Understanding anaphors in story dialogue

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Previous research has identified two processes that play an important role in anaphor resolution. An activation process increases the accessibility of an anaphor's referent; a suppression process diminishes the accessibility of its nonreferents. In this study, we examined how these processes operate when reference to two story characters shifts rapidly, as it does in story dialogue. Dialogue raises interesting questions about how the antecedent of an anaphor becomes the most activated entity in the reader's discourse model. Do readers suppress an anaphor's nonreferent even though that same entity is likely to be the referent of a subsequent anaphor? Are activation and suppression processes triggered by the anaphor itself or by cues that signal a change of speaker? We found that an anaphor's antecedent is activated differently in dialogue than it is elsewhere in a narrative. Our results suggest that readers use knowledge about the structure of dialogue to anticipate the referent of an upcoming anaphor.

The reader's goal in text comprehension is usually to construct a representation of the real or imaginary world that the text describes. This representation is called a discourse model, a representation of the entities (e.g., people, objects, places) and events that appear in a text and of the relations among them (Garnham, 1981, 1987; Greene, McKoon, & Ratcliff, 1992; Johnson-Laird & Garnham, 1980). Readers construct a discourse model incrementally by integrating each sentence into their developing representation. This involves discovering both referential relations (i.e., the knowledge that two text elements refer to the same entity) and coherence relations (i.e., the knowledge that two ideas have a logical relation).

Readers are aided in finding referential relations among entities in their discourse model by their knowledge about anaphors, linguistic forms that refer to entities (antecedents) introduced earlier in a discourse. The process of comprehending anaphors is frequently discussed in terms of activation (Corbett & Chang, 1983; Dell, McKoon, & Ratcliff, 1983; Gernsbacher, 1989; Greene et al., 1992; McKoon & Ratcliff, 1980). The antecedent for an anaphor is presumably the entity in the discourse model that is the most strongly activated. An important aim of text-processing research has been to understand how the activation of entities in the discourse model waxes and wanes as a reader proceeds through a text.

Psychologists are beginning to understand some of the factors that affect an entity's accessibility. An entity tends to be accessible to the extent that it was mentioned first in a text (Chang, 1980; Corbett & Chang, 1983; Gernsbacher, 1989; Gernsbacher & Hargreaves, 1988), was mentioned frequently (Crawley, 1986; Givón, 1979), was grammatically marked in some way (Gordon & Chan, 1995; Gordon, Grosz, & Gilliom, 1993), or was mentioned

in a recent clause (Bever & Townsend, 1979; Chang, 1980; von Eckardt & Potter, 1985).

Psychologists are also beginning to understand the processes that alter an entity's accessibility. One process, activation, increases the accessibility of relevant concepts in long-term memory (Gernsbacher, 1989; Greene, Gerrig, McKoon, & Ratcliff, 1994; McKoon, Gerrig, & Greene, 1996; McKoon & Ratcliff, 1998). Activation is often described as a fast-acting, passive process by which information in active memory sends signals to information in long-term memory, automatically and in parallel. A second process, suppression, plays an important role in Gernsbacher's structure building framework (Gernsbacher, 1989, 1990). A referent can become the most accessible entity in the discourse model if the activation of other concepts is suppressed. Suppression dampens the activation of memory concepts when their content is unrelated to the developing discourse representation.

Recent evidence suggests that suppression effects can be relatively long-lasting. O'Brien, Albrecht, Hakala, and Rizzella (1995) had participants read passages containing two antecedents. They manipulated (1) the position of the antecedents in the passage (one appeared early and one late), (2) elaboration of the antecedents (one antecedent was elaborated by mentioning it several times), and (3) the presence or absence of a sentence at the end of the passage that prompted reinstatement of the early antecedent. After reading each passage, participants verified a set of statements about it, including statements about the two antecedents. Readers were slow to verify a statement about the late antecedent when the early antecedent was elaborated and reinstated. O'Brien et al. argued that readers considered potential antecedents when they comprehended the reinstatement sentence and suppressed the inappropriate ones. This suppression effect was found even after a delay of several seconds.

Our goal in this study was to examine how an anaphor's antecedent becomes the most accessible entity in the reader's discourse model when reference to characters in

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Table 1
Example Story
(From The Reader's Digest Association, 1987, page 42)

Dean, an instructor at an Army airfield in Florida, had to fly upstate on business. He decided to take Frank, his student, along as pilot. Frank had recently received his pilot's license. On the trip back, Dean₁ dozed off for a bit. When he woke, nothing below looked familiar. He picked up the intercom.

"Are we on course?" Dean asked.

"Yes, sir," answered Frank₄.

"All checkpoints okay?" asked Dean.

"Yes, sir," replied Frank.

"How soon do you expect to land?" questioned Dean worriedly.

"Ten minutes, sir," replied Frank.

There was a click but apparently the intercom failed to disconnect, for Dean heard Frank say under his breath, "That's what I keep telling myself."

Note—The numbers indicate probe positions used in Experiments 1 and 2. From *Reader's Digest Fun and Laughter* (p. 42), by the Reader's Digest Association, 1987, Pleasantville, NY: Author.

a story alternates rapidly. This situation occurs naturally in stories that contain a dialogue between two or more characters. Dialogue raises interesting issues about how an anaphor's antecedent becomes the most activated entity. Consider the story in Table 1. The story introduces two characters, *Dean* and *Frank*. When the dialogue begins, *Dean* is the more prominent character; he was the first-mentioned participant, the most frequently mentioned, and the character mentioned in the most recent clause. Thus, *Dean* should be very accessible as the antecedent for the anaphor *Dean* in the sentence "*Are we on course?*" *Dean* asked. In addition, *Frank* should be suppressed as the nonselected antecedent. An interesting question arises when we consider the next line. Will readers experience comprehension difficulty because the focus has shifted from *Dean* to *Frank*, the less accessible entity in the discourse model? This question is particularly interesting when we consider the possibility that suppression effects may last for some time (O'Brien et al., 1995).

In the experiments that follow, we examined readers' comprehension of anaphors embedded in story dialogue. We considered two alternatives for how activation and suppression processes may operate. One is that these processes are involved in dialogue as they are elsewhere in a narrative. Prominent antecedents should be easily accessible—that is, strongly activated and resistant to suppression (Gernsbacher, 1989). Thus, readers should find it easy to resolve an anaphor when its antecedent is the more prominent character in the discourse and difficult when the antecedent is the less prominent character. If activation and suppression are involved in dialogue, another interesting question arises. How are these processes triggered? Are they triggered by information in the anaphor or by knowledge that a change of speaker has occurred, knowledge that may be available before readers encounter the anaphor?

A second alternative is that readers may strongly activate all the characters participating in a dialogue on the

basis of knowledge about dialogue's alternating structure. This activation would not change as long as the characters continued their conversation. Readers might also act strategically to suspend any suppression process. This would prevent diminishing the accessibility of an entity that is the likely referent of an upcoming anaphor.

EXPERIMENT 1

We adopted a methodology used by Gernsbacher (1989) to investigate whether explicit anaphors immediately trigger activation and suppression processes. Participants read short stories presented word by word on a computer screen (using a moving-window method). We measured the activation of entities (e.g., *Dean*, *Frank*) in the discourse model by means of a probe-verification task. Test probes were referents or nonreferents of explicit name anaphors. The anaphors appeared in dialogue and nondialogue portions of the story, and the probes were presented immediately before or immediately after the anaphors. The various probe positions are marked by numbers in Table 1. The participants decided whether each test probe had or had not appeared in the passage. Their time to make this decision was used as a measure of the concept's activation.

Based on previous studies of the role of activation and suppression in anaphor resolution (Gernsbacher, 1989, 1990), we predicted the following pattern of results for Probe Positions 1 and 2. At Position 1, the referent (*Dean*) and the nonreferent (*Frank*) should both be fairly accessible. Although *Dean* was mentioned first in the story, *Frank* was mentioned in the most recent clause. At Position 2, activation and suppression processes should operate to make *Dean* the more accessible entity. Therefore, the participants should be faster to verify the referent (*Dean*) when it appears in Position 2 than when it appears in Position 1, whereas they should be slower to verify the nonreferent (*Frank*) in Position 2 than in Position 1.

Our interest in this study concerned readers' responses to probes at Positions 3 and 4. At this point, readers will have just comprehended a sentence containing the anaphor *Dean*. If readers comprehended the anaphor by strongly activating its referent (*Dean*) and suppressing its nonreferent (*Frank*), their response to the probe *Frank* at Position 3 may be affected. That is, readers may respond faster to the nonreferent (*Dean*) of the upcoming anaphor than to the referent (*Frank*). In addition, their responses at Position 4 may be affected by any difficulty they have activating a recently suppressed entity.

An alternative possibility is that knowledge about dialogue's alternating structure may act to trigger activation and suppression processes before readers reach Position 3. Readers may understand that a change of speaker has occurred and act to enhance the activation of the current speaker (*Frank*) and to suppress the activation of the last speaker (*Dean*). Thus, readers may respond faster to the referent (*Frank*) of the upcoming anaphor than to the nonreferent (*Dean*) at both Positions 3 and 4.

Method

Participants. The participants were 44 undergraduate psychology students, who received course credit for their participation. All the participants spoke English as their first language.

Materials. We selected 48 short stories from a published collection of stories that originally appeared in the Reader's Digest magazine (Reader's Digest Association, 1987). The stories shared several characteristics: Each had a moral or a point, often humorous; each introduced two characters who participated in a dialogue at some point in the story; the first line of dialogue was spoken by the more prominent of the two characters in each story, and the second line by the less prominent character; each story was no longer than 150 words. Half of the stories were used in experimental trials; half were used as fillers.¹

Test probes were character names in the stories or distractor names (i.e., names that had not appeared in the story). Three probes appeared in each experimental story. Two probes were character names: One appeared early in the story once both characters had been introduced (the nondialogue condition), and one appeared in the second line of dialogue (the dialogue condition). Thus, 24 probes appeared in nondialogue, and 24 appeared in dialogue. The third probe in each story was a distractor. The probes appeared immediately before or after the anaphor and were either the anaphor's referent or its nonreferent. The distractor probes were positioned randomly throughout the stories but also appeared before or after an anaphor. We wrote two comprehension questions for each story. The questions were true/false paraphrases of information contained in the stories.

We constructed four material sets. Each set contained the 24 experimental stories; we counterbalanced probe position and name both within and across material sets. The dialogue condition was not manipulated across material sets; each story contained two probes, one in nondialogue and one in dialogue. Each material set also contained the 24 filler stories. Three probes appeared in each filler story; one was a character name, and two were distractor names. The probes were always positioned before or after an anaphor. Two comprehension questions were presented after each story. Half of the questions were true about the story; half were false.

Procedure. The stories were presented in random order. Each was preceded by asterisks that appeared in the center of the screen for 1,000 msec. A single story then appeared; each letter in the story was replaced by an X. All punctuation and formatting appeared as it did in the original publication. The participants read the story by pressing the spacebar on the keyboard. Each keypress revealed a word in the story. A subsequent keypress caused the next word to be revealed and the current word to be concealed again by Xs. When the participants reached the point where a probe was to appear, the story disappeared, and the probe appeared in capital letters at the top of the screen. The probe remained until the participants pressed a key or 2.5 sec had elapsed. The participants responded *yes* if the probe had appeared in the story and *no* if it had not appeared. Once the participants had responded, the story reappeared. The next word was revealed by pressing the spacebar. Each story was followed by two comprehension questions. The questions were preceded by the word TEST at the bottom of the screen for 1,000 msec. The participants responded *yes* if the question was true about the story and *no* if it was false.

Results and Discussion

We performed 2 (dialogue) $\times$ 2 (position) $\times$ 2 (referent) analyses of variance on the errors and response times. Dialogue (nondialogue vs. dialogue), position (before vs. after anaphor), and referent (referent vs. nonreferent name) were within-subjects and within-items

factors. The analyses were performed with participants treated as a random variable (F_1) and, again, with items treated randomly (F_2). Mean response times to the probes appear in Figure 1. The participants made few errors to the comprehension questions and probes ($M = 3\%$ and 2.8% , respectively). Errors and outliers constituted 4.2% of the data.

Our analysis of the response time data revealed reliable effects of dialogue and referent [$F_1(1,43) = 11.11$, $MS_e = 38,165$, $p = .002$, $F_2(1,23) = 10.75$, $MS_e = 24,936$, $p = .003$, and $F_1(1,43) = 50.96$, $MS_e = 49,756$, $p < .001$, $F_2(1,23) = 17.96$, $MS_e = 81,349$, $p < .001$, respectively]. We also found a reliable referent $\times$ position interaction [$F_1(1,43) = 9.87$, $MS_e = 26,074$, $p = .003$; $F_2(1,23) = 5.17$, $MS_e = 59,508$, $p = .03$]. A dialogue $\times$ position interaction was reliable in the subjects analysis [$F_1(1,43) = 26.81$, $MS_e = 33,802$, $p < .001$] but was only marginally reliable in the items analysis [$F_2(1,23) = 3.62$, $MS_e = 14,220$, $p = .07$].

Of particular relevance in this study was a reliable dialogue $\times$ referent $\times$ position interaction [$F_1(1,43) = 8.22$, $MS_e = 25,422$, $p = .006$; $F_2(1,23) = 21.91$, $MS_e = 26,935$, $p < .001$]. The participants showed no response time differences to referent and nonreferent names presented before the anaphor (all $F_s < 1$), whereas they were faster to referent than to nonreferent names presented after the anaphor [$F_1(1,43) = 78.97$, $p < .001$; $F_2(1,23) = 11.75$, $p = .002$]. In addition, the participants showed the typical pattern of activation and suppression. Responses to referent names were faster after the anaphor than before it [$F_1(1,43) = 46.52$, $p < .001$; $F_2(1,23) = 5.60$, $p = .03$], whereas responses to nonreferent names showed the opposite pattern. This latter effect was reliable in the subjects analysis [$F_1(1,43) = 4.07$, $p = .05$] but was only marginally reliable in the items analysis [$F_2(1,23) = 4.23$, $p = .06$].

The pattern of response times in the dialogue condition was quite different. The participants responded faster to referent than to nonreferent names both before and after the anaphor [$F_1(1,43) = 15.75$, $p < .001$, $F_2(1,23) = 22.19$, $p < .001$, and $F_1(1,43) = 49.99$, $p < .001$, $F_2(1,23) = 4.47$, $p = .04$, respectively]. Although the participants exhibited the typical suppression effect, responding faster to nonreferent names before the anaphor than after it [$F_1(1,43) = 5.44$, $p = .03$; $F_2(1,23) = 4.37$, $p = .05$], they did not show the typical activation effect. We found no response time differences to referent names before and after the anaphor (all $F_s < 1$). In addition, we found that readers responded to referent names before the anaphor faster in dialogue than in nondialogue [$F_1(1,43) = 31.40$, $p < .001$; $F_2(1,23) = 8.09$, $p = .01$]. In contrast, we found no effect of dialogue condition for referent names that appeared after the anaphor (all $F_s < 1$).

Our results suggest that the activation process operated differently in dialogue than in nondialogue. In the nondialogue condition, activation was triggered by the explicit anaphor. Referents were more activated after the anaphor than before it. In the dialogue condition, however, activation occurred *before* readers comprehended the anaphor.

Figure 1. Mean response times and standard errors to test probes in Experiment 1.

Referents were more activated than nonreferents both before and after the anaphor. In addition, referents before the anaphor were more activated in the dialogue than in the nondialogue condition. These results suggest that readers used their knowledge that a change of speaker had occurred, anticipating the referent of the upcoming anaphor.

We had hypothesized that readers would act strategically to suspend their suppression process in dialogue. This would prevent dampening the activation of an entity that was the likely referent of an upcoming anaphor. Somewhat to our surprise, we found that this was not the case. The readers' responses to nonreferents in the dialogue and nondialogue conditions did not differ. Nonreferents were somewhat less activated after the anaphor than before it in both conditions.

In addition to examining response times to probe words, we also examined reading times for anaphors in dialogue and nondialogue. If readers activated referents of anaphors in dialogue before they encountered the anaphors, we might expect faster reading times for anaphors in dialogue than in nondialogue. We identified all explicit name anaphors in each story and then excluded from further analysis all anaphors that appeared in a sentence where a test probe had been presented. For each character, we computed a mean reading time for explicit name anaphors that appeared in dialogue and one for anaphors that appeared in nondialogue.

We analyzed the reading times to examine the effects of character (prominent vs. less prominent) and position (dialogue vs. nondialogue). Anaphors in dialogue were read faster than those in nondialogue [$M = 441$ and 459 msec, respectively; $F(1,43) = 9.87$, $MS_e = 14,160$, $p = .003$]. We found no effect of character ($F < 1$). Faster reading times for anaphors in dialogue than in nondialogue is consistent with the idea that readers activated the referent of an anaphor in dialogue before they encountered the anaphor. This interpretation is problematic, however, because readers exhibited faster reading times overall in dialogue than in nondialogue. Sentences in dialogue were read 2,182 msec faster than those in nondialogue [$M = 4,306$ and $M = 6,488$ msec, respectively; $F(1,43) = 8.45$, $MS_e = 287,991$, $p = .005$].

We considered two alternative explanations for our reading time results. First, the reading time difference may be due to the relative position of the dialogue and nondialogue in our stories. In 17 of the 24 stories, the nondialogue came at the beginning of the story, and the dialogue at the end. Research has shown that reading times decrease as readers proceed through a text (Haberlandt, Berian, & Sandson, 1980; Haberlandt & Graesser, 1985); thus, readers may have comprehended the anaphors in dialogue faster than those in nondialogue because the dialogue usually came first. We investigated this by examining reading times for anaphors in those 7 stories in which the dialogue appeared in the middle. We computed

mean reading times for anaphors in the dialogue and the mean times for anaphors in the nondialogue that ended the stories. We found once again that anaphors in dialogue were read faster than those in nondialogue [$M = 438$ and 452 msec, respectively; $F(1,43) = 4.09$, $MS_e = 192,900$, $p = .05$].

The second explanation for the reading time difference is that sentences embedded in dialogue were easier to comprehend than those in nondialogue. We did not systematically compare all of the sentence characteristics that might contribute to reading time differences. We did, however, compare the average lengths of sentences in dialogue and nondialogue. Sentences in dialogue were shorter than those in nondialogue ($M = 9.17$ and 12.6 words, respectively). We think it very likely that differences in the complexity of the sentences appearing in dialogue and nondialogue contributed to our reading time results.

In summary, our probe verification results suggest that readers anticipated the referent of an upcoming anaphor in dialogue. The reading time difference between anaphors in dialogue and nondialogue is consistent with this conclusion but does not provide unambiguous support for it. Our second experiment was conducted to investigate the possibility that readers adopted special strategies for responding to probes in the dialogue condition.

EXPERIMENT 2

Our goal in this experiment was to investigate the possibility that the readers adopted different strategies for responding to probes in the dialogue and nondialogue conditions. The readers may have adopted different response strategies because the position of our probes was more predictable in dialogue than in nondialogue. In the nondialogue condition, the probes always occurred after both characters were introduced, but otherwise they were distributed across the nondialogue portions of the stories. In the dialogue condition, the probes always appeared in the second line. We had positioned the probes at this point deliberately because it was the point at which we expected readers to have the greatest comprehension difficulty. This was the first shift in focus from a more to a less prominent character. As a consequence, however, the readers may have developed expectations about the upcoming probes that affected their pattern of response times. Therefore, in this experiment, we varied the position of the probes in the dialogue condition. We presented only one probe per story. The probe appeared in either the dialogue or the nondialogue condition. In the dialogue condition, the probes were distributed throughout the dialogue portions of the stories.

We also attempted to minimize readers' use of special strategies by changing the nature of the test probes. In Experiment 1, the probes were character names that had either appeared or not appeared in the stories. Gordon, Hendrick, and Ledoux (1998) have presented data suggesting that readers respond in probe verification tasks

by building listlike memory representations that contain words they think are likely to be probed. When the probes were predictable (e.g., were one of two character names), readers exhibited different patterns of response times than when the probes were less predictable (e.g., any noun from the sentence). In this experiment, we took advantage of the fact that the characters in our stories were identified both by name and by occupation or role. We used the occupations or roles associated with the characters as our critical test probes. We also included additional true probes; these were nouns, other than the occupations or roles, that had also appeared in the stories. False probes were occupations, roles, or other nouns that had not appeared in the stories.

An added advantage of changing the nature of our probes was that we minimized the possibility that our results would be affected by perceptual or lexical priming. In Experiment 1, the test probes were always lexically, although not visually, identical to the anaphors. The occupation probes used in this experiment were not lexically related to the explicit name anaphors; therefore, any facilitation to a probe should be due to the association between the probe and the character in the story.

Method

Participants. The participants were 48 undergraduate psychology students, who received course credit for their participation. All the participants spoke English as their first language.

Materials and Procedure. We used the same 48 short stories as those we used in the previous experiment. In addition, we selected 12 more stories to be used as fillers. These stories had the same characteristics as the stories used previously.

One test probe appeared in each experimental story. The critical probes were all single words (nouns) that described the occupations or roles of the characters. The probes in nondialogue appeared at some point after the two characters had been introduced and appeared immediately before or after an explicit name anaphor. The probes in dialogue also appeared immediately before or after an explicit name anaphor. We positioned the probes so that they were evenly distributed across the dialogue sections of the stories.

We constructed eight material sets. Each set contained the 24 experimental stories; we counterbalanced dialogue condition, probe position, and name both within and across material sets. Each set also contained the 36 filler stories. Two probes appeared in each filler story. The probes in the filler stories were 24 nouns that had appeared in the stories but were not occupations or roles associated with the characters (true probes), 24 occupation or role nouns that had not appeared in the stories (false probes), and 24 other nouns that had not appeared in the stories (false probes). The probes were distributed across the stories. Half of the probes appeared before or after explicit name anaphors; half were distributed randomly in the stories. The procedure was identical to the one used in Experiment 1.

Results and Discussion

Mean response times to the probes appear in Figure 2. The participants made few errors in response to the comprehension questions and test probes ($M = 3\%$ and 3.1% , respectively). Errors and outliers constituted 4.8% of the data.

Our analysis of the response time data revealed reliable effects of dialogue and referent [$F_1(1,47) = 36.38$, $MS_e = 53,552$, $p < .001$, $F_2(1,23) = 31.91$, $MS_e = 28,312$,

Figure 2. Mean response times and standard errors to test probes in Experiment 2.

$p < .001$, and $F_1(1,47) = 38.03$, $MS_e = 48,957$, $p < .001$, $F_2(1,23) = 5.03$, $MS_e = 28,120$, $p = .04$, respectively]. The dialogue $\times$ referent interaction was reliable in the subjects analysis [$F_1(1,47) = 10.93$, $MS_e = 42,069$, $p = .002$], but not in the items analysis [$F_2(1,23) = 2.69$, $MS_e = 19,398$, $p = .12$].

The dialogue $\times$ referent $\times$ position interaction was reliable in the subjects analysis [$F_1(1,47) = 4.04$, $MS_e = 33,214$, $p = .05$] and was marginally reliable in the items analysis [$F_2(1,23) = 4.25$, $MS_e = 21,388$, $p = .06$]. In the nondialogue condition, the participants showed no differences to referent and nonreferent occupations before the anaphor (all $F_s < 1$), whereas they were faster to referent than to nonreferent occupations after the anaphor [$F_1(1,47) = 11.23$, $p = .002$; $F_2(1,23) = 4.49$, $p = .04$]. The readers showed the typical activation effect in the nondialogue condition. Responses to referent occupations were faster after the anaphor than before it [$F_1(1,47) = 4.93$, $p = .04$; $F_2(1,23) = 4.34$, $p = .05$], whereas responses to nonreferent occupations showed the opposite pattern. This latter effect was marginally reliable in the subjects analysis [$F_1(1,47) = 3.26$, $p = .07$] but was not reliable in the items analysis [$F_2(1,23) = 1.46$, $p = .24$].

The pattern of response times in the dialogue condition suggested that readers activated information associated with an anaphor's referent before they encountered the anaphor. The participants responded faster to referent than to nonreferent occupations, both before and after the

anaphor [$F_1(1,47) = 39.22$, $p < .001$; $F_2(1,23) = 7.96$, $p = .01$, and $F_1(1,47) = 21.40$, $p < .001$, $F_2(1,23) = 7.82$, $p = .02$, respectively]. In addition, the readers responded to referent names before the anaphor faster in the dialogue than in the nondialogue condition [$F_1(1,47) = 62.78$, $p < .001$; $F_2(1,23) = 14.07$, $p = .001$]. In contrast, we found no effect of dialogue condition for referent names that appeared after the anaphor (all $F_s < 1$). Although the mean response times were consistent with a suppression effect—faster responses to nonreferent occupations before the anaphor than after it—this effect was not reliable in either the subjects or the items analysis [$F_1(1,47) = 1.08$, $F_2 < 1$].

In this experiment, we tried to minimize the readers' use of different strategies in responding to probes in nondialogue and dialogue. The position of probes was less predictable here than it was in Experiment 1. In addition, the probes themselves were less predictable, reducing the possibility that the readers would construct a listlike representation of the sentences (Gordon et al., 1998). The changes in our materials and procedures resulted in somewhat longer response times overall in Experiment 2 than in Experiment 1, but in similar response patterns. In both the experiments, the readers showed the typical activation effect in the nondialogue condition, faster response times to referent probes after the anaphor than before it. The activation effect in the dialogue condition was also similar in the two experiments. The readers responded

faster to referent than to nonreferent probes, both before and after the anaphors. In addition, the readers responded to referent probes before the anaphor faster in dialogue than in nondialogue.

GENERAL DISCUSSION

We began this study by asking how readers select an anaphor's antecedent when reference to two characters shifts rapidly, as it does in story dialogue. We became interested in this issue when we considered that readers may suppress an antecedent that turns out to be the referent of an upcoming anaphor. Our interest was heightened by recent evidence suggesting that suppression effects can be relatively long-lasting (O'Brien et al., 1995).

We hypothesized that readers may act strategically to suspend their suppression process in dialogue to prevent comprehension difficulties. We based this hypothesis on research suggesting that suppression may be an attentionally demanding process under readers' strategic control (Gernsbacher & Faust, 1995; Long, Seely, & Oppy, 1999). Readers appear to suppress information when it is useful to do so. To the extent that suppression is mediated by its utility, readers may be able to suspend their suppression process when its operation is likely to cause comprehension difficulties (e.g., when they comprehend anaphors in dialogue).

Our hypothesis that readers would suppress nonreferents in the nondialogue, but not in the dialogue, condition was not confirmed. In Experiment 1, we found a suppression effect for nonreferents in both the dialogue and the nondialogue conditions. The readers suppressed the nonreferent of an anaphor in dialogue even though it was the likely referent of an upcoming anaphor. In Experiment 2, we also found no effect of dialogue condition on the likelihood of suppression. Although the readers tended to respond to nonreferents faster before the anaphor than after it in both dialogue and nondialogue, the effect was not reliable in either condition. Thus, we found little evidence that suppression operates differently in dialogue than it does in nondialogue.

Our most interesting finding was that activation appeared to be triggered by different types of information in dialogue than in nondialogue. Activation in nondialogue was triggered by the anaphor. Like previous studies of anaphor resolution, we found no difference in readers' responses to referent and nonreferent probes before the anaphor, whereas readers were faster to referent than to nonreferent probes after the anaphor (Gernsbacher, 1989, 1990). In contrast, activation in dialogue was triggered by information encountered before the anaphor; readers were faster to respond to referent than to nonreferent probes, both before and after the anaphor. Moreover, readers responded to referent probes before the anaphor faster in dialogue than in nondialogue. Readers may anticipate the referents of upcoming anaphors in dialogue, using knowledge about turn-taking in conversation and

knowledge about how turn-taking is signaled in texts (e.g., punctuation and formatting).

In many previous studies of anaphor resolution, researchers have studied anaphors embedded in simple, one- or two-sentence contexts (Corbett & Chang, 1983; Dell et al., 1983; Gernsbacher, 1989; Haviland & Clark, 1974). This has provided important information about the local, sentence-level factors that influence anaphor resolution, such as properties of the anaphor (e.g., explicitness, gender, number) and properties of the anaphor's referent (e.g., frequency of mention, first mention, syntactic role). Our results suggest that global, discourse-level factors are also involved in anaphor resolution. Readers' knowledge about the structure of dialogue in texts appears to be one of these factors.

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NOTE

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