whether the addition of any adjectival modifier to the

Table 5
Probe Response Times (in Milliseconds), Error Rates (in Percentages), and Last Line Reading Times (in Milliseconds) in Experiments 3 and 4

Version	Response Time	Error Rate	Reading Time
Experiment 3: <i>Sumptuous Dessert</i>			
No-anaphor	847	18.3	1,838
Anaphor	799	17.1	2,020
Difference	48*	1.2	182*
Experiment 4: <i>Good Dessert</i>			
No-anaphor	830	16.1	1,855
Anaphor	805	16.5	1,939
Difference	25*	0.4	–84*

* $p < .05$

anaphoric noun phrase is sufficient to increase the salience of the anaphor or whether the adjective itself must be highly salient. To achieve these goals, we replaced the adjectives used in Experiment 3 with more common, higher frequency words. For example, instead of describing the dessert in the sample passages as “sumptuous,” it was described simply as “good.” If the mere presence of any adjectival modifier makes the anaphor a better memory retrieval cue, the results of this experiment should replicate those in Experiment 3; recognition latencies to the antecedent probe should be faster in the anaphor version, in which readers have just encountered the anaphor, than in the no-anaphor version, in which they have not.

Method

Participants. Ninety-one undergraduates at the State University of New York at Binghamton participated for course credit. The data from 15 participants who made more than 25% probe or comprehension question errors were eliminated. Therefore, the data analyses were based on 76 participants.

Materials. The passages were identical to those in Experiment 3 except that the adjectival modifiers in the anaphor versions were replaced by more common words. Whereas the mean frequency of the adjectival modifiers in Experiment 3 was 64 per million, in the present experiment the mean frequency was 364 per million (Francis & Kučera, 1982). These differed reliably [$t_2(34) = 2.9$, $SEM = 103.43$]. A sample passage can be found in Table 4, and a complete list of the adjectives for both Experiments 3 and 4 can be found in the Appendix. The 22 filler passages from the previous experiments were used.

Design and Procedure. The design and procedure were identical to those in Experiment 3.

Results and Discussion

Correct recognition probe response times and error rates are presented in Table 5.

Error rates. Error rates did not differ between versions [$t_2(17) = 0.22$, $SEM = 0.77$, $p = .83$].

Probe recognition times. The mean correct recognition times were computed after discarding outliers composing 5.4% of the data. Probe recognition times were 25 msec faster in the anaphor version than in the no-anaphor version—that is, 805 and 830 msec, respectively. This difference was reliable by subjects [$t_1(75) = 2.34$, $SEM = 10.55$, $p = .022$] and marginally so by items [$t_2(17) = 1.82$, $SEM = 14.39$, $p = .087$].

The most general conclusion to be drawn from these results is that readers are sensitive to quite subtle linguistic cues. This is supported by a between-experiments contrast in which the probe facilitation in the anaphor condition is averaged for Experiments 2 (distractor–anaphor vs. distractor–no-anaphor), 3 (anaphor vs. no-anaphor) and 4 (anaphor vs. no-anaphor), and compared with the null effect from Experiment 1 (distractor–anaphor vs. distractor–no-anaphor) [$F_1(1,254) = 5.42$, $MS_e = 4,412$, $p = .02$; $F_2(1,88) = 3.88$, $MS_e = 3,820$, $p = .05$].²

More specifically, in contrast with the results of Experiment 1, the simple addition of a common adjectival modifier to the anaphoric noun phrase was sufficient to lead to resolution. That is, readers were more likely to

resolve the anaphors *good dessert* and *early class* than *dessert* and *class*. Why might this be? First, we assume that the adjective did not serve to increase the semantic overlap between the anaphor and the antecedent: *good dessert* does not overlap more with *tart* than does *dessert*. Second, we assume that the adjective did not serve to differentiate between the antecedent and the distractor: Both the tart and the cake could be described as “good.” So what role did the adjective play? Clearly, in some way the adjectival modifier made the anaphor more salient. This may have been simply because the adjective added a proposition, creating a richer and more interconnected memory representation. In contrast, the adjective may have served a more specialized function as the result of the particular pragmatic functions that adjectives serve. For instance, adjectives often serve a contrastive function, indicating that the modified concept is a subset of a larger set; thus, they provide an additional “presupposition-trigger” (Levinson, 1983, p. 181), providing in this case an additional signal beyond the definite article that a specific referent exists.

It is interesting to note that although the high-frequency adjectives used in the present experiment were sufficient to lead to resolution, the effect size was about half of that in Experiment 3, in which low-frequency adjectives were used. Although we must be cautious about drawing conclusions from this nonsignificant between-experiments comparison [$F_1(1,111) = 1.64$, $MS_e = 4,142$, $p = .20$], it appears that whereas the simple inclusion of an adjectival modifier increases the probability of drawing an anaphoric inference, the qualities of that adjective may also be important.

Last line reading times. Last line reading times will be presented next for all four experiments. Note that in Experiments 1 and 2, last lines were identical in the distractor–anaphor and no-distractor–anaphor versions, whereas in Experiments 3 and 4, last lines differed across versions. Thus, in the latter two experiments, any increase in reading times for the anaphor version, as compared with its no-anaphor control, potentially reflects more than the resources invested in resolving the anaphor. However, last lines were equated for length and were kept as similar as possible across versions and are worth considering.

In Experiment 1, reading times in the no-distractor–anaphor version did not differ reliably from the no-anaphor control ($ps > .2$), suggesting that resolving the anaphor in the no-distractor–anaphor version was relatively fast. Surprisingly, reading times were slower in the distractor–anaphor version than the no-distractor–anaphor version, despite the fact that readers did not resolve the anaphor. However, this difference was reliable neither by subjects [$t_1(38) = 1.89$, $SEM = 49.17$, $p = .07$] nor by items [$t_2(17) = 1.14$, $SEM = 56.22$, $p = .27$], and the difference between the same two conditions was only 4 msec in Levine et al.’s (2000) Experiment 4. Thus, although it is possible that the anaphors in the distractor–anaphor version were resolved in some small proportion of the

passages, leading to a slowdown in reading, strong conclusions cannot be drawn from this nonreplicable, non-significant result.

In Experiment 2, reading times were almost identical for the no-distractor-anaphor version (2,073 msec) and the no-anaphor version (2,076 msec). As in the results of Experiment 1, it appears that drawing an inference in the no-distractor-anaphor version was fast. More interesting is the 115-msec slowdown in the distractor-anaphor version, as compared with the no-distractor-anaphor version. This difference was marginally reliable by subjects [$t_1(59) = 1.89$, $SEM = 60.82$, $p = .064$] and reliable by items [$t_2(17) = 2.74$, $SEM = 58.62$, $p = .014$]. Given that the last lines were identical in these two versions, it appears that the *wh*-cleft construction led readers to invest additional resources into resolving the anaphor in the distractor-anaphor version.

In Experiment 3, reading times were also longer in the anaphor version than in the no-anaphor version. The 182-msec difference was significant by subjects [$t_1(36) = 3.94$, $SEM = 46.18$, $p < .001$] and marginally reliable by items [$t_2(17) = 2.06$, $SEM = 90.22$, $p = .056$]. Again, the longer reading times in the anaphor version are consistent with the conclusion that resolving these anaphors involved additional attentional resources. However, given that the last lines were not identical across versions in this experiment and that a low-frequency adjective was not included in the last line in the no-anaphor version, the slowdown in the anaphor version may have been due in part (or even fully) to the presence of the low-frequency adjective.

Finally, in Experiment 4, last line reading times were again slower in the anaphor version than in the no-anaphor version. And in agreement with the smaller recognition effect in Experiment 4 than in Experiment 3, the reading time difference was also smaller. The 84-msec difference was reliable by subjects [$t_1(75) = 2.87$, $SEM = 29.5$, $p = .005$] but not by items [$t_2(17) = 1.5$, $SEM = 67.4$, $p = .15$]. Why might this be? One possibility is that the participants were less likely to draw an anaphoric inference in Experiment 4, in which there was a high-frequency adjectival modifier, than in Experiment 3, in which there was a low-frequency modifier. In contrast, if the slowdown in Experiment 3 reflected the processing of the low-frequency adjective, rather than time needed for anaphor resolution, the smaller effect size in Experiment 4 may simply be the result of readers' taking less time to process higher frequency adjectives (e.g., *good*) than low-frequency adjectives (e.g., *sumptuous*).

GENERAL DISCUSSION

Implicit in the study of anaphoric inferences has been the assumption that they are necessary inferences and are therefore reliably drawn. However, Levine et al. (2000) argued that the probability of anaphor resolution is a function of two factors: the accessibility in memory of the antecedent and the extent to which resolution is nec-

essary to create a coherent discourse representation. More specifically, they reasoned that if an antecedent is not automatically retrieved from memory when its anaphor is encountered, it should be inefficient for readers to devote additional resources to reinstating the antecedent if their standard of coherence is met.

In the present article, we started with the assumption that readers are efficient information processors and are most likely to engage in more extensive processing when text information is central to a narrative. This is consistent with Givón's (1992) suggestion that linguistic cues function as mental processing instructions, informing readers about the importance of concepts. More specifically, we hypothesized that a noun phrase anaphor that is made salient should receive additional processing, increasing the probability of resolution. To test this hypothesis, we examined the influence of two different linguistic cues that should serve to make anaphors more salient: syntactic focus and the addition of an adjectival modifier.

In Experiment 1, we replicated the result found by Levine et al. (2000): Readers failed to resolve noun phrase anaphors, despite the fact that there were no time constraints and that an antecedent was available in the passage. Following this, in Experiment 2, anaphoric noun phrases appeared as the focused constituents of *wh*-clefts. On the basis of prior research (e.g., Birch & Rayner, 1997; Cutler & Fodor, 1979), we hypothesized that these anaphors would be perceived as more salient and, thus, would be more likely to be resolved. The results of Experiment 2 provided support for this hypothesis. The change in the syntax of the anaphoric noun phrases was sufficient to lead to the successful reinstatement of their antecedents. This was despite the fact that the antecedents were no more accessible in memory than they were in Experiment 1; a highly typical and elaborated same-category distractor again intervened between the anaphor and its antecedent.

One concern about the generalizability of the findings with the *wh*-clefts is that they are used somewhat infrequently in narratives, which may have led readers to engage in slow or strategic processing. This concern was addressed in Experiment 3; instead of placing the critical anaphors in *wh*-clefts, an adjective was added to each anaphoric noun phrase. In contrast with *wh*-clefts, the use of adjectival modifiers is more common and should not induce any special strategies.

In Experiment 3, the simple addition of an adjective to the anaphoric noun phrase altered processing. Readers reinstated the antecedents when they encountered the target anaphors. This occurred despite the fact that the passages were coherent without identifying the particular antecedent; it was not necessary to know which dessert Wanda was referring to in order to integrate the target sentence with the rest of the passage. In addition, the adjective neither differentiated between the antecedent and the distractor nor increased the semantic overlap between the anaphor and its antecedent.

To further generalize the findings from Experiments 2 and 3, in Experiment 4 higher frequency adjectival modifiers were selected. The results of Experiment 3 do not make clear whether it was merely the presence of an adjectival modifier that altered readers' processing of the anaphoric noun phrases or whether it was the fact that many of the adjectives in Experiment 3 were low-frequency words, leading readers to process them slowly and deliberately. To distinguish between these two explanations, high-frequency adjectives with relatively little semantic content, such as *nice* and *good*, were used in Experiment 4. Impressively, these high-frequency adjectives also led to the reinstatement of the antecedents.

There are several reasons why an anaphoric noun phrase with an adjectival modifier (e.g., *the good dessert*) might be processed differently than an anaphoric noun phrase without an adjectival modifier (e.g., *the dessert*). One possibility is that the inclusion of an adjective simply serves to add a proposition to the text (e.g., *<dessert, good>*). This elaborated anaphor then serves as a more effective retrieval cue. A second possibility is that the adjective plays a more specialized role, indicating to readers that the modified concept is "given," or old information. Adjectives often serve a contrastive function, differentiating one previously mentioned instance from another (e.g., Sedivy et al., 1999). For example, one is more likely to refer to *the tall tree* than *the tree* when there is more than one tree in the discourse context. Although there was only one possible referent for the target anaphors in the experimental passages (i.e., the guests only knew about one dessert), and although the adjective did not serve a contrastive function (e.g., *sumptuous* and *good* applied equally well to the tart and the cake), the readers may not have known this when they initially encountered the anaphoric noun phrase. In other words, the adjectival modifier may have at least temporarily suggested to readers that the modified noun was meant to refer to one member of a set of at least two potential antecedents in the prior text. In this way, the adjective served as an additional cue that *the dessert* was an anaphor, or old information, referring to a previously mentioned concept. This may in turn have led readers to devote additional time to reinstating the antecedent from long-term memory. Although the present set of experiments do not differentiate between these two explanations, we can conclude that the adjective in some way served to make the anaphoric concept more salient. As with the *wh*-cleft construction, this increased salience led readers to devote additional attentional resources to processing the anaphor, which resulted in the resolution of previously unresolved anaphors.

If one places our findings within a bottom-up theory of discourse processing, such as Kintsch's (1988) construction-integration model or Myers and O'Brien's (1998) resonance model, anaphors should act in the same way as any other input to memory. Thus, when an anaphor is encountered, related concepts in memory are automatically activated; in a subsequent stage some of those reactivated concepts may be integrated with the

current text input. Furthermore, although the activation process is initiated automatically, the amount of processing that each input receives may differ. This may be a general mechanism that operates in such a way that readers continually adjust the amount of processing devoted to each text input on the basis of its perceived importance, or salience. In agreement with this, Kintsch (1992) demonstrated that simply increasing the self-connection strengths of syntactically emphasized propositions in the construction-integration model (Kintsch, 1988) resulted in increased activation levels for these propositions, as well as an increase in the model's memory for those propositions. Similarly, Myers and O'Brien suggested that syntactic emphasis could be incorporated into the resonance model by increasing the activation values for the emphasized concepts in the input vector. Either of these mechanisms could easily account for our findings: Anaphoric concepts that have been made more salient, either because of a *wh*-cleft construction or an adjectival modifier, would be assigned higher activation values. This, in turn, would make them more effective cues to memory, increasing the probability that related information from long-term memory would be retrieved.

In contrast, salience may have its influence at a later stage—after a comprehension failure has occurred. For example, according to Myers and O'Brien's (1998) resonance model, readers can continue processing a text input, resampling long-term memory with the current contents of working memory when processing fails—for example, "when an anaphoric reference fails to produce an appropriate antecedent" (p. 133). Furthermore, they argue that the decision of whether to continue processing depends in part on the reader's motivation, or standard of coherence. Thus, readers may be more likely to engage in additional processing when an unresolved anaphor is perceived as salient.

Given either of these mechanisms, the results of the four experiments reported here demonstrate that readers are efficient information processors who are remarkably sensitive to a variety of subtle linguistic cues. Although the present set of experiments focused solely on the processing of anaphoric noun phrases, we believe that these conclusions are more general. In addition to the finding that readers make use of syntactic focus as a salience cue (e.g., Birch & Rayner, 1997; McKoon et al., 1993), a great deal of evidence has been accumulated that suggests that readers make use of other linguistic markers to structure their mental representation of texts. For example, morphosyntactic cues such as verb tense and aspect have been shown to foreground concepts in readers' representation of text (Carreiras, Carriedo, Alonso, & Fernández, 1997; Magliano & Schleich, 2000; Morrow, 1985; Zwaan, Madden, & Whitten, 2000). Thus, in agreement with Kintsch's (1992) argument, it appears that comprehension is influenced by a host of linguistic cues and that theories of discourse comprehension have not fully accounted for the linguistic richness of texts. To work toward the development of a complete model of discourse processing, future experiments should con-

tinue to investigate the variety of text factors that function as mental processing instructions (Givón, 1992), informing readers about the importance of concepts and the amount of attention to devote.

REFERENCES

- ALBRECHT, J. E., & MYERS, J. L. (1995). Role of context in accessing distant information during reading. *Journal of Experimental Psychology: Learning, Memory, & Cognition*, **21**, 1459-1468.
- ALBRECHT, J. E., & MYERS, J. L. (1998). Accessing distant text information during reading: Effects of contextual cues. *Discourse Processes*, **26**, 87-107.
- ALMOR, A. (1999). Noun-phrase anaphora and focus: The informational load hypothesis. *Psychological Review*, **106**, 748-765.
- BAKER, L., & WAGNER, J. L. (1987). Evaluating information for truthfulness: The effects of logical subordination. *Memory & Cognition*, **15**, 247-255.
- BATTIG, W. F., & MONTAGUE, W. E. (1969). Category norms of verbal items in 56 categories: A replication and extension of the Connecticut category norms. *Journal of Experimental Psychology*, **80**, 1-46.
- BIRCH, S. L., ALBRECHT, J. E., & MYERS, J. L. (2000). Syntactic focusing structures influence discourse processing. *Discourse Processes*, **30**, 285-304.
- BIRCH, S. L., & GARNSEY, S. M. (1995). The effect of focus on memory for words in sentences. *Journal of Memory & Language*, **34**, 232-267.
- BIRCH, S. [L.], & RAYNER, K. (1997). Linguistic focus affects eye movements during reading. *Memory & Cognition*, **25**, 653-660.
- BREDART, S., & DOCQUIER, M. (1989). The Moses illusion: A follow-up on the focalization effect. *Current Psychology of Cognition*, **9**, 357-362.
- CARPENTER, P. A., & JUST, M. A. (1977). Integrative processes in comprehension. In D. LaBerge & S. J. Samuels (Eds.), *Basic processes in reading: Perception and comprehension* (pp. 217-241). Hillsdale, NJ: Erlbaum.
- CARREIRAS, M., CARRIEDO, N., ALONSO, M. A., & FERNÁNDEZ, A. (1997). The role of verb tense and verb aspect in the foregrounding of information during reading. *Memory & Cognition*, **25**, 438-446.
- CORBETT, A. (1984). Prenominal adjectives and the disambiguation of anaphoric nouns. *Journal of Verbal Learning & Verbal Behavior*, **23**, 683-695.
- CUTLER, A., & FODOR, J. A. (1979). Semantic focus and sentence comprehension. *Cognition*, **7**, 49-59.
- DELL, G. S., MCKOON, G., & RATCLIFF, R. (1983). The activation of antecedent information during the processing of anaphoric reference in reading. *Journal of Verbal Learning & Verbal Behavior*, **22**, 121-132.
- FRANCIS, W. N., & KUČERA, H. (1982). *Frequency analysis of English usage: Lexicon and grammar*. Boston: Houghton Mifflin.
- GERNSBACHER, M. A., & JESCHENIAK, J. D. (1995). Cataphoric devices in spoken discourse. *Cognitive Psychology*, **29**, 24-58.
- GIVÓN, T. (1992). The grammar of referential coherence as mental processing instructions. *Linguistics*, **30**, 5-55.
- KINTSCH, W. (1988). The role of knowledge in discourse comprehension: A construction-integration model. *Psychological Review*, **95**, 163-182.
- KINTSCH, W. (1992). How readers construct situation models for stories: The role of syntactic cues and causal inferences. In A. F. Healy & S. M. Kosslyn (Eds.), *Essays in honor of William K. Estes* (Vol. 2, pp. 261-278). Hillsdale, NJ: Erlbaum.
- LEVINE, W. H., GUZMÁN, A. E., & KLIN, C. M. (2000). When anaphor resolution fails. *Journal of Memory & Language*, **43**, 594-617.
- LEVINSON, S. C. (1983). *Pragmatics*. Cambridge: Cambridge University Press.
- MAGLIANO, J. P., & SCHLEICH, M. C. (2000). Verb aspect and situation models. *Discourse Processes*, **29**, 83-112.
- MCKOON, G., WARD, G., RATCLIFF, R., & SPROAT, R. (1993). Morphosyntactic and pragmatic factors affecting the accessibility of discourse entities. *Journal of Memory & Language*, **32**, 56-75.
- MORRIS, R. K., & FOLK, J. R. (1998). Focus as a contextual priming mechanism in reading. *Memory & Cognition*, **26**, 1313-1322.
- MORROW, D. G. (1985). Prepositions and verb aspect in narrative understanding. *Journal of Memory & Language*, **24**, 390-404.
- MYERS, J. L., & O'BRIEN, E. J. (1998). Accessing the discourse representation during reading. *Discourse Processes*, **26**, 131-157.
- NI, W., CRAIN, S., & SHANKWEILER, D. (1996). Sidestepping garden paths: Assessing the contributions in syntax, semantics and plausibility in resolving ambiguities. *Language & Cognitive Processes*, **11**, 283-334.
- O'BRIEN, E. J., RANEY, G. E., ALBRECHT, J. E., & RAYNER, K. (1997). Processes involved in the resolution of explicit anaphors. *Discourse Processes*, **23**, 1-24.
- RUSSELL, B. (1905). On denoting. *Mind*, **14**, 479-493.
- SEDIVY, J. C., TANENHAUS, M. K., CHAMBERS, C. G., & CARLSON, G. N. (1999). Achieving incremental semantic interpretation through contextual representation. *Cognition*, **71**, 109-147.
- VAN DEN BROEK, P., RISDEN, K., & HUSEBYE-HARTMANN, E. (1995). The role of readers' standards for coherence in the generation of inferences during reading. In R. F. Lorch, Jr., & E. J. O'Brien (Eds.), *Sources of coherence in reading* (pp. 353-373). Mahwah, NJ: Erlbaum.
- ZWAAN, R. A., MADDEN, C. J., & WHITTEN, S. N. (2000). The presence of an event in the narrated situation affects its availability to the comprehender. *Memory & Cognition*, **28**, 1022-1028.

NOTES

1. In several analyses, we found highly significant effects in the analysis with participants as the random variable but marginal effects with items as the random variable. This clearly points to insufficient power in the items analysis. Although twice as many items would have resolved this issue, we were concerned about the risks of losing the participants' attention as well as the manipulation's becoming transparent.
2. In order to increase the power of this between-experiments analysis, we averaged the data from Levine, Guzmán, and Klin's (2000) Experiment 1 with the data from the present Experiment 1 (the latter was an exact replication of the former).

APPENDIX
Complete List of Antecedents, Distractors, Anaphors, and Adjectives Used
in the Experiments

Antecedent	Distractor	Anaphor	Adjective (Experiment 3)	Adjective (Experiment 4)
instrumental	blues	music	terrific	good
turtles	kittens	animals	small	small
cauliflower	corn	vegetables	healthy	fine
clogs	pumps	shoes	stylish	black
daiquiris	beer	drinks	cold	nice
tart	cake	dessert	sumptuous	good
armchair	couch	furniture	attractive	nice
flannel	wool	fabric	terrific	nice
lavender	blue	color	pretty	nice
Scrabble	Monopoly	game	entertaining	fun
ball	Barbie	toy	fun	little
lasagna	tuna casserole	food	delicious	good
raspberries	mangoes	fruit	delectable	nice
Cuba	Australia	country	far-away	new
irises	daisies	flowers	fragrant	nice
mystery	romance	book	fascinating	good
Camaro	Camry	car	eye-catching	nice
accounting	history	class	early	early

(Manuscript received June 18, 2001;
revision accepted for publication October 20, 2003.)