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Mechanisms that improve referential access*

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Abstract

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Two mechanisms, suppression *and* enhancement, *are proposed to improve referential access. Enhancement improves the accessibility of previously mentioned concepts by increasing or boosting their activation; suppression improves concepts' accessibility by decreasing or dampening the activation of other concepts. Presumably, these mechanisms are triggered by the informational content of anaphors. Six experiments investigated this proposal by manipulating whether an anaphoric reference was made with a very explicit, repeated name anaphor or a less explicit pronoun. Subjects read sentences that introduced two participants in their first clauses, for example, "*Ann *predicted that* Pam *would lose the track race," and the sentences referred to one of the two participants in their second clauses, "but* Pam/she *came in first very easily." While subjects read each sentence, the activation level of the two participants was measured by a probe verification task. The first two experiments demonstrated that explicit, repeated name anaphors immediately trigger the enhancement of their own antecedents and immediately trigger the suppression of other (nonantecedent) participants. The third experiment demonstrated that less explicit, pronoun anaphors also trigger the suppression of other nonantecedents, but they do so less quickly—even when, as in the fourth experiment, the semantic information to identify their antecedents occurs prior to the pronouns (e.g., "Ann predicted that Pam would lose the track race. But after winning the race,* she *..."). The fifth experiment demonstrated that more explicit pronouns – pronouns that match the gender of only one participant—trigger suppression more powerfully. A final experiment demonstrated that it is not only*

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rementioned participants who improve their referential access by triggering the suppression of other participants; newly introduced participants do so too (e.g., "Ann predicted that Pam would lose the track race, but Kim ...*"). Thus, both suppression and enhancement improve referential access, and the contribution of these two mechanisms is a function of explicitness. The role of these two mechanisms in mediating other referential access phenomena is also discussed.*

Comprehending a narrative requires knowing who's doing what to whom. But how do comprehenders successfully track who or what is being referred to? Like all languages, English has a variety of devices for referring back to previously mentioned concepts. Such devices are called *anaphors*, and the concepts they refer back to are called *antecedents*. For example, to refer to the antecedent *John* in the sentence, "John went to the store," one of several anaphoric devices could be used: a repeated noun phrase, such as *John*, a definite noun phrase, such as *the guy*, or a pronoun, such as *he*.

How language users negotiate anaphora has been the focus of a growing body of psycholinguistic research. Why has anaphora captured so much attention? One reason is that anaphors are very common linguistic devices. Consider only pronoun anaphors; in English, they are some of the most frequently occurring lexical units (Kučera & Francis, 1967).[1] To study the comprehension of anaphors is, therefore, to study the comprehension of very common words.

Moreover, the process of understanding anaphors presents an interesting case of lexical access: Perhaps more than other lexical units, the meanings of some anaphors greatly depend on the context in which they occur. Consider the pronoun, *it*. Its meaning is constrained only to the extent that the concept be inanimate and singular;[2] beyond that, it can take on a host of different meanings. For instance, in just the present paper, the lexical unit *it* has over 50 different antecedents. Some anaphors seem to be, in a sense, lexically transparent.

Despite the ubiquity and transparency of some anaphors, for each

[1]This is not the case in other languages, such as Mandarin Chinese (Li & Thompson, 1979, 1981), Japanese (Hinds, 1978), or Spanish (Huang, 1984). In those languages, zero anaphora (e.g., "John went to the store and ∅ bought a quart of milk") is more often the rule and pronominal anaphora the exception. In fact, an English text would require ten times the number of pronouns as its Chinese translation (Li & Thompson, 1979).

[2]In some situations, animacy and number constraints are relaxed. For example, *it* is often used to refer to animates when the gender is unclear, as in "What a beautiful baby. Is *it* a boy or a girl?" And *they* is often used to refer to individuals when the gender is unimportant, as in "I asked someone how to get to Straub Hall, but *they* didn't know where it was either." (Gernsbacher, 1986).

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anaphor, a comprehender must access an appropriate antecedent; in other words, comprehenders must access each anaphor's unique referent (Clark & Sengul, 1979; van Dijk & Kintsch, 1983). How does this happen?

Let us consider how a typical, nonanaphoric word is uniquely accessed. Commonly, this process is described in terms of activation (either in the traditional sense of individual nodes becoming activated or in the distributed sense in which a pattern of activation represents an individual word). During an initial recognition phase, information provided by the word activates various candidates. Then, during an identification phase, constraints provided by lexical, semantic, syntactic, and other sources of information alter the candidates' levels of activation. Eventually, one candidate becomes most strongly activated. The most strongly activated candidate is the lexical representation that the comprehender can most easily access, and that is the representation which is incorporated into the comprehender's developing discourse representation (these proposals are culled from the models of Becker, 1976; Kintsch & Mross, 1985; Marslen-Wilson & Welsch, 1978; McClelland & Rumelhart, 1981; Norris, 1986).

The process of comprehending anaphors could proceed similarly. This process has also been conceived of in terms of activation (Corbett & Chang, 1983; Dell, McKoon, & Ratcliff, 1983; McKoon & Ratcliff, 1980). Like the meaning of a word, the identity of an anaphor—its antecedent—is presumably the candidate representation that becomes the most strongly activated (Kintsch, 1988; Walker & Yekovich, 1987).[3]

Behavioral data support this proposal. Consider the following sentence:

(1) Ann predicted that Pam would lose the track race, but *she* came in first very easily.

The antecedent of the pronoun, *she*, is the participant, *Pam*; the other participant, *Ann*, is what I shall refer to as a nonantecedent. When activation is measured after comprehenders have finished reading this sentence, the pronoun's antecedent, *Pam*, is indeed more activated than the nonantecedent, *Ann* (Corbett & Chang, 1983).

But how does an anaphor's antecedent become the most activated concept? Two cognitive mechanisms might play a role in this process. These two mechanisms belong to a framework I have proposed that describes some

[3]Note that I am not suggesting that once an anaphor's antecedent is accessed, comprehenders then activate that antecedent. Rather, I am suggesting that because an anaphor's antecedent is activated, it can then be accessed (and incorporated into the developing discourse representation). Consider again the analogy with word identification: Comprehenders do not figure out the identity of a word, and then activate that word. Rather, it is because the lexical representation is activated that the word can be accessed.

general, cognitive processes involved in comprehension (Gernsbacher, 1985, 1989). According to the framework, the goal of comprehension is to build a coherent mental representation or "structure." The two proposed mechanisms enable building these structures by moderating the activation of mental representations. One mechanism, *enhancement*, increases or boosts activation; the other mechanism, *suppression*, dampens or decreases activation. Although these mechanisms are considered general, cognitive mechanisms, they potentially play a role in many language comprehension phenomena.

For instance, I have suggested that the mechanism of suppression plays a role in how comprehenders disambiguate homographs. Immediately after comprehenders hear or read a homograph such as *bug*, multiple meanings are often activated—even when a particular meaning is specified by the preceding semantic context (e.g., "spiders, roaches, and other *bugs*," Swinney, 1979), or the preceding syntactic context (e.g., "I like *the watch*" versus "I like *to watch*," Tanenhaus, Leiman, & Seidenberg, 1979). However, after a quarter of a second, only the more appropriate meaning remains activated. What happens to the inappropriate meanings? One explanation is that a suppression mechanism, triggered by the semantic and syntactic context, decreases the less appropriate meanings' activation (Gernsbacher, Varner, & Faust, 1989; Kintsch, 1988; Swinney, 1979).

The mechanism of suppression as well as enhancement might also play a role in how comprehenders access the appropriate antecedent for an anaphor. The role they play might be to improve an antecedent's accessibility by modifying the activation levels of mental representations. Perhaps an antecedent becomes more accessible because it is enhanced, that is, its activation level is increased. Perhaps an antecedent also becomes more accessible because *other concepts* are suppressed. That is, a rementioned concept might rise to the top of the queue of potential referents because the activation levels of other concepts are decreased. So, enhancement might increase the antecedent's activation, and suppression might decrease the activation of nonantecedents. The two mechanisms' net effect would be that an anaphor's antecedent would become substantially more activated than other concepts; therefore, the antecedent could be easily accessed and incorporated into the comprehender's developing discourse structure. The experiments reported here examined this proposal.

But what triggers the mechanisms of suppression and enhancement? In the case of anaphoric reference, they are most likely triggered by information that specifies the antecedent's identity. The most available source of such information is the anaphor itself. However, anaphors differ in how much information they provide about their antecedents. Some anaphors, such as

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repeated noun phrases, are very explicit; they match their antecedents exactly (e.g., "*John* went to the store. *John* bought a quart of milk."). Other anaphors, such as the pronoun *it*, are less explicit; they often match several potential antecedents, and the information to uniquely identify their antecedents comes only from sources external to the anaphors.

Intuitively, more explicit anaphors seem more accessible than less explicit anaphors; empirically, sentences containing more explicit anaphors are read more rapidly than comparable sentences containing less explicit anaphors (Haviland & Clark, 1974; Yekovich & Walker, 1978). Furthermore, the antecedents of more explicit anaphors are more activated than the antecedents of less explicit anaphors (Corbett & Chang, 1983; McKoon & Ratcliff, 1980).

For instance, compare sentence (2) below with sentence (1) above.

(2) Ann predicted that Pam would lose the track race, but *Pam* came in first very easily.

In sentence (2), the second-clause anaphor is the repeated proper name, *Pam*. This is an example of a very explicit anaphor; it matches its antecedent exactly. In contrast, the anaphor in sentence (1), the pronoun, *she*, is considerably less explicit. It could refer to either participant, and only the semantic information in the second clause identifies its unique antecedent.[4] When Corbett and Chang (1983) measured activation after comprehenders read these two types of sentences, the antecedents were more activated than the nonantecedents (as mentioned above). Perhaps more intriguing, this difference was considerably larger when the anaphors were explicit proper names rather than less explicit pronouns.

This finding suggests that the information content of an anaphor affects its antecedent's accessibility. And it does so by separating its antecedent's activation level from other concepts' activation levels. One way this would happen is if the information available in an anaphor triggers the mechanisms of suppression and enhancement. If so, then the more explicit the anaphor (i.e., the more information it provides about its antecedent), the more likely it should be to trigger the suppression of nonantecedents and the enhancement of its own antecedent. In other words, the effects of suppression and enhancement should be a function of anaphoric explicitness. The experiments reported here examined this proposal.

How does an anaphor trigger the mechanisms of suppression and enhancement? If we consider an anaphor as analogous to a retrieval cue, we can draw upon models of recognition memory to illuminate this process. According to

[4]Some might argue that certain syntactic strategies, for instance, a preference for parallel structure, provide information about the antecedent's identity (Cowan, 1980; Sheldon, 1974).

many models, a retrieval cue makes previously represented traces accessible in the same way that a tuning fork evokes vibrations from tuning forks of similar frequencies. Indeed, Ratcliff (1978) describes retrieval as "resonance" (and uses the tuning fork analogy), and Hintzman (1987, 1988) describes it as a "probe" evoking an "echo."

Furthermore, in such models, the more similar a retrieval cue is to a previously experienced trace, the greater the resonance or the more intense the echo. In other words, accessibility (through retrieval) is a function of the similarity between a retrieval cue and a memory trace. Simulations and experiments confirm this assumption (these proposals are culled from the models of Bower, 1967; Hintzman, 1987, 1988; McClelland & Rumelhart, 1986; Raaijmakers & Shiffrin, 1981; Ratcliff, 1978).

In a similar way, an anaphor might evoke (or trigger) the mechanisms of suppression and enhancement in order to improve its antecedent's accessibility. If so, the greater the similarity between an anaphor and its antecedent—in other words, the more explicit the anaphor is—the more powerfully the anaphor should trigger suppression and enhancement.

Information about an antecedent's identity also comes from sources beyond the anaphor, just as factors beyond the nature of the retrieval cue affect retrieval, and para-lexical (e.g., semantic and syntactic) information affects the recognition of nonanaphoric words. Presumably, information from these other sources also triggers suppression and enhancement, but most likely it does so more slowly (or perhaps less powerfully). The experiments reported here examined this proposal.

In essence, the model sketched above suggests that comprehenders access the appropriate antecedents for anaphors somewhat similarly to how they access the appropriate meanings of nonanaphoric words. In both cases, comprehenders access the most activated mental representations. The novel proposal is that two mechanisms play a role in this process by modifying activation. Suppression decreases the activation of other, nonantecedent concepts, while enhancement increases the antecedents' activation. The model also suggests that the mechanisms of suppression and enhancement are triggered by information that specifies the antecedents' identity. Foremost is the information provided by the anaphors. Therefore, more explicit anaphors should trigger more suppression and enhancement, just like more explicit retrieval cues evoke more resonance. Information from other sources (e.g., semantic and pragmatic information) should also trigger suppression and enhancement, but more slowly. Thus, the role of the two mechanisms is to improve a referent's accessibility. Comprehenders can then access that referent and incorporate it into their developing discourse structures.

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Experiment 1

The first experiment investigated whether more versus less explicit anaphors immediately trigger suppression or enhancement. To investigate this, the activation levels of antecedents versus nonantecedents were measured immediately before versus immediately after comprehenders read explicit versus less explicit anaphors.

Subjects read two clause sentences such as (1) or (2) above. In the first clause of each sentence, two participants were introduced, just as *Ann* and *Pam* are introduced in the first clauses of sentences (1) and (2). In the second clause of each sentence, one of those two participants was anaphorically referenced by either a less explicit, pronoun anaphor, such as *she* in sentence (1) or a more explicit, repeated name anaphor, such as *Pam* in sentence (2).

Immediately before and immediately after subjects read these anaphors, the activation level of the anaphors' antecedents (e.g., *Pam*) and nonantecedents (e.g., *Ann*) was measured. This was accomplished through a probe verification task: Subjects were presented with a probe word, and they rapidly verified whether the probe word had occurred in the sentence they were reading. Faster verification latencies reflect higher levels of activation (Ratcliff, Hockley, & McKoon, 1985). For the experimental sentences, the probe words were the names of the antecedents (e.g., *Pam*) or nonantecedents (e.g., *Ann*).

Three variables were manipulated: anaphor type (whether the anaphors were names or pronouns), probe name (whether the probe names were the antecedents or nonantecedents), and test point (whether the probe names were tested immediately before or immediately after the anaphors). A fourth variable was also manipulated; it was antecedent position (whether the antecedents were the first-mentioned participants, NP_1s, or the second-mentioned participants, NP_2s, in the first clause). An example of an NP_1 and an NP_2 experimental sentence appears in Table 1.

Method

Subjects

The subjects were 128 undergraduates at the University of Oregon. As in all the following experiments, the subjects participated as a means of fulfilling an introductory psychology course requirement; they were all native American English speakers, and no subject participated in more than one experiment.

Table 1. *Example stimulus sentences for Experiments 1, 2, and 3*

NP_1 type sentence
PRONOUN - ANTECEDENT (BILL)
Bill handed John some tickets to a concert[2] but[1] *he*[1,2,3] took the tickets back immediately.[3]
NAME - ANTECEDENT (BILL)
Bill handed John some tickets to a concert[2] but[1] *Bill*[1,2,3] took the tickets back immediately.[3]
PRONOUN - NONANTECEDENT (JOHN)
Bill handed John some tickets to a concert[2] but[1] *he*[1,2,3] took the tickets back immediately.[3]
NAME - NONANTECEDENT (JOHN)
Bill handed John some tickets to a concert[2] but[1] *Bill*[1,2,3] took the tickets back immediately.[3]
NP_2 type sentence
PRONOUN - ANTECEDENT (PAM)
Ann predicted that **Pam** would lose the track race[2] but[1] *she*[1,2,3] came in first very easily.[3]
NAME - ANTECEDENT (PAM)
Ann predicted that **Pam** would lose the track race[2] but[1] *Pam*[1,2,3] came in first very easily.[3]
PRONOUN - NONANTECEDENT (ANN)
Ann predicted that **Pam** would lose the track race[2] but[1] *she*[1,2,3] came in first very easily.[3]
NAME - NONANTECEDENT (ANN)
Ann predicted that **Pam** would lose the track race[2] but[1] *Pam*[1,2,3] came in first very easily.[3]

Note: For each sentence, the probe name appears in parentheses, the antecedent appears in boldface, the anaphor is in italics, and the two test points are superscripted with the experiment's number.

Materials and design

Sixty-four experimental sentences were constructed. All contained two clauses, mentioned two participants in the first clause (NP_1 and NP_2), and rementioned one of those two participants in the second clause. Many were modifications of Corbett and Chang's (1983) experimental sentences but with two additional properties controlled. The first property was the distance between the first mention of the NP_2s in the first clause and the anaphors in the second clause (for example, the distance between *John* and either the pronoun *he* or the rementioned name *Bill* in the first sentence shown in Table 1). Six words always intervened between those two points. The second property was the distance between the anaphors and the ends of the sentences. Five words always intervened between those two points.

To ensure that the information in the second clauses identified a unique antecedent, the following normative data were collected. Fifty subjects at the

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University of Texas, who were otherwise uninvolved with any of the experiments reported here, read the experimental sentences in their pronoun-anaphor forms (e.g., "Bill handed John some tickets to a concert, but *he* took the tickets back immediately"). The subjects indicated which of the two participants the pronouns referred to. Only sentences that elicited more than 90% agreement with the experimenter were used in the experiment. These sentences are listed in Appendix A.

In each sentence, the two participants' names were typical, American first names that were matched for perceived familiarity and length in letters. They were names commonly ascribed to only one gender (for instance, names such as "Pat" were avoided). Across all the sentences, half the names were stereotypically female, and half were stereotypically male. But within each sentence, the two names were stereotypic of the same gender.

To encourage comprehension, each experimental sentence was followed by a two-alternative WH question, with the two answers being the two participants' names. Half the questions were about the first clause, and half were about the second clause. When the anaphors were pronouns, the questions were about the second clause. This served the purpose of discovering whether subjects understood who the pronouns referred to. Examples of this type of question for the NP_1 and NP_2 sentences in Table 1 are "Who took the tickets back immediately?" and "Who came in first very easily?", respectively. When the anaphors were names, the questions were about the first clauses. And, as a finer division, half the questions were about the first-mentioned participants' activity in the first clause (e.g., "Who handed someone some tickets?" or "Who predicted that someone would lose a race?"), and half were about the second-mentioned participants' activity in the first clause (e.g., "Who was handed some tickets?" or "Who was predicted to lose the race?").

Forty-eight lure sentences were constructed. A lure sentence was one in which the probe name did not occur. The lure sentences had one of the following three syntactic forms: (i) 16 were identical to the NP_1 experimental sentences with half the anaphors being pronouns and half being the names of NP_1, (ii) 16 were identical to the NP_2 experimental sentences with half the anaphors being pronouns and half being the names of NP_2, and (iii) 16 had first clauses identical to the experimental sentences, but the anaphors were the plural pronoun *they*, for example, "Bobby saw David walking over to the library, and *they* decided to walk there together." In these lure sentences, the probe names were tested at one of four different locations. In 12 lure sentences (four each of the three syntactic forms), the probe names were tested relatively early in the sentence; in another 12 sentences, the probe names were tested relatively late in the sentence; in another 12, the probe names were tested immediately prior to the anaphors (just like the experi-

mental sentences) and in the final 12, the probe names were tested immediately after the anaphors (again, just like the experimental sentences).

Eight material sets were formed. Within a material set, there was an equal number of experimental sentences in the eight experimental conditions. Across material sets, each experimental sentence occurred in all eight of its experimental conditions. Twelve subjects were randomly assigned to each material set; thus, each subject was exposed to an experimental sentence in only one of its conditions. The lure sentences occurred in the same randomly selected order in each material set.

Procedure

The stimulus sentences appeared word-by-word in the center of a video display monitor. How long each word remained on the screen was a function of its length plus a constant. The function was 16.667 ms per character, and the constant was 300 ms. For example, a five-letter word was shown for 383.3 ms. These timing parameters were based on the reading times produced by 12 subjects, who were otherwise uninvolved with the experiment, and who read self-paced, word-by-word through the experimental materials. Even the slowest of these 12 subjects read comfortably faster than the rate produced by the above function.

Each trial began with a warning signal, which was a plus sign that appeared for 750 ms in the center of the screen. After that, each word of the sentence appeared with an interword interval of 150 ms. When the probe names were tested, they appeared in capital letters at the top of the screen. When the probe names were tested before the anaphors, they appeared 150 ms after the offset of the word immediately prior to the anaphors. When they were tested immediately after the anaphors, they appeared 150 ms after the offset of the anaphors. The probe names remained on the screen until either the subjects responded or 2.5 seconds elapsed. Subjects responded with their dominant hand, pressing one key with their index finger and another with their middle finger.

After each experimental sentence, the word *Test* appeared for 750 ms toward the bottom of the screen to warn subjects that a comprehension question would appear next. Appearing along with the comprehension question were its two answer choices (i.e., the two participants' names). One answer choice appeared in the bottom left corner, and the other in the bottom right corner. The answer choice in each corner was correct half the time. The questions and answer choices remained on the screen until either the subjects responded by pressing one of two response keys, or 10 s elapsed. After responding, the subjects were given feedback about their accuracy.

Subjects were replaced if they failed to meet the following criteria: 90%

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Results

The following is true of all the analyses reported for this and the subsequent experiments: The correct response times were analyzed in two sets of analyses of variance (ANOVAs). In the first set, *subjects* was treated as a random effect; in the second, *items* was treated as a random effect. The results reported here are based on the *minF'* statistic (Clark, 1973) and a significance level of $p < .05$ or lower.

For Experiment 1, the design of both sets of ANOVAs was 2 (Anaphor Type: name vs. pronoun) × 2 (Probe Name: antecedent vs. nonantecedent) × 2 (Test Point: before vs. after the anaphors) × 2 (Antecedent Position: NP_1 vs. NP_2). In the subjects' analysis, all four factors were within-subjects. In the items' analysis, antecedent position (NP_1 vs. NP_2) was a between-items factor.

One main effect was significant: Responses were faster when the probe names were the antecedents ($M = 861$) than the nonantecedents ($M = .905$), $minF'(1,120) = 24.69$; in other words, the antecedents were more activated than the nonantecedents. This effect replicates Corbett and Chang (1983).

Four interactions were significant. One was between antecedent position (NP_1 vs. NP_2) and probe name (antecedents vs. nonantecedents), $minF'(1,151) = 37.59$. This interaction is actually an effect of order of mention: Responses were significantly faster when the probe names were the first-mentioned participants (i.e., the antecedent position was NP_1 and the probe names were the antecedents, or the antecedent position was NP_2 and the probe names were the nonantecedents) than when the probe names were the second-mentioned participants (i.e., the antecedent position was NP_2 and the probe names were the antecedents, or the antecedent position was NP_1 and the probe names were the nonantecedents). In other words, first-mentioned participants were verified more rapidly ($M = 853$) than second-mentioned participants ($M = 913$).

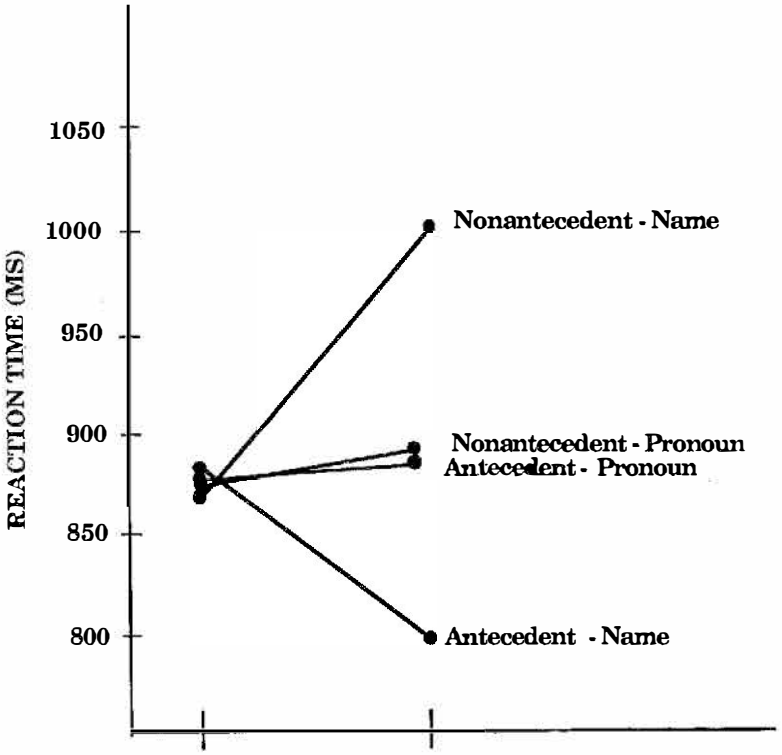
This advantage for first-mentioned participants has been observed before (Corbett & Chang, 1983; Stevenson, 1986; Von Eckardt & Potter, 1985). Among its more trivial explanations is the notion that the first-mentioned participants' names (although assigned randomly) were more salient. However, even in Experiment 4 when antecedent position was manipulated within-items, the same advantage held. The source of this advantage will be

discussed in the General Discussion.

Of the three other significant interactions, one was between anaphor type and probe name, *minF'*(1,160) = 43.51, and one was between probe name and test point, *minF*(1,127) = 37.26. However, both of these interactions were qualified by the remaining significant interaction, a three-way interaction involving anaphor type (name vs. pronoun), probe name (antecedent vs. nonantecedent), and test point (before vs. after the anaphors), *minF'*(1,162) = 53.74. This three-way interaction is illustrated in Figure 1.

Consider first what happened when the anaphors were explicit, repeated names. As illustrated in Figure 1, when the anaphors were names, probe name interacted with test point, *minF'*(1,157) = 103.26, in the following way:

Figure 1. *Subjects' mean response times in Experiment 1.*



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Responses to the nonantecedents were 122 ms slower after the name anaphors (M = 990) than before (M = 868), $minF'(1,155) = 66.90$. On the other hand, responses to the antecedents were 76 ms faster after the name anaphors (M = 803) than before (M = 879), $minF'(1,117) = 22.60$.

This is the pattern one expects if name anaphors trigger both the suppression of nonantecedent participants—which is why the nonantecedents were less activated immediately after the anaphors than before—as well as the enhancement of their own antecedents—which is why the antecedents were more activated immediately after the anaphors than before. Thus, explicit, repeated name anaphors appear to improve their antecedents' accessibility by triggering both of the proposed mechanisms.

However, as also illustrated in Figure 1, this is what happens with explicit name anaphors, but not necessarily less explicit pronouns. Indeed, when the anaphors were pronouns, the probe name by test point interaction was far from reliable, $F_1(1,127) = 0.04$, $F_2(1,62) = 0.03$ (which was the basis of the three-way interaction between anaphor type, probe name, and test point). In fact, response times after the pronouns (M = 885) were statistically indistinguishable from response times before the pronouns (M = 877), both Fs < 1, and this was true for both the antecedents and the nonantecedents, both $minF$s < 1. In other words, there was no immediate change in activation as a result of subjects reading the pronouns.

Discussion

Experiment 1 demonstrated that explicit name anaphors immediately improve their antecedents' accessibility by both suppression and enhancement. The evidence that name anaphors immediately trigger the suppression of other nonantecedent participants came from the finding that the nonantecedents were considerably less activated after the names than before; the evidence that name anaphors immediately trigger the enhancement of their antecedents came from the finding that the antecedents were considerably more activated after their anaphors than before. The two mechanisms' net effect was that the antecedents and nonantecedents differed markedly in their levels of activation; thus, together the two mechanisms greatly improved their antecedents' accessibility.[5]

[5]An alternative explanation for the name anaphor data is that responses immediately following the name anaphors were faster to the antecedents than the nonantecedents because the name anaphors and the antecedents were visually identical. First, the two stimuli were not identical as all the probe words were presented in upper case while the anaphors, like all the words in the sentences, were presented in lower case with the proper names having capitalized initial letters. Second, this visually identical explanation cannot explain why

In contrast to explicit name anaphors, less explicit pronouns do not appear to immediately trigger either suppression or enhancement. This contrast suggests that the anaphors' informational content (their explicitness) affects how rapidly (and possibly how powerfully) they affect their antecedents' accessibility. More explicit anaphors, such as repeated names, appear to immediately trigger suppression and enhancement; less explicit anaphors, such as pronouns that match the gender, number, and case of multiple participants, do not immediately affect the activation of either their antecedents or nonantecedents.

Indeed, in Experiment 1, the pronouns' antecedents and nonantecedents were just as activated before the pronouns as immediately after. This suggests that both the antecedents and nonantecedents were already activated before the pronouns, and they simply remained at that level of activation immediately afterward. Although this finding conflicts with many psycholinguists' assumption that pronouns immediately "reactivate" their antecedents, it confirms many functional linguists' assumption that speakers and writers use pronouns to refer to concepts that are already activated in their listeners' and readers' mental representations.

For instance, according to Karmiloff-Smith (1980), "anaphoric pronominalization functions as an implicit instruction for the addressee *not* to recompute for retrieval of an antecedent referent, but rather to treat the pronoun as the default case for the thematic subject of a span of discourse." Similarly, in Chafe's (1974) view, pronouns are used to refer to "given information" about which he writes: "If the exploration in terms of consciousness is correct, it is misleading to speak as if the addressee needs to perform some operation of recovery for given information. The point is rather that such information is already on stage in the mind." In recent work, Chafe (1987) has translated his conception of "on stage in the mind" into cognitive psychologists' nomenclature of "already active."

Other behavioral data corroborate Experiment 1 and thereby support func-

the nonantecedents were responded to substantially more slowly immediately after the name anaphors than immediately before; that is, it fails to explain the effect attributed to suppression, which was substantially larger than the effect attributed to enhancement (and hypothetically accounted for by visual identity). Third, the visual-identity explanation cannot explain why the nonantecedents were responded to more slowly immediately after the name anaphors than immediately after the pronouns; the nonantecedents were as visually dissimilar to the name anaphors as they were to the pronouns. And fourth, the visual-identity explanation cannot explain why, in Experiment 3, when activation was measured at the ends of the sentences, neither the name anaphors' antecedents nor their nonantecedents became more or less activated across the sentences' second clauses; that is, there was no change in activation from the test point immediately after the anaphors to a test point at the ends of the sentences. If the enhancement effect was due to visual-identity, one would surely expect the visual-identity advantage to be stronger immediately after the anaphors than at the ends of the sentences.

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tional linguists' assumption. For instance, in a study by Tyler and Marslen-Wilson (1982), subjects heard sentences such as

(3) The sailor tried to save the cat, but *he/it* fell overboard instead.

Each sentence introduced a human and a nonhuman participant (e.g., *sailor* and *cat*), and in the second clause of each sentence, one of the participants was referred to with a human versus nonhuman pronoun (e.g., *he* or *it*). While listening to each sentence, comprehenders made lexical decisions to probe words, which on the experimental trials were related to one of the two participants. For instance, the probe word for sentence (3) might have been *boat* or *dog*.

The probe words were responded to more rapidly when they were related to one of the two participants than when they were presented during control (unrelated) sentences. But it did not matter whether the probe words were tested before versus after the pronouns; neither did it matter whether the probe words were related to the pronouns' antecedents or the nonantecedents. The same level of semantic facilitation was observed in each case. In other words, like Experiment 1, there was evidence that both the antecedents and nonantecedents were already activated prior to the pronouns, and like Experiment 1, this level of activation did not change immediately because of the pronouns.

Indeed, Tyler and Marslen-Wilson (1982) concluded that "the analysis that fits the results best [is] that both [participants] are activated early in the second clause, and remain activated for at least the next few words" (p. 281).

So, the Tyler and Marslen-Wilson (1982) data, as well as Experiment 1, demonstrate that less explicit, pronoun anaphors do not immediately trigger suppression or enhancement to improve their antecedents' accessibility. But surely, at some point, the pronouns' antecedents and nonantecedents must differ in their activation level. How else would comprehenders access the pronouns' unique referents? Experiments 3, 4, and 5 in this series explored how and when this occurs.

Before turning toward those experiments, an alternative explanation for one aspect of Experiment 1's results needs elimination. Perhaps the before-the-anaphor test point demonstrated that the antecedents and nonantecedents were already activated because that test point occurred at the beginning of a clause. Perhaps, at the beginning of a clause, recently mentioned concepts are automatically reactivated. Such a hypothesis falls out of certain processing models that treat clauses as their processing units. In such models, it seems advantageous if—at the beginning of a new processing cycle (e.g., a clause)—concepts from the prior cycle were made more accessible. Experiment 2 attempted to rule out this explanation and while doing so provided an opportunity to replicate Experiment 1.

Experiment 2

Experiment 2 was identical to Experiment 1 except that the before-the-anaphor test point was moved up one word. Recall that in Experiment 1, the before-the-anaphor test point was immediately after the conjunctions and, therefore, after the first words of the second clauses. In Experiment 2, the before-the-anaphor test point was immediately after the last words of the first clauses, that is, immediately prior to the conjunctions. This revised test point is indicated in Table 1 with the superscript *2*. As indicated in Table 1, the after-the-anaphor test point was identical to Experiment 1.

Method

The only methodological difference between Experiment 2 and Experiment 1 was that when the probe names were tested before the anaphors, they appeared 150 ms after the offset of the first clauses' final words. Ninety-six subjects participated.

Results

The design of the ANOVAs was the same as in Experiment 1, and the results were identical. Responses were faster when the probe names were the antecedents (M = 922) than the nonantecedents (M = 974), $minF'(1,108) = 20.13$. This replicates both Experiment 1 and Corbett & Chang (1983). In addition, antecedent position (NP_1 vs. NP_2) interacted with probe name, $minF'(1,106) = 23.39$, again, demonstrating that, in general, first-mentioned participants were verified more rapidly (M = 920) than second-mentioned participants (M = 976).

Furthermore, as in Experiment 1, three other interactions were significant. One interaction was between anaphor type and probe name, $minF'(1,139) = 35.68$, and another was between probe name and test point, $minF'(1,116) = 10.23$. However, both interactions were again qualified by a three-way interaction involving anaphor type, probe name, and test point, $minF'(1,87) = 8.26$, and this three-way interaction is shown in Figure 2.

As illustrated in Figure 2, when the anaphors were names, probe name (antecedent vs. nonantecedent) strongly interacted with test point (before vs. after the anaphors), $minF'(1,116) = 34.64$. And the pattern of this interaction was identical to Experiment 1: Responses to the nonantecedents were 127 ms slower after the name anaphors (M = 1069) than before (M = 942), $minF'(1,111) = 34.81$. On the other hand, responses to the antecedents were

Figure 2. *Subjects' me*

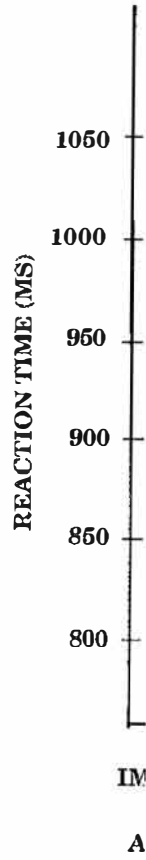

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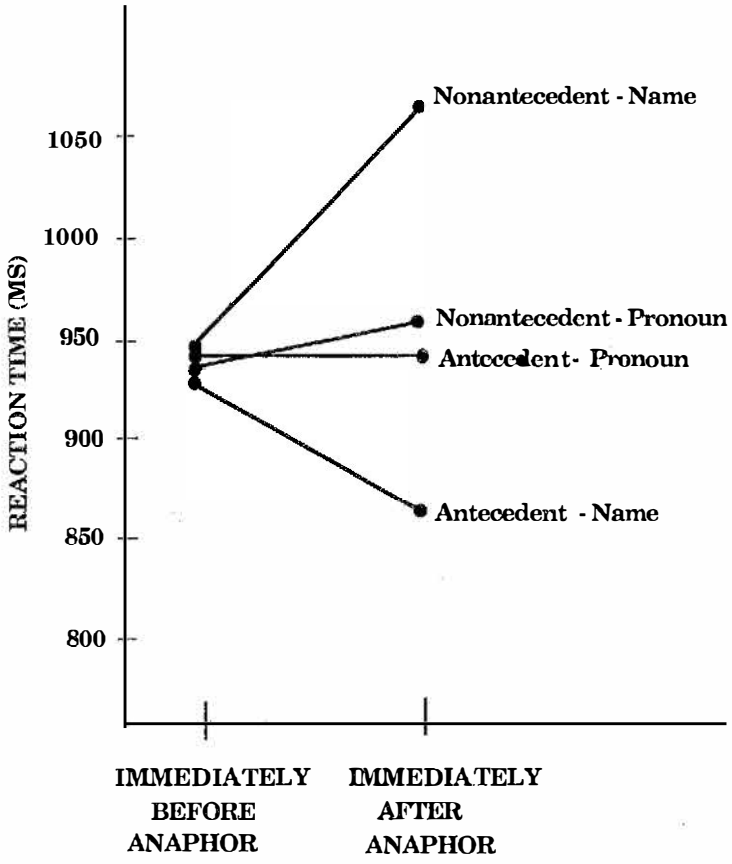
Figure 2. *Subjects' mean response times in Experiment 2.*



85 ms faster after the name anaphors (M = 864) than before (M = 949), $minF'(1,124) = 14.19$.

As in Experiment 1, this pattern suggests that name anaphors immediately trigger both the suppression of nonantecedents—which is why the nonantecedents were less activated after the anaphors than before—and the enhancement of their antecedents—which is why the antecedents were more activated after the anaphors than before. So, like Experiment 1, Experiment 2 provided evidence that explicit, repeated name anaphors improve their antecedents' accessibility by immediately triggering both of the proposed mechanisms.

However, also like Experiment 1, this evidence was observed only for the name anaphors. Indeed, when the anaphors were less explicit pronouns, the

probe name by test point interaction was far from reliable, $minF' < 1.0$. That is, response times after the pronouns ($M = 942$) were statistically indistinguishable from response times before the pronouns ($M = 937$), both Fs < 1. And again, this was true for both the antecedents and the nonantecedents, both $minF$s < 1. Thus, there was no immediate change in activation as a result of subjects reading the pronouns.

Discussion

Experiment 2 perfectly replicated Experiment 1 in demonstrating that explicit name anaphors immediately improve their antecedents' accessibility by both suppression and enhancement. Experiment 2 also perfectly replicated Experiment 1 in demonstrating that, in contrast to explicit name anaphors, less explicit pronouns do not trigger suppression or enhancement immediately. As in Experiment 1, the pronouns' antecedents were activated at the same level as their nonantecedents both before and after the pronouns. This pattern again suggests that the two sentence participants were already activated prior to the anaphors, and the pronouns did not alter those activation levels. Furthermore, Experiment 2 demonstrated that when this pattern was observed in Experiment 1, it was not due to the participants being reactivated at the beginnings of their second clauses.

But, as mentioned before, surely at some point following the pronouns, their antecedents and nonantecedents should be activated at different levels. How else would comprehenders access the pronouns' unique referents? Indeed, when Corbett and Chang (1983) measured activation at the ends of the sentences, they found that the pronouns' antecedents and nonantecedents differed in activation.

Perhaps the semantic information presented in the second clauses combines with information provided by the pronouns.[6] This combined information might also trigger suppression or enhancement, but it might do so less quickly or less powerfully than if the information was explicitly provided by the anaphor. Experiment 3 investigated this proposal by measuring activation immediately after the anaphors (as in Experiments 1 and 2) and at the ends of the sentences (as in Corbett & Chang's study, 1983).

[6] I am using the term "semantic information" very loosely. Actually, this information can only be interpreted by employing the "real world" or model-based (Johnson-Laird & Garnham, 1980) knowledge. For instance, comprehenders must know that the person who comes in first very easily is typically the person about whom a prediction was made rather than the person who made the prediction.

Experiment 3

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Experiment 3

Experiment 3 was identical to Experiments 1 and 2 except that activation was measured immediately after the anaphors and at the ends of the sentences. These two points are indicated in Table 1 with the superscript *3*. Measuring activation immediately after the anaphors provided the opportunity to replicate the after-the-anaphor test point data from Experiments 1 and 2; measuring activation at the ends of the sentences provided the opportunity to replicate Corbett and Chang (1983). Comparing the two test points provided the opportunity to document what happens over the second clauses of the sentences to make the pronouns' antecedents more accessible.

Method

Experiment 3 used the same materials as Experiments 1 and 2. The procedure was also identical, with the following major exception: The probe names were presented either 150 ms after the offset of the anaphors or 150 ms after the offset of the final words of the sentences. Recall that six words always intervened between the introduction of the second sentence participants (NP_2) and the anaphors, and five words always intervened between the anaphors and the ends of the sentences. Ninety-six subjects participated.

Results

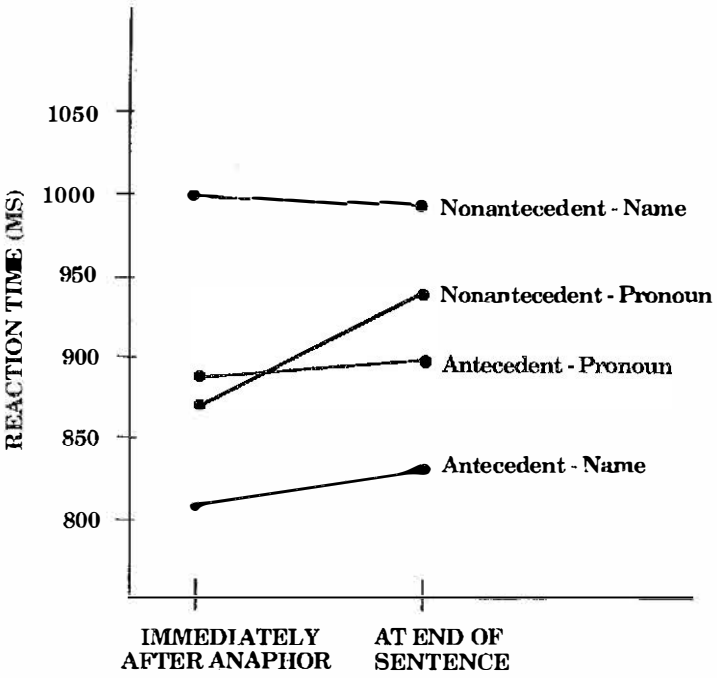
The design of the ANOVAs was the same as in Experiments 1 and 2. Two main effects were significant. First, responses were faster to the antecedents ($M = 849$) than the nonantecedents ($M = 947$), $minF'(1,95) = 40.54$. Second, responses were faster immediately after the anaphors ($M = 891$) than at the ends of the sentences ($M = 914$), $minF'(1,116) = 5.55$.

Three interactions were significant. First, as in Experiments 1 and 2, antecedent position interacted with probe name, $minF'(1,99) = 23.88$, again demonstrating that, in general, first-mentioned participants were verified more rapidly ($M = 870$) than second-mentioned participants ($M = 936$).

Second, probe name interacted with anaphor type, $minF'(1,143) = 86.21$. But this two-way interaction was qualified by the only other significant interaction: a three-way interaction involving probe name, anaphor type, and test point, $minF'(1,120) = 7.47$. This three-way interaction is shown in Figure 3.

As illustrated in Figure 3, when the probe names were the nonantecedents, anaphor type (name vs. pronoun) interacted with test point, $minF'(1,119) = 10.28$, creating the following effect: The difference between response times

Figure 3. *Subjects' mean response times in Experiment 3.*



when the anaphors were names versus pronouns was much larger immediately after the anaphors (134 ms) than at the ends of the sentences (55 ms), although both differences were reliable, $minF'(1,121) = 49.87$, and $minF'(1,119) = 11.03$, respectively. On the other hand, when the probe names were the antecedents, anaphor type did not interact with test point, $minF' < 1$; the difference between response times when the anaphors were names versus pronouns was about the same immediately after the anaphors as at the ends of the sentences.

Another way to think about this three-way interaction is that the effect of test point was greatest on one particular combination of anaphor type and probe name. That combination was when the anaphors were pronouns, and the probe names were nonantecedents. For that combination, and that combination alone, the difference between the two test points was reliable (all other $minF$s < 1). This difference arose because responses to the pronouns' nonantecedents were significantly slower at the ends of the sentences ($M = 933$) than they were immediately after the anaphors ($M = 866$), $minF'(1,106) = 12.49$.

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Discussion

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In other words, only the activation level of the pronouns' nonantecedents changed as subjects read the second clauses. As illustrated in Figure 3, the change was that the pronouns' nonantecedents became less activated. One interpretation of this change is that the information provided by the pronouns, combined with the semantic information available in the second clauses, triggered the suppression of the nonantecedents. Thus, like repeated name anaphors, semantically-biased pronouns also appear to trigger suppression, but they do so more slowly and less powerfully.

Further analyses compared Experiment 3 with Experiment 1, Experiment 2, and Corbett and Chang (1983). First, consider the data collected immediately after the pronouns in Experiment 3. Those data perfectly replicated Experiments 1 and 2. All three experiments found that response times to the pronouns' antecedents versus nonantecedents were statistically indistinguishable ($minF' < 1$ for Experiment 3). So, again, there was no evidence that pronouns immediately affect the activation of either their antecedents or nonantecedents.

Next, consider the data collected immediately after the names in Experiment 3. Those data also perfectly replicated Experiments 1 and 2. All three experiments demonstrated that immediately after the more explicit name anaphors, the antecedents and nonantecedents were activated at considerably different levels. In Experiment 3 this difference was 191 ms; in Experiment 1 it was 187 ms; and in Experiment 2 it was 202 ms. Experiments 1 and 2 suggested that this difference arose because name anaphors immediately trigger both the suppression of their nonantecedents and the enhancement of their antecedents.

Finally, consider the data collected at the ends of the sentences in Experiment 3. Those data perfectly replicated Corbett & Chang (1983). In both studies, anaphor type interacted with probe name. That is, the difference between the antecedents versus nonantecedents was greater when the anaphors were explicit names than it was when they were less explicit pronouns. Again, this suggests that the more explicit the anaphor—that is, the more information it provides about its antecedent—the more likely it is to trigger suppression and enhancement.

Discussion

Experiment 3 further illustrated the role that the mechanism of suppression plays in improving referential access. Experiment 3 demonstrated that semantically-biased pronouns also trigger the suppression of nonantecedents. This demonstration came from the following effect: Immediately after the pronouns, the antecedents and nonantecedents did not differ in activation (re-

plicating Experiments 1 and 2), but by the ends of the sentences, they did (replicating Corbett & Chang, 1983). As illustrated in Figure 3, this difference arose because the nonantecedents lost activation. So, it appears that pronouns also improve their antecedents' referential access by triggering the suppression of other concepts, but they do so more slowly (and perhaps less powerfully).

Why do pronouns trigger suppression more slowly than name anaphors? One explanation is that pronouns are less explicit than repeated name anaphors. That is, even though—as in the sentences presented in these experiments—semantic information often helps disambiguate pronouns, pronouns per se are less explicit than other forms of anaphora. So, the suppression mechanism is triggered more slowly, perhaps because information has to be gathered from other sources.

Unfortunately, this assumption is hard to test directly with the sentences used in Experiment 3 because it was not until the second clauses that the semantic information occurred: That factor alone could explain why the effects of suppression were not observed until the test point at the end of the sentences. A stronger test of this proposal could be made if the semantic information occurred prior to the pronouns, and the second clauses were neutral. If suppression is still triggered more slowly, this would suggest that information available in the anaphors is what primarily triggers the mechanism of suppression during referential access. Experiment 4 explored this proposal.

Experiment 4

In Experiment 4, the two-clause sentences of Experiments 1, 2, and 3 were expanded into sentence pairs. The first sentence of each pair introduced the two participants and created a context, as in

(4) Bill lost a tennis match to John.

These first sentences remained constant across all the conditions. The second sentence of each pair began with a participial phrase. These preposed phrases were what provided the semantic information to further identify the anaphors, as in

(5) Accepting the defeat, he walked quickly toward the showers.
(6) Enjoying the victory, he walked quickly toward the showers.

The second sentence of each pair had two versions. In one version, the participial phrases referred to the first-mentioned participants (NP_1), as in

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Table 2. *Example st*

NP_1 version
PRONOUN -
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NAME - AN
Bill lost a ten
Accepting the
PRONOUN -
Bill lost a ten
Accepting the
NAME - NO
Bill lost a ten
Accepting the
NP_2 version
ANTECEDE
Bill lost a ten
Enjoying the
ANTECEDE
Bill lost a ten
Enjoying the
NONANTEC
Bill lost a ten
Enjoying the
NONANTEC
Bill lost a ten
Enjoying the

Note: For ea
boldface, the
number.

(5) above; in the other version, the phrases referred to the second-mentioned participants (NP_2), as in (6) above. In this way, the antecedent position variable was manipulated within-items. However, both versions of the second sentences had identical main clauses, and these were intended to be neutral vis-à-vis the anaphors' identities. In this way, the semantic information was restricted to the preposed participial phrases (i.e., the information occurring before the anaphors).

Table 2. *Example stimulus sentences for Experiment 4*

NP_1 version
PRONOUN - ANTECEDENT (BILL) **Bill** lost a tennis match to John. Accepting the defeat, *he*[4] walked slowly toward the showers.[4]
NAME - ANTECEDENT (BILL) **Bill** lost a tennis match to John. Accepting the defeat, ***Bill***[4] walked slowly toward the showers.[4]
PRONOUN - NONANTECEDENT (JOHN) **Bill** lost a tennis match to John. Accepting the defeat, *he*[4] walked slowly toward the showers.[4]
NAME - NONANTECEDENT (JOHN) **Bill** lost a tennis match to John. Accepting the defeat, *Bill*[4] walked slowly toward the showers.[4]
NP_2 version
ANTECEDENT - PRONOUN (JOHN) Bill lost a tennis match to **John**. Enjoying the victory, *he*[4] walked slowly toward the showers.[4]
ANTECEDENT - NAME (JOHN) Bill lost a tennis match to **John**. Enjoying the victory, *John*[4] walked slowly toward the showers.[4]
NONANTECEDENT - PRONOUN (BILL) Bill lost a tennis match to **John**. Enjoying the victory, *he*[4] walked slowly toward the showers.[4]
NONANTECEDENT - NAME (BILL) Bill lost a tennis match to **John**. Enjoying the victory, *John*[4] walked slowly toward the showers.[4]

Note: For each sentence, the probe name appears in parentheses, the antecedent appears in boldface, the anaphor is in italics, and the two test points are superscripted with the experiment's number.

As in Experiment 3, the variables anaphor type (whether the anaphors were names or pronouns), probe name (whether the probe names were the antecedents or nonantecedents), and test point (whether the probe names were tested immediately after the anaphors or at the ends of the sentences) were also manipulated. An example experimental sentence appears in Table 2.

Method

Subjects

The subjects were 192 undergraduates at the University of Oregon.

Materials and design

Sixty-four experimental sentence pairs were constructed. As mentioned above, a sentence pair comprised a context-setting sentence that introduced the two participants, followed by a sentence that referred to only one of the two participants. The second sentences began with one of two participial phrases. The two participial phrases were as similar in form as possible, and, although they were not identical in length, they typically varied by only a couple of characters. The distance between the anaphors and the ends of the sentences was always five words.

To make sure that the proposed participial phrases did indeed refer to only one of the participants, the following normative data were collected. Fifty subjects at the University of Texas, who were otherwise uninvolved with any of the experiments reported here, read the experimental sentence pairs with the second sentence of each pair in its pronoun-anaphor form. For example, the subjects read, "Bill lost a tennis match to John. Accepting the defeat, he walked quickly toward the showers." Or they read, "Bill lost a tennis match to John. Enjoying the victory, he walked quickly toward the showers." The subjects indicated which of the two participants the pronouns referred to. Only sentence pairs that elicited more than 90% agreement with the experimenter were used in Experiment 4.

In addition, to make sure that the information following the anaphors was neutral, more normative data were collected. Another group of 50 subjects at the University of Texas, who were otherwise uninvolved with the experiments, also read the sentences in their pronoun forms. But for these subjects, the second clauses of the second sentences were replaced with ellipses. For example, these subjects read, "Bill lost a tennis match to John. Accepting the defeat, he ... ." Or they read, "Bill lost a tennis match to John. Enjoying the victory, he ... ." Again, subjects indicated which of the two participants

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the pronouns referred to. Only sentence pairs that elicited over 95% agreement between this second group of subjects and the first group (who had received the sentence pairs with their final clauses intact) were used in Experiment 4. The 64 experimental sentence pairs appear in Appendix B.

As in Experiments 1, 2, and 3, the names of the two participants in each sentence pair were matched for perceived familiarity and length in letters and were stereotypic of only one gender. Across all sentence pairs, half the names were stereotypically female, and half were stereotypically male.

Also as in Experiments 1, 2, and 3, to encourage comprehension, each experimental sentence was followed by a two-alternative WH question. The two answers were the two participants. Half the questions were about the first sentences (the context-setting sentences), and half were about the second sentences. When the anaphors were pronouns, the questions were about the second sentences. And, as a finer division, half were about the participial phrases; for example, for the sentence in Table 2, these questions were "Who enjoyed the victory?" and "Who accepted the defeat?" The other half were about the main clauses (e.g., "Who walked quickly toward the showers?"). These questions tested whether subjects had identified who the pronouns referred to. When the anaphors were names, the questions were about the first sentences. And, as a finer division, half were about the first-mentioned participants' activity (e.g., "Who lost a tennis match?"), and the other half were about the second-mentioned participants' activity (e.g., "Who won a tennis match?").

Forty-eight lure sentence pairs were constructed with the following syntactic forms: (i) 16 were identical to the NP_1 experimental sentence pairs, with half the anaphors being pronouns and half being the names of NP_1, (ii) 16 were identical to the NP_2 experimental sentence pairs, with half the anaphors being pronouns and half being the names of NP_2 and (iii) 16 had first sentences identical to the experimental sentence pairs, but the anaphors in the second sentences were the plural pronoun *they*, for example, "Bobby showed the new computer to David. After setting it up, *they* wanted to try it out."

Sixteen material sets were formed. Within a material set, there was an equal number of experimental sentences in the 16 experimental conditions. Across material sets, each sentence occurred in all of its experimental conditions. Twelve subjects were randomly assigned to each material set; thus, each subject was exposed to an experimental sentence in only one of its conditions. The lure sentences occurred in the same randomly selected order on each material set.

Procedure

The procedure was identical to that of Experiment 3.

Results

The design of both the subjects' and items' ANOVAs was a 2 (Anaphor Type: name vs. pronoun) × 2 (Probe Name: antecedent vs. nonantecedent) × 2 (Test Point: immediately after the anaphors vs. at the ends of the sentences) × 2 (Antecedent Position: NP_1 vs. NP_2). In both sets of ANOVAs, all four factors were within-subjects (or items) factors.

Two main effects were significant, the same ones as in Experiment 3. Responses were faster to the antecedents (M = 888) than the nonantecedents (M = 989), *minF'*(1,133) = 171.18. And responses were faster immediately after the anaphors (M = 920) than at the ends of the sentences (M = 958), *minF'*(1,129) = 29.08.

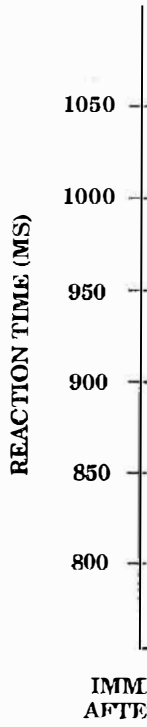
Three interactions were also significant. First, as in Experiments 1, 2, and 3, antecedent position (NP_1 vs. NP_2) interacted with probe name, *minF'*(1,137) = 52.03, again demonstrating that, in general, first-mentioned participants were verified more rapidly (M = 909) than second-mentioned participants (M = 969).

The second significant interaction also replicated Experiment 3. It was between probe name and anaphor type, *minF'*(1,170) = 128.66. And again it was qualified by the only other significant interaction, a three-way interaction involving probe name, anaphor type, and test point, *minF'*(1,127) = 6.881. The three-way interaction is shown in Figure 4.

As illustrated in Figure 4, when the probe names were the nonantecedents, anaphor type (name vs. pronoun) interacted with test point (immediately after the anaphors vs. at the ends of the sentences), *minF'*(1,133) = 6.746, in the following way: The difference between response times when the anaphors were names versus pronouns was larger immediately after the anaphors (102 ms) than at the ends of the sentences (49 ms). In contrast, when the probe names were the antecedents, anaphor type did not interact with test point, *minF'* < 1; the difference between response times when the anaphors were names versus pronouns was about the same immediately after the anaphors as at the ends of the sentences.

This three-way interaction suggests, as it did in Experiment 3, that the combination of anaphor type and probe name most affected by test point was when the anaphors were pronouns, and the probe names were the nonantecedents. In other words, the activation of the pronouns' nonantecedents changed the most across the second clauses of the sentences. As illustrated in Figure 4, this change resulted from the pronouns' nonantecedents becoming less activated. One interpretation of this change is that the information provided by the pronouns, combined with the semantic information provided by the participial phrases, triggered the suppression mechanism.

Figure 4. *Subjects' me*



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Discussion

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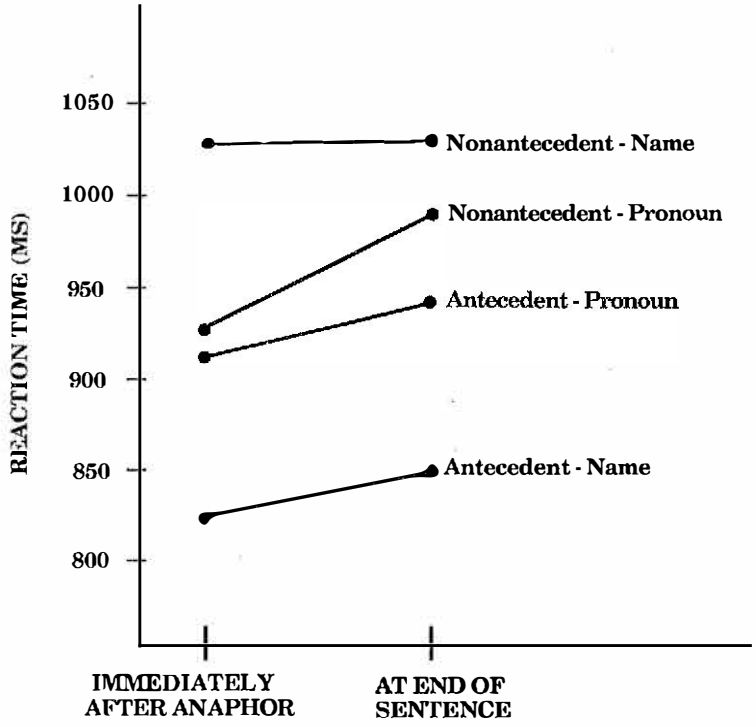
Figure 4. *Subjects' mean response times in Experiment 4.*



Further analyses suggested that it was not the semantic information alone that triggered suppression. Had that been the case, then the pronouns' nonantecedents should have been less activated at the earlier test point, because the semantic information had already occurred by then. However, at the early test point, response times to the pronouns' antecedents versus nonantecedents were statistically indistinguishable, $minF'(1,206) = 1.365$, $p > .25$. In contrast, by the ends of the sentences, responses were significantly slower to the pronouns' nonantecedents than their antecedents, $minF'(1,152) = 5.749$.

Discussion

Experiment 4, like Experiment 3, further illustrated the role that the mechanism of suppression plays in improving referential access. Experiment 4 also demonstrated that semantically-biased pronouns improve their antece-

dents' accessibility by triggering the suppression of nonantecedents. In fact, Experiment 4 replicated Experiment 3, even though in Experiment 4 the semantic information occurred before the pronouns. However, like Experiment 3, the pronouns' nonantecedents were not observably suppressed until the test point at the ends of the sentences. This suggests that semantic information alone is insufficient to trigger suppression. Rather, semantic information must be combined with information provided by the anaphor. And because pronouns—even pronouns biased by a previous semantic context—are less explicit than repeated name anaphors, suppression is triggered more slowly.

What if the pronouns were made more explicit? What if they matched the gender of only one of the two participants? If the mechanism of suppression is primarily triggered by the informational content of the anaphor, then gender-explicit pronouns should trigger suppression more rapidly or more powerfully.

Existing data support this prediction. For instance, a pronoun's antecedent is overtly identified more rapidly when the pronoun matches the gender of only one participant, as in

(7) John phoned Susan because *he* needed some information.

than when the pronoun matches the gender of more than one participant, as in

(8) John phoned Bill because *he* needed some information.

(Caramazza, Grober, Garvey, & Yates, 1977; Erhlich, 1980; Vonk, 1985). Similarly, clauses containing gender-explicit pronouns (like the second clause of sentence (7)) are read more rapidly than identical clauses containing less explicit pronouns (like the second clause of sentence (8)) (Garnham & Oakhill, 1985). These data demonstrate that the antecedents of gender-explicit pronouns are more accessible.

Perhaps they are more accessible because gender-explicit pronouns trigger suppression more rapidly or more powerfully. More data to support this prediction come from a study by Chang (1980). Chang (1980) measured activation at the ends of sentences and found that the nonantecedents of gender-explicit pronouns were no more activated than the nonantecedents of repeated name anaphors. To account for Chang's data, one can assume that the gender-explicit pronouns' nonantecedents were never activated. Or one can assume that they were once as activated as the antecedents, but by the ends of the sentences they had been suppressed very powerfully. Experiment 5 empirically examined these alternatives.

Experiment 5

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Experiment 5

Experiment 5 was identical to Experiment 3 except that the two participants in each sentence differed in gender. (And therefore the pronouns matched the gender of only one participant). In all other respects, the two experiments were identical.

Method

The materials used in Experiment 5 were modified from those used in Experiment 3 by assigning a stereotypically female name to one of the two participants and a stereotypically male name to the other. The two names were matched for perceived familiarity and length in letters. Half the antecedents at each antecedent position were female, and half were male. Sixty-four subjects participated.

Results

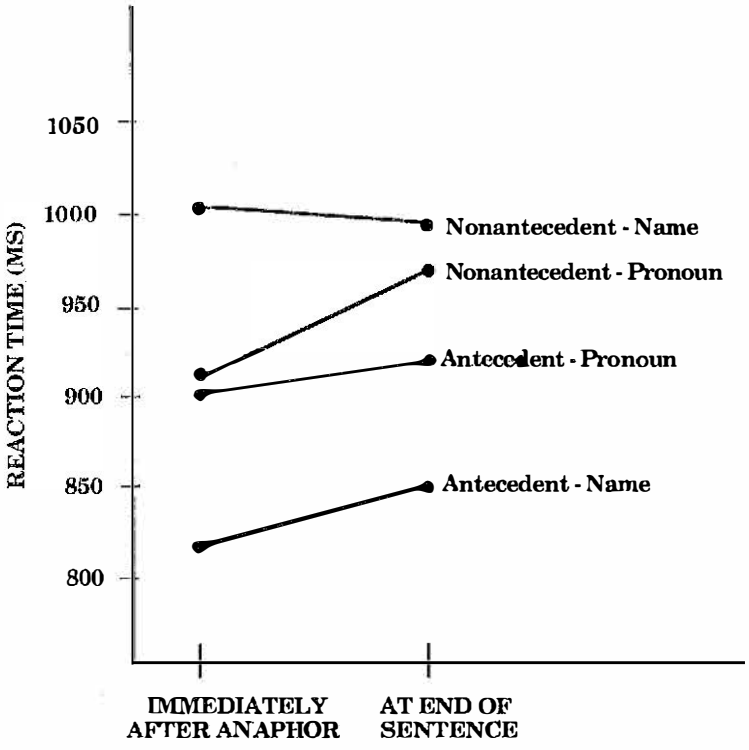
The design of the ANOVAs was identical to Experiment 3. Two main effects were significant, the same two as in Experiments 3 and 4. First, responses were faster to the antecedents (M = 882) than the nonantecedents (M = 971), $minF'(1,118) = 47.37$. Second, responses were faster immediately after the anaphors (M = 912) than at the ends of the sentences (M = 941), $minF'(1,99) = 4.409$.

Three interactions were significant. As in the first four experiments, antecedent position interacted with probe name, $minF'(1,118) = 8.068$, again demonstrating that, in general, first-mentioned participants were verified more rapidly (M = 907) than second-mentioned participants (M = 946).

The second significant interaction was also the same as in Experiments 3 and 4. It was between probe name and anaphor type, $minF'(1,116) = 45.56$. And, as in Experiments 3 and 4, it was qualified by a three-way interaction involving probe name, anaphor type, and test point, $minF'(1,118) = 6.564$. This three-way interaction is illustrated in Figure 5.

As shown in Figure 5, when the probe names were the nonantecedents, anaphor type interacted with test point, $minF'(1,117) = 7.925$, creating the following effect: The difference between response times when the anaphors were names versus pronouns was greater immediately after the anaphors (101 ms) than at the ends of the sentences (25 ms). In contrast, when the probe names were the antecedents, anaphor type did not interact with test point, both Fs < 1; the difference between response times when the anaphors were

Figure 5. *Subjects mean response times in Experiment 5.*



names versus pronouns was about the same immediately after the anaphors as at the ends of the sentences.

Further analyses examined the data from the pronoun conditions only. Immediately after the pronouns, response times to the pronouns' antecedents versus nonantecedents were statistically indistinguishable, both Fs < 1. Thus, despite a strong cueing by gender, the pronouns had no immediate effect on either their antecedents or nonantecedents. This finding corroborates Tyler and Marslen-Wilson (1982), who found that pronouns matching the human status of only one participant did not immediately affect the activation of their antecedents or nonantecedents.

In contrast, by the ends of the sentences in Experiment 5, responses were significantly slower to the pronouns' nonantecedents than their antecedents, $F_1(1,56) = 5{,}256$, $F_2(1,62) = 3.778$. In other words, by the ends of the sentences, the pronouns' antecedents and nonantecedents differed in their levels

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Experiment 6

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However, in contrast to Experiments 3 and 4, the data collected at the ends of the sentences replicate Chang (1980). Recall that Chang found that at the ends of the sentences the pronouns' nonantecedents were activated at the same level as the names' nonantecedents. Similarly, at the ends of the sentences in Experiment 5, responses to the pronouns' nonantecedents versus the names' nonantecedents differed by only a marginally significant 25 ms, $minF'(1,86) = 3.22$, $p < .10$. Actually, Chang's data can be approximated even more closely by considering only the Experiment 5 data for the antecedent position that he tested; for those data, the difference was a nonsignificant 12 ms. Thus, the pronouns' greater explicitness more powerfully triggered the suppression of their nonantecedents.

Discussion

Experiment 5 further illustrated the role that the mechanism of suppression plays in improving referential access. Experiment 5 demonstrated that gender-explicit pronouns also trigger the suppression of their nonantecedents, and when compared to Experiments 3 and 4, they do so more powerfully than gender-ambiguous pronouns.

How general is the role that the suppression mechanism plays in improving referential access? That is, is it only rementioned participants who improve their accessibility by triggering the suppression of other participants? Or is the mechanism's role more general so that simply the most recently mentioned participants—regardless of whether they are reinstated or novel—trigger suppression in order to improve their accessibility? Experiment 6 answered these questions.

Experiment 6

The experimental sentences in Experiment 6 were similar to those in Experiment 1; in fact, in one condition of Experiment 6, the sentences were identical to the Experiment 1 name-anaphor sentences, for example:

(9) Bill handed John some tickets to a concert, but *Bill* took the tickets back immediately.

However, in another condition, the sentences were modified: Instead of one of the two original participants being rementioned at the beginning of their second clause, a new participant was introduced, as in

(10) Bill handed John some tickets to a concert, but *Mark* said the tickets were counterfeit.

Three variables were manipulated. In the interest of simplicity, though not accuracy, one will be referred to as "anaphor" type. This variable simply refers to who the subjects of the second clauses were. Half the time the "anaphors" were repeated, anaphoric, or what will be referred to as "old" names. An example is the rementioned *Bill* in sentence (9) above. The other half of the time the "anaphors" were new names, for example, the newly introduced *Mark* in sentence (10) above. In this second situation, the label "anaphors" was clearly a misnomer. Manipulating this variable revealed whether introducing a new participant (e.g., *Mark*) had the same effect on the other participant (e.g., *John*) as rementioning an old participant (e.g., *Bill*).

The second variable was probe name: The probe names were the names of either the antecedents or the nonantecedents. This variable also lost its meaning when the "anaphors" were new names. Given that the new names were not truly anaphors, they had neither antecedents nor nonantecedents. So the distinction boiled down to a comparison between the two original participants. When the "anaphors" were the new names, no differences between response times to the two original participants were expected. But the distinction was preserved in the interest of a balanced experimental design. Finally, the third variable was antecedent position: The antecedents were either the NP_1 or the NP_2 of the first clause.

To summarize, the three variables were "anaphor" type (whether the "anaphors" were old names or new names), probe name, and antecedent position. Unlike the previous five experiments, test point was not manipulated. Because the experimental question was whether the effects on previously mentioned participants are the same after introducing new participants versus rementioning old participants, response times were measured at only one test point: immediately after the "anaphors" (i.e., immediately after either NP_1 or NP_2 was repeated or NP_3 was introduced). An example experimental sentence of both antecedent position types appears in Table 3.

Method

Subjects

The subjects were 48 undergraduates at the University of Oregon.

Table 3. *Example s*

NP_1 type sent
OLD NAME Bill handed J
NEW NAME Bill handed J
OLD NAME Bill handed J
NEW NAME Bill handed J
NP_2 type sent
OLD NAME Ann predicte
NEW NAME Ann predicte
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Table 3. *Example stimulus sentences for Experiment 5*

NP_1 type sentence
OLD NAME - ANTECEDENT (BILL) Bill handed John some tickets to a concert but *Bill* took the tickets back immediately.
NEW NAME - "ANTECEDENT" (BILL) Bill handed John some tickets to a concert but *Mark* said the tickets were counterfeit.
OLD NAME - NONANTECEDENT (JOHN) Bill handed John some tickets to a concert but *Bill* took the tickets back immediately.
NEW NAME - "NONANTECEDENT" (JOHN) Bill handed John some tickets to a concert but *Mark* said the tickets were counterfeit.
NP_2 type sentence
OLD NAME - ANTECEDENT (PAM) Ann predicted that Pam would lose the track race but *Pam* came in first very easily.
NEW NAME - "ANTECEDENT" (PAM) Ann predicted that Pam would lose the track race but *Jan* predicted that Pam would win.
OLD NAME - NONANTECEDENT (ANN) Ann predicted that Pam would lose the track race but *Pam* came in first very easily.
NEW NAME - "NONANTECEDENT" (ANN) Ann predicted that Pam would lose the track race but *Jan* predicted that Pam would win.

Note: For each sentence, the probe name appears in parentheses, and the "anaphor" is in italics.

Materials and design

The materials were modified from the sentences used in Experiment 1 in the following ways. First, for each experimental sentence, an alternative second clause was written that introduced a new participant. The new participant's name matched the original two participants' names in perceived familiarity, length in letters, and gender.

Second, the comprehension questions were reconstructed. Half the questions were about the first clause, and half were about the second clause. The questions were about the first clause whenever the "anaphors" were the new names. And, as a finer division, half of these questions were about the first-mentioned participants' activity (e.g., "Who handed someone some tickets?"), and half were about the second-mentioned participants' activity (e.g., "Who was handed some tickets?"). The questions were about the second

clause whenever the "anaphors" were the old names (e.g., "Who took the tickets back immediately?").

Third, 24 of the 48 lure sentences were reconstructed so that they too introduced a third participant. In addition, in 12 of the lure sentences the probe names were tested toward the ends of their sentences, and, in another 12, the probe names were tested toward the beginnings of their sentences. As in Experiments 1 and 2, this variation was intended to discourage subjects from expecting the probe names to be tested always in the middle of the sentences.

Four material sets were formed. Within a material set, there was an equal number of experimental sentences in each of the four experimental conditions. Across material sets, each sentence occurred in all four experimental conditions. Twelve subjects were randomly assigned to each material set so that each subject was exposed to an experimental sentence in only one of its experimental conditions. The lure sentences occurred in the same randomly selected order on each material set.

Procedure

The procedure was identical to Experiment 1, with the major exception that all the probe names were presented 150 ms after the offset of the "anaphors."

Results

The subjects' average correct response times are shown in Table 4. The design of both the subjects' and items' ANOVAs was a 2 ("Anaphor" Type: old name vs. new name) × 2 (Probe Name: antecedent vs. nonantecedent) × 2 (Antecedent Position: NP_1 vs. NP_2). In the subjects' analysis, all three factors were within-subjects factors. In the items' analysis, antecedent position was a between-items factor.

Two main effects were significant. The first was an effect of probe name: Responses were faster to antecedents (M = 928) than nonantecedents (M =

Table 4. *Average correct response times in Experiment 6*

		Probe type	
		Antecedent	Nonantecedent
"Anaphor" type	Old name	851	1018
	New name	1005	1009

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Discussion

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1013), *minF'*(1,106) = 29.95. The second was an effect of "anaphor" type: Responses were faster following old names (M = 934) than new names (M = 1007), *minF'*(1,104) = 33.10.

Two interactions were significant. The first was the familiar antecedent position by probe name interaction, *minF'*(1,101) = 10.81, again demonstrating that, in general, first-mentioned participants were verified more rapidly (M = 943) than second-mentioned participants (M = 998).

The other interaction was between "anaphor" type and probe name, *minF'*(1,103) = 35.51. This interaction indicated that the effect of probe name was greater when the "anaphors" were old names than it was when they were new names. In fact, when the "anaphors" were new names, there was no effect of probe name: Response times to the antecedents were statistically indistinguishable from response times to the nonantecedents, both Fs < 1. As mentioned above, this was expected as when the "anaphors" were new names, as in sentence (10) above, the distinction between antecedents and nonantecedents was meaningless. On the other hand, when the anaphors were old names, responses were faster to the antecedents than the nonantecedents, *minF'*(1,93) = 59.64. Replicating the previous five experiments, this suggests that name anaphors improve their antecedents' accessibility, most likely by triggering the mechanisms of suppression and enhancement.

Other planned comparisons suggested that suppression was not limited to anaphoric names; introducing new participants also triggered the mechanism. That is, response times to the nonantecedents following old names were statistically indistinguishable from response times to either the new-name antecedents or the new-name nonantecedents, all Fs < 1. Although, of course, responses to the antecedents following old names were significantly faster than responses to either the new-name antecedents or the new-name nonantecedents, *minF'*(1,102) = 60.01 and *minF'*(1,106) = 56.78, respectively.

Discussion

Experiment 6 further illustrated the role that the mechanism of suppression plays in improving referential access. Experiment 6 demonstrated that rementioned participants are not the only ones who gain a privileged status by triggering the suppression of other participants. Rather, simply the most recently mentioned participants, regardless of whether they are new or old, use this mechanism to improve their referential access.

In fact, this suppression mechanism is probably not limited to participants either. Most likely the mechanism is triggered by concepts in general. Several studies support this proposal.

For instance, data from Dell et al. (1983) can be interpreted as demonstrating that new concepts trigger the suppression of previously mentioned concepts. In their study, subjects read four-sentence texts whose first lines contained a critical noun phrase, for example, *a burglar* as in

(11) *A burglar* surveyed the garage set back from the street.

In one condition, the texts' fourth lines contained an anaphoric noun phrase, which was a semantic superordinate of the critical noun phrase, for example,

(12) *The criminal* slipped away from the street lamp.

Responses to the critical noun phrases (e.g., *burglar*) were slightly (12 ms) faster immediately after subjects read the anaphors (e.g., *criminal*) than immediately before. In other words, the noun phrase anaphors appeared to trigger the enhancement of their antecedents.

In a second condition, the anaphoric noun phrases in the fourth line were replaced with novel noun phrases, for example, *a cat* as in

(13) *A cat* slipped away from the street lamp.

In this condition, responses to the antecedents (e.g., *burglar*) were 32 ms slower immediately after the novel noun phrases (e.g., *cat*) than immediately before. This pattern can be interpreted in terms of suppression: Perhaps the novel noun phrases (*a cat*) triggered the suppression of other concepts, including the antecedent (*burglar*).

In fact, explicitly introducing a new topic—as opposed to implicitly maintaining an old topic—makes other concepts less accessible. For instance, when a new topic is introduced, as opposed to an old topic being maintained, sentence segments containing pronouns that refer to the old topic are read more slowly (Clifton & Ferreira, 1987) and the old topics are less strongly activated (O'Brien, Duffy, & Meyers, 1986). Perhaps this effect is also attributable to the mechanisms of suppression (see also O'Brien et al.'s baseline, preanaphor, and semantic control conditions, as they too introduced or elaborated on new topics).

The mechanism of suppression might also explain Clark and Sengul's (1979) "discontinuity effect." Clark and Sengul found that reading times for sentences containing anaphors increased according to how far back in the text the anaphors' antecedents occurred. However, their data demonstrated a sharp discontinuity: Reading times were fastest if the antecedents were mentioned only one sentence or clause back, but distances beyond that did not matter; the antecedents could occur either two or three sentences or clauses back, and reading times were equally slow. If each sentence or clause introduced a new concept, it is possible that each new concept triggered the suppression of its prior c
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In sum, Experiments 4, 5, and 6, plus the experiments reviewed above, suggest that the mechanism of suppression very commonly improves referential access. It is perhaps the primary mechanism by which comprehenders keep track of the *who*s and *what*s in discourse.

General discussion

This series of experiments demonstrated that the mechanisms of suppression and enhancement play a role in referential access: They improve concepts' accessibility. In addition, the experiments demonstrated that how rapidly and powerfully these two mechanisms are triggered is a function of the concepts' explicitness.

Although the experiments reported here investigated only three levels of explicitness, data from other experiments flesh out a continuum that illustrates an *explicitness principle*: The more explicit the concepts, the more likely they are to trigger the suppression of other concepts, and, when used anaphorically, the more likely they are to enhance their antecedents.

For instance, the most explicit concepts examined in this series of experiments were proper names. Only rarely do proper names lead to referential ambiguity. When they do, speakers and writers usually disambiguate the concepts by saying something like "*the* Fred Jones who lives down the street." According to the explicitness principle, proper names should most powerfully trigger the suppression of other concepts and, when used anaphorically, they should most powerfully trigger the enhancement of their own antecedents. Indeed, in Experiment 1, the proper name anaphors produced a 122 ms suppression effect and a 76 ms enhancement effect; in Experiment 2, they produced a 127 ms suppression effect and an 84 ms enhancement effect.

Less explicit than proper names are common nouns. When used anaphorically, the relation between common noun phrases and their antecedents is typically synonymy (e.g., "John threw *the stone*. *The rock* was heavy") or semantic superordinance (e.g., "John fed *the robin*. *The bird* was hungry"). Because virtually all words have at least a few synonyms and semantic subordinates, common noun phrase anaphors have more potential antecedents than do proper name anaphors. In fact, noun phrase anaphors are easier to comprehend when they are more general than their antecedents, rather than vice versa (Garnham, 1981, 1984; Garrod & Sanford, 1977; Sanford & Garrod, 1980). For example, reading times are faster for the sequence,

(14) John fed the robin. The bird was hungry.

than the sequence,

(15) John fed the bird. The robin was hungry.

Given that an anaphor such as *the bird* can refer to *the robin, the sparrow, the canary*, or even *the chicken*, noun phrase anaphors are obviously less explicit than proper name anaphors.

According to the explicitness principle, noun phrase anaphors should less powerfully suppress their nonantecedents and less powerfully enhance their antecedents. This prediction is supported by Dell et al.'s (1983) data: With noun phrase anaphors, their data illustrate a 32 ms suppression effect and a 12 ms enhancement effect. Both effects are numerically smaller than the comparable effects observed with proper name anaphors in Experiments 1 and 2.

Pronouns are less explicit than common noun phrases. Even in a language such as English, with its variety of pronouns, each pronoun can have a myriad of potential antecedents. So, according to the explicitness principle, pronouns should be considerably less powerful at triggering suppression and enhancement. Indeed, as Experiments 1 and 2 demonstrated, pronouns do not immediately trigger either suppression or enhancement.

However, as Experiments 3, 4, and 5 demonstrated, pronouns do eventually trigger suppression, and how rapidly they do is a function of their explicitness: More explicit pronouns—for instance, pronouns that match the gender of only one of their sentences' participants—trigger suppression more powerfully. By the ends of their sentences, the nonantecedents of gender-explicit pronouns are activated at about the same level as the nonantecedents of very explicit, proper name anaphors. Less explicit pronouns—for instance, pronouns that match the gender, number, and case of two participants—trigger suppression less powerfully. By the ends of their sentences, their nonantecedents are still highly activated relative to how activated they are when the anaphors are more explicit, proper names.

Finally, the least explicit of all referential forms is zero anaphora (e.g., "John went to the store and ∅ bought a quart of milk"). Although the present series of experiments did not include a zero anaphora manipulation, Corbett & Chang's (1983) Experiment 1 did, and their data perfectly support the explicitness principle: Zero anaphors trigger even less suppression than ambiguous pronouns. That is, by the ends of their sentences, the nonantecedents of zero anaphors are substantially more activated than the nonantecedents of ambiguous pronouns.

Anaphoric explicitness is not simply physical similarity. Anaphoric explicitness must also incorporate definiteness, as the following examples illustrate.

A physically similar

(16) The waitress w
(17) The waitress w

However, an equall

(18) A waitress was
(19) A waitress was

(For experimental c
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Walker, 1978.) Thu

Suppression and enh

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Table 5. *Three disc
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A physically similar pair like (16) and (17) seem coreferential:

(16) The waitress was counting the money.
(17) The waitress was daydreaming about getting off early.

However, an equally similar pair like (18) and (19) seem less coreferential:

(18) A waitress was counting the money.
(19) A waitress was daydreaming about getting off early.

(For experimental demonstrations that support this intuition, see Guindon, 1985; Haviland & Clark, 1974; Murphy, 1984; de Villiers, 1974; Yekovich & Walker, 1978.) Thus, anaphoric explicitness depends on definiteness.

Suppression and enhancement and other referential access phenomena

At least three properties of discourse affect how easily comprehenders can access antecedents. These same three properties are related to speakers' and writers' choices of how explicit an anaphor to use. Because these properties both affect referential accessibility and correlate with anaphoric explicitness, their relations might be mediated by the mechanisms of suppression and enhancement. These three properties are listed in Table 5.

Table 5. *Three discourse properties and their relations with anaphoric explicitness and referential accessibility*

Referential distance
Relation between referential distance and anaphoric explicitness: At longer distances, anaphors are more explicit Relation between referential distance and referential accessibility: At longer distances, antecedents are less accessible
Topicality
Relation between topicality and anaphoric explicitness: For more topical concepts, anaphors are less explicit Relation between topicality and referential accessibility: For more topical concepts, antecedents are more accessible
Episode structure
Relation between episode structure and anaphoric explicitness: At the beginnings of episodes, anaphors are more explicit Relation between episode structure and referential accessibility: At the beginnings of episodes, antecedents are less accessible

Referential distance

One property that correlates with anaphoric explicitness and affects referential access is referential distance. Referential distance is the distance between an anaphor and its antecedent. A wealth of cross-linguistic, text-count data document the following relation: The longer the distance between an anaphor and its antecedent, the more explicit the anaphor. Consider, for instance, the least explicit anaphors in English, zero anaphors; in only 2% of Givón's (1983) sample of spoken English are the antecedents of zero anaphors farther back than one clause. In contrast, some antecedents of more explicit, noun phrase anaphors occur as far back as 15 clauses (see also Clancy, 1980; Hinds, 1978).

Furthermore, a wealth of psycholinguistic (reading time) data document the following relation between referential distance and referential accessibility: The longer the distance between an anaphor and its antecedent, the less accessible the anaphor (Clark & Sengul, 1979; Erhlich, 1983; Erhlich & Rayner, 1983; Frederiksen, 1981).

Why is referential access harder at longer referential distances? And why do speakers and writers use the most explicit forms of anaphora at longer referential distances? One explanation draws on the following probability: The longer the distance between an anaphor and its antecedent, the higher the probability that other concepts intervene. Because mentioning new concepts suppresses older concepts, it might not be distance (or time) per se that underlies these relations. Rather, it might be the intervention of other concepts and the mechanism of suppression.

Indeed, referential distance does not always affect accessibility (e.g., Carroll & Slowiaczek, 1987); sometimes it is only when the distance is filled by introducing other concepts (Clifton & Ferreira, 1987; Friedrich, 1980; Lesgold, Roth, & Curtis, 1979). The relation between anaphoric explicitness and referential distance might also be attributable to the intervention of other concepts and the mechanism of suppression. Thus, the mechanism of suppression may mediate the relations among referential distance, anaphoric explicitness, and referential accessibility.

Topicality

A second property that correlates with anaphoric explicitness and affects referential access is topicality: The more topical the antecedent, the less explicit the anaphor (Chafe, 1974, 1976; van Dijk & Kintsch, 1983; Fletcher, 1984; Givón, 1983; Marslen-Wilson, Levy, & Tyler, 1982). For example, when comprehenders join two sentences that share their topic, as in

(20) Pete intended to go bowling last night.
(21) Pete broke his leg.

they typically refer t

(22) Pete intended t

In contrast, when th

(23) Pete intended t
(24) Sam broke his

comprehenders typi
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(25) Pete intended t

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Episode structure

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they typically refer to the common topic with a pronoun, as in

(22) Pete intended to go bowling but *he* broke his leg.

In contrast, when the two sentences do not share topics, as in

(23) Pete intended to go bowling with Sam last night.
(24) Sam broke his leg.

comprehenders typically refer to these less topical antecedents with a name anaphor, as in

(25) Pete intended to go bowling with Sam, but *Sam* broke his leg.

(Fletcher, 1984). Furthermore, the more topical the antecedent, the more accessible the anaphor; that is, sentences containing references to more topical antecedents are read more rapidly than sentences containing references to less topical antecedents (Anderson, Garrod, & Sanford, 1983; Clifton & Ferreira, 1987; Crawley, 1986; Lesgold et al., 1979; Yekovich, Walker, & Blackman, 1979).

Why is referential access easier for topical concepts? And why do speakers and writers use less explicit forms of anaphora for topical concepts? One key to understanding these relations is understanding what it means for a concept to be topical. Typically, it is because the concept is mentioned frequently (Givón, 1979) or because it occurs in the privileged first position of a sentence (Li & Thompson, 1981) or the privileged first or "foregrounded" position of a narrative (Chafe, 1976). In fact, experimental studies often manipulate topicality by manipulating frequency of mention (Crawley, 1986) or primacy of mention (Fletcher, 1984; Lesgold et al., 1979).

It is obvious how frequency of mention can improve referential access through suppression and enhancement: Each time a concept is mentioned, its activation is enhanced, and other concepts are suppressed. As for primacy of mention, the present six experiments demonstrated that it, too, improves referential access via suppression and enhancement. I shall comment further on this effect below, but briefly put: First-mentioned concepts are more strongly enhanced by their antecedents and are more resistant to being suppressed by other concepts. Thus, the mechanisms of suppression and enhancement may mediate the relations among topicality, anaphoric explicitness, and referential accessibility.

Episode structure

A third property that correlates with anaphoric explicitness and that affects referential accessibility is episode structure: At the beginnings of episodes

and paragraphs, speakers and writers typically use the most explicit forms of anaphora (Fox, 1986; Marslen-Wilson et al., 1982; Tomlin, 1987).

Furthermore, although I am unaware of data that specifically demonstrate this, I strongly predict that referential access is harder at the beginnings of episodes. This is because comprehending episode boundaries leads to processing shifts (Gernsbacher, 1984, 1985). During a processing shift, comprehenders shift from actively constructing one substructure of their mental representation and begin developing another. After a processing shift, information represented in the previous substructure is less accessible. Thus, one hypothesis is that referential access is more difficult across episode boundaries because anaphors are less able to trigger the enhancement of their antecedents when the two are represented in different structures.

However, another explanation for why more explicit anaphors are used at episode beginnings and why referential access is more difficult at episode beginnings is the potential intervention of other concepts. Paragraph and episode beginnings are prime locations for introducing new topics and reintroducing old ones. Consider, for example, the speaker that Marslen-Wilson et al. (1982) studied. He typically used the most explicit anaphoric forms at what Marslen-Wilson et al. referred to as "event boundaries." These event boundaries were also places where "the narrative was shifting focus among the main actors" (p. 355). Because introducing new concepts and reintroducing old concepts both trigger the suppression of other concepts, it might not be episode boundaries per se that underlie these relations; it might be the mechanism of suppression.

Suppression and enhancement and the advantage of the first-mentioned participant

In all six of the experiments reported here, at all test points, for antecedents, nonantecedents, proper names, and pronouns, the following effect was observed: First-mentioned participants were verified more rapidly than second-mentioned participants. On the average, first-mentioned participants enjoyed a 60 ms advantage. In other words, first-mentioned participants were more strongly enhanced and more resistant to being suppressed.

What is the basis of this advantage? It does not arise from the tendency in English for first-mentioned participants to be agents. That is, the same advantage holds when the first-mentioned participants are semantic agents, as *Ann* is in

(26) Ann beat Pam in the state tennis match.

as when the first-mentioned participants are semantic patients, as *Ann* is in

(27) Ann was beate

Neither is the advar
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(28) Ann and Pam a

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(29) According to A

Finally, the advanta
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an adverbial phrase

(30) Two weeks ago

or whether the phras

(31) Ann mailed Par

or whether the phras

(32) Ann mailed Par

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(27) Ann was beaten by Pam in the state tennis match.

Neither is the advantage due to the tendency in English for first-mentioned participants to be syntactic subjects; the advantage maintains when the first- and second-mentioned participants share subjecthood, as *Ann* and *Pam* do in

(28) Ann and Pam argued with one another at the party.

In fact, the advantage maintains even when the first-mentioned participants are no longer the syntactic subjects of their sentences, as in

(29) According to Ann, Pam was a terrible loser.

Finally, the advantage is not due to the fact that in all the previous experiments in which the advantage was observed—including the six reported here—the first-mentioned participants were also the initial words of their stimulus sentences. That is, the advantage maintains regardless of whether an adverbial phrase such as *two weeks ago* is preposed, as in

(30) Two weeks ago Ann mailed Pam a box full of clothes.

or whether the phrase is postposed, as in

(31) Ann mailed Pam a box full of clothes two weeks ago.

or whether the phrase does not occur at all, as in

(32) Ann mailed Pam a box full of clothes.

Thus, the advantage must depend on each participant's position relative to the other participants (all of these findings are reported in Gernsbacher (Hargreaves, 1988).

We have suggested that the advantage arises from cognitive processes that occur normally during comprehension (Gernsbacher & Hargreaves, 1988, in press). Given that the goal of comprehension is to build a mental structure of the information being comprehended, initial information must form the foundation of this structure (Gernsbacher, 1989). In a sentence about two participants, the first-mentioned participant serves as the foundation; other information, including information about the second-mentioned participant, must be added onto the developing structure via connections to the first-mentioned participant. This process affords first-mentioned participants a privileged place in comprehenders' mental representations, and, because of this privileged position, they are affected in a special way by the mechanisms that improve referential access: They are more resistant to being suppressed and they are more strongly enhanced.

Suppression and enhancement as general cognitive mechanisms

Suppression and enhancement are *general* cognitive mechanisms; that is, I assume that they play a role in language comprehension processes other than referential access. For example, as mentioned earlier, suppression might contribute to a process I refer to as "fine tuning" the activation of lexical concepts, for instance, fine tuning the contextually appropriate meanings of ambiguous words (Gernsbacher, 1989; Gernsbacher & Faust, in press).

Suppression might also help fine tune the multiple associations of more typical, nonambiguous words. That is, even though all concepts have multiple associations, some associations are more relevant in certain contexts. For example, the association between *apple* and *pie* is more relevant in the context

(33) James baked the apples.

whereas the association between *apple* and *tree* is more relevant in the context

(34) James picked the apples.

Just like the multiple meanings of ambiguous words, multiple associations of unambiguous words are immediately activated. But after a brief period, only the more relevant association remains activated (Gernsbacher & Faust, in press). Again, the less relevant association's loss of activation (like the less appropriate meaning's loss of activation) might be attributable to the mechanism of suppression. Indeed, the inability to quickly get rid of the inappropriate association—which might result from a less efficient suppression mechanism—characterizes less-skilled comprehenders (Gernsbacher et al., 1989).

The mechanisms of suppression and enhancement might also underlie the loss of "surface" information as opposed to thematic information (Sachs, 1967, 1974). To understand how these mechanisms can account for this phenomenon, one must consider what surface information is. Typically, surface information is defined as information about a stimulus that does not contribute to its meaning. But another definition is that the surface properties of any stimulus are those that change the most rapidly. For example, consider a passage of text: If well composed, each sentence conveys the same thematic idea, but each sentence does not present the same syntactic form. Because the passage's syntactic form changes more rapidly than its thematic contact, its syntactic form is considered surface information, while its thematic content is not.

Based on this definition, the mechanisms of suppression and enhancement explain why surface information is typically less accessible than thematic information. Because surface information is constantly changing, the newer

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Appendix A: Stim

NP_1 sentences

Bill handed John s
immediately.
Jan went to visit S
a bouquet of
Ned saw Dan stan
canoe.
Sharon walked D
outside in the
Jim poured a drin
a drink for hi
Chuck saw that Da
for some help
Carol took over fo
a much bette
Helen interviewed
fused to answ
Sara tutored Anna
dollars an ho
Fred loaned Mike
long.
Greg watched Neil
curtain.

surface information is constantly suppressing the old. In contrast, because thematic information is constantly being reintroduced, it gets repeatedly enhanced. The net result is that thematic information is activated at a considerably higher level than surface information.

Moreover, I propose that the mechanisms of suppression and enhancement are so general that they underlie nonlinguistic skills as well. This commonality might arise because—as Lieberman (1984) and others have suggested—language comprehension evolved from other nonlinguistic cognitive skills. Or the commonality might arise simply because the mind is best understood by reference to a common architecture (e.g., a connectionist architecture). Both proposals support the orientation that mechanisms that play a crucial role in language comprehension—such as improving referential access—are general, cognitive mechanisms.

Appendix A: Stimulus sentences for Experiments 1, 2, and 3

NP_1 sentences

Bill handed John some tickets to a concert but Bill/he took the tickets back immediately.

Jan went to visit Sue during the hospital's visiting hours and Jan/she brought a bouquet of flowers.

Ned saw Dan standing on the river bank and Ned/he waved hello from his canoe.

Sharon walked Debbie over to the dentist's office but Sharon/she waited outside in the lobby.

Jim poured a drink for Don that was really quite strong and Jim/he poured a drink for himself.

Chuck saw that Danny was in very serious trouble and Chuck/he ran quickly for some help.

Carol took over for Ellen all the household laundry chores and Carol/she did a much better job.

Helen interviewed Julie about cheating in college courses but Helen/she refused to answer some questions.

Sara tutored Anna in history, math, and English and Sara/she charged ten dollars an hour.

Fred loaned Mike a blue ball point pen but Fred/he wanted it back before long.

Greg watched Neil act in a broadway play and Greg/he applauded at the final curtain.

Shawn saved Brent from drowning in the creek and Shawn/he quickly became a hero.

Alice received from Jenny one of those chain letters but Alice/she did not continue the chain.

Thomas wanted to tell Edward the exciting and unexpected news but Thomas/he couldn't find a nearby phone.

Paula borrowed a book from Vicky all about the Civil War but Paula/she never even gave the book back.

Susan stood up until Nancy had brought in another chair then Susan/she sat down on the new chair.

David saw that Brian was fixing a flat tire and David/he stopped to offer some help.

Cindy described to Janet how life was in Detroit but Cindy/she didn't mention the terrible pollution.

Cathy wouldn't accept from Donna a check for the amount but Cathy/she would accept a credit card.

Amy inherited from Kim a very substantially large fortune and Amy/she spent all the money foolishly.

Alex broke a leg while skiing with Hank at a very expensive resort and Alex/he had to leave on crutches.

Jill lost to Ruth in the state tennis match but Jill/she accepted the major defeat gracefully.

James saw Keith outside stealing a parked car but James/he did not call the police.

Marsha was being tickled by Cheryl while they were watching TV but Marsha/she managed not to laugh aloud.

George aimed a pistol at Robert that looked like a toy but George/he did not pull the trigger.

Richard wrapped a gift for Charles that was a big surprise and Richard/he hid it away in the closet.

Betty was knitting a scarf for Diane for an early Christmas present but Betty/she did not have enough yarn.

Randy was amusing Jerry by doing some fancy acrobatics but Randy/he slipped and broke an arm.

Phil made sure that Dick was already very sound asleep and Phil/he tiptoed quietly out of the house.

Tina bought a car from Lisa that was eight years old and Tina/she was pleased with its performance.

Linda made Debra a rich chocolate pound cake and Linda/she used an old fashioned recipe.

Sam handed Ray the telephone in the den after Sam/he had gotten tired of talking.

NP_2 sentences

Ann predicted that
very easily.

Andy tried to beat
every time.

Penny accused Wend
victed of the cri

Jane waited for Mar
half hour late.

Peg gave Eve some d
them.

Barb wanted a snap
wouldn't pose f

Ron spilled a drink
to change clothe

Fay found out that
speedy recovery

Dawn asked Cher to

Stan pitched Russ a

Rob blamed Ted for
fault.

Joel loaned Kent so
week later.

Patty sent Becky a
check immediat

Walter expected Ron
train.

Sally asked Karen to
other plans.

Donald sent Michael
with several sac

Michelle called Shirle
third ring.

Tommy passed the f
it in for a touch

Brenda urged Patsy
fall.

Ralph went to visit
on a vacation.

Sandra gave Elaine
the advice serio

NP_2 sentences

Ann predicted that Pam would lose the track race but Pam/she came in first very easily.
Andy tried to beat Gary in a game of chess but Gary/he managed to win every time.
Penny accused Wendy of committing a big robbery and Wendy/she was convicted of the crime.
Jane waited for Mary in the fancy restaurant lounge and Mary/she arrived a half hour late.
Peg gave Eve some directions to the zoo and Eve/she had no trouble following them.
Barb wanted a snapshot of Lynn in front of the museum but Lynn/she wouldn't pose for the camera.
Ron spilled a drink on Joe at the New Year's party and Joe/he went home to change clothes.
Fay found out that Meg was feeling a little sick but Meg/she made a very speedy recovery.
Dawn asked Cher to pick out a card and Cher/she drew the ace of diamonds.
Stan pitched Russ a very fast curve ball and Russ/he hit it into the outfield.
Rob blamed Ted for causing the car accident but Ted/he was really not at fault.
Joel loaned Kent some tools for the garden and Kent/he returned them a week later.
Patty sent Becky a check for twenty dollars and Becky/she cashed the $20 check immediately.
Walter expected Ronald to arrive on the train but Ronald/he was not on the train.
Sally asked Karen to play a round of golf but Karen/she had already made other plans.
Donald sent Michael to do the grocery shopping and Michael/he returned with several sacks.
Michelle called Shirley on a special wats line and Shirley/she answered on the third ring.
Tommy passed the football to Ricky on a third down play and Ricky/he ran it in for a touchdown.
Brenda urged Patsy to apply to law school and Patsy/she got accepted in the fall.
Ralph went to visit Larry one rainy afternoon in July but Larry/he was away on a vacation.
Sandra gave Elaine some truly heart felt advice but Elaine/she didn't take the advice seriously.

Harold tied Arnold to a chair in the basement but Arnold/he was able to get loose.
Steven locked Clarke out of the house accidentally and Clarke/he broke in through a window.
Lucy mailed Suzy a package of top secret information and Suzy/she received it within a week.
Kate thought that Joan was hard at work studying but Joan/she had gone to a movie.
Bob punched Tim during a bar room brawl and Tim/he got a terrible black eye.
Dave tried to amuse Rick with a somewhat off-color joke but Rick/he didn't even laugh at it.
Jeff begged Paul to play a game of handball and Paul/he reluctantly agreed to play.
Kay gave Bev a very long and nagging lecture and Bev/she listened to it very patiently.
Tom scratched Ken with a pocket knife accidentally and Ken/he started bleeding from the wound.
Lois cleaned the house for Rita for several hours one day while Rita/she took a nap on the sofa.
Abe threw a pie at Roy that was big and gooey but Roy/he ducked before it could hit.

Appendix B: Stimulus sentences for Experiment 4

Jim lost a tennis match to Don.
Accepting the defeat, Jim/he started walking toward the showers.
Enjoying the victory, Don/he started walking toward the showers.

Tom stole the basketball from Ken.
After grabbing the ball, Tom/he heard the fans yelling wildly.
After losing the ball, Ken/he heard the fans yelling wildly.

Linda reminded Becky to do the dishes.
Hating having to give such reminders, Linda/she got in a bad mood.
Hating having to hear such reminders, Becky/she got in a bad mood.

Beth tutored Gail in algebra and geometry.
Always having been very good in math, Beth/she really enjoyed the tutoring session.
Never having been very good in math, Gail/she really enjoyed the tutoring session.

Tina invited Lisa to a
After extending the i
After accepting the ir

Kay painted a portrai
After painting for sev
After posing for sever

Carol tempted Ellen
After providing the t
Giving in to the temp

Dick beat Phil in a ga
Being a horrible winn
Being a terrible loser,

Kate repeated the qu
Not having spoken cl
centrate.
Not having heard clea
trate.

Thomas watched Edw
After watching severa
After jogging several

Bob borrowed some
Grateful for the loan,
Generous with the lo

Gina greeted Judy wi
While giving the warn
Surprised by the warn

Lucy laughed very lou
Out of breath from la
Annoyed by being lau

Doug rescued Mark f
Enjoying being a hero
Eternally grateful, Ma

John aimed a water p
Ready to shoot, John
Ready to duck, Bill/h

Tina invited Lisa to a dinner party.
After extending the invitation, Tina/she hoped it would be fun.
After accepting the invitation, Lisa/she hoped it would be fun.

Kay painted a portrait of Bev.
After painting for several hours, Kay/she was pleased with the portrait.
After posing for several hours, Bev/she was pleased with the portrait.

Carol tempted Ellen with a box of candy.
After providing the temptation, Carol/she thought about all the calories.
Giving in to the temptation, Ellen/she thought about all the calories.

Dick beat Phil in a game of chess.
Being a horrible winner, Dick/he talked about the game forever.
Being a terrible loser, Phil/he talked about the game forever.

Kate repeated the question for Joan.
Not having spoken clearly the first time, Kate/she tried even harder to concentrate.
Not having heard clearly the first time, Joan/she tried even harder to concentrate.

Thomas watched Edward jog around the park.
After watching several laps, Thomas/he got a drink of water.
After jogging several laps, Edward/he got a drink of water.

Bob borrowed some money from Tim.
Grateful for the loan, Bob/he felt a sense of comradery.
Generous with the loan, Tim/he felt a sense of comradery.

Gina greeted Judy with hugs and smiles.
While giving the warm welcome, Gina/she began to get teary eyed.
Surprised by the warm welcome, Judy/she began to get teary eyed.

Lucy laughed very loudly at Suzy.
Out of breath from laughing, Lucy/she got quiet for minute.
Annoyed by being laughed at, Suzy/she got quiet for a minute.

Doug rescued Mark from a burning building.
Enjoying being a hero, Doug/he talked about it for years.
Eternally grateful, Mark/he talked about it for years.

John aimed a water pistol at Bill.
Ready to shoot, John/he thought of a better idea.
Ready to duck, Bill/he thought of a better idea.

Jack taught Dave how to paint a house.
Being a good teacher, Jack/he made the job seem easy.
Being a good student, Dave/he made the job seem easy.

Jeff handed the telephone to Paul.
After letting go of the receiver, Jeff/he sat down on a chair.
After taking hold of the receiver, Paul/he sat down on a chair.

Sally saw Karen fall down some stairs.
Running for the doctor, Sally/she needed to find some help.
Calling out in pain, Karen/she needed to find some help.

Alex mowed the front lawn for Hank.
After finishing the mowing, Alex/he trimmed all of the hedges.
While the yard was being mowed, Hank/he trimmed all of the hedges.

Alan nominated Gary for class president.
After making the nomination, Alan/he was excited about the future.
After winning the election, Gary/he was excited about the future.

Jill angrily yelled at Ruth.
Feeling guilty for yelling, Jill/she was sorry the incident occurred.
Not enjoying being yelled at, Ruth/she was sorry the incident occurred.

Lois cleaned the house for Rita.
After finishing the housework, Lois/she took an afternoon nap.
While the housework was being done, Rita/she took an afternoon nap.

Barb promised Lynn that the tickets would be picked up early in the morning.
Not remembering the promise until afternoon, Barb/she drove to the box office.
After realizing the promise had been broken, Lynn/she drove to the box office.

Ron gave Joe a ride to school.
While parking the car in the lot, Ron/he was thinking about first period.
While getting out at the corner, Joe/he was thinking about first period.

Abe found a pen that belonged to Roy.
After realizing who it belonged to, Abe/he looked around for another pen.
After realizing that it was missing, Roy/he looked around for another pen.

Arnold told Harold about the new movie.
After giving the review, Arnold/he daydreamed about being the hero.
After hearing the review, Harold/he daydreamed about being the hero.

Amy picked up the cl
Glad to do the favor,
Appreciating the favo

Ann scared Pam by sn
Not meaning to cause
After calming down c

Fred lit a cigarette for
Blowing out the matc
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Stan visited Russ in th
Hating to even visit h
Having just had major

Anna mailed a packag
Sending the package f
Eager to receive the p

Sharon told Debbie th
After having said it, S
After having heard it,

Andy threw a big crea
Not being a good aim,
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Rob convinced Ted to
After spending several
After spending hours c

Deb loaned twenty do
Able to spare the cash
Needing to pay some

Joel accused Kent of
Strongly repeating the
Strongly denying the

Neil broke a glass that
After offering to repla
After saying not to wo

Jerry locked Billy out
After realizing the mis
After breaking in thro

Amy picked up the cleaning for Kim.
Glad to do the favor, Amy/she thought about their special friendship.
Appreciating the favor, Kim/she thought about their special friendship.

Ann scared Pam by sneaking up.
Not meaning to cause an alarm, Ann/she started feeling a little foolish.
After calming down considerably, Pam/she started feeling a little foolish.

Fred lit a cigarette for Mike.
Blowing out the match, Fred/he watched the smoke flow upwards.
Puffing on the cigarette, Mike/he watched the smoke flow upwards.

Stan visited Russ in the hospital.
Hating to even visit hospitals, Stan/he was not feeling very talkative.
Having just had major surgery, Russ/he was not feeling very talkative.

Anna mailed a package to Sara.
Sending the package first class, Anna/she hoped it would arrive quickly.
Eager to receive the package, Sara/she hoped it would arrive quickly.

Sharon told Debbie the awful truth.
After having said it, Sharon/she hoped it wouldn't be repeated.
After having heard it, Debbie/she hoped it wouldn't be repeated.

Andy threw a big cream pie at Rick.
Not being a good aim, Andy/he watched the pie hit the wall.
Not being a good target, Rick/he watched the pie hit the wall.

Rob convinced Ted to apply to college.
After spending several hours convincing, Rob/he waited to hear the decision.
After spending hours on the application, Ted/he waited to hear the decision.

Deb loaned twenty dollars to Liz.
Able to spare the cash, Deb/she felt good about the transaction.
Needing to pay some bills, Liz/she felt good about the transaction.

Joel accused Kent of denting the car.
Strongly repeating the charges, Joel/he began to get very angry.
Strongly denying the charges, Kent/he began to get very angry.

Neil broke a glass that belonged to Greg.
After offering to replace it, Neil/he looked around for the broom.
After saying not to worry about it, Greg/he looked around for the broom.

Jerry locked Billy out of the house.
After realizing the mistake was made, Jerry/he put a key under the mat.
After breaking in through a window, Billy/he put a key under the mat.

Dan always read the newspaper to Ned.
Though hating to read out loud, Dan/he liked knowing about current events.
Having been blind since birth, Ned/he liked knowing about current events.

Laura dunked Alice in the swimming pool.
After doing such a mean thing, Laura/she reached for the pool side.
After coming up from the water, Alice/she reached for the pool side.

Cindy sang an original song for Janet.
Carefully listening to the words, Janet/she wanted to cherish the meaning.
Carefully pronouncing the words, Cindy/she wanted to cherish the meaning.

Cheryl told Evette a very important secret.
After telling just that one person, Cheryl/she kept the secret strictly confidential.
After swearing not to tell anyone, Evette/she kept the secret strictly confidential.

Cathy received a chain letter from Donna.
After having sent the letter weeks ago, Donna/she practically forgot all about it.
After trying to figure out who it was from, Cathy/she practically forgot all about it.

Walter built Ronald a bird feeder.
After finishing the feeder, Walter/he hoped the birds liked it.
After receiving the feeder, Ronald/he hoped the birds liked it.

Donald carried a heavy box for George.
Being strong enough to lift it, Donald/he wondered what could be inside.
Being too weak to lift it, George/he wondered what could be inside.

Jeffrey congratulated Michael on the successful deal.
After accepting the congratulations, Michael/he bought a round of drinks.
After offering the congratulations, Jeffrey/he bought a round of drinks.

Susan made a chocolate cake for Nancy.
Using an old fashioned recipe, Susan/she knew it would taste good.
Receiving the old fashioned gift, Nancy/she knew it would taste good.

Brenda fixed Sherry up on a blind date.
Enjoying being a match-maker, Brenda/she looked forward to the date.
Enjoying being matched up, Sherry/she looked forward to the date.

David got a postcard from Robert.
Though jealous about the vacation, David/he enjoyed staying in touch with friends.

While vacationing i
friends.

Michelle cooked Shi
While preparing the
enough.
Seeing all that had b
enough.

Helen picked some f
After gathering a bo
After receiving the b

Danny splashed Larr
After setting down t
After getting comple

James passed the foo
After watching the to
After running for a to

Paula helped Patty a
After offering assista
After being kindly as

Peggy saved a place
After standing in line
After taking the save

Lilly read Denise the
After finishing the st
After hearing the sto

Frank scolded the pu
After scolding the do
While hearing the sc

Clark embarrassed R
Watching his friend's
said.
Feeling his cheeks be
said.

Richard called the fi
After calling for the
Waiting to be rescue

While vacationing in Mexico, Robert/he enjoyed staying in touch with friends.

Michelle cooked Shirley a seven course meal.
While preparing the huge meal, Michelle/she hoped everyone was hungry enough.
Seeing all that had been prepared, Shirley/she hoped everyone was hungry enough.

Helen picked some flowers to give to Julie.
After gathering a bouquet, Helen/she liked the way it smelled.
After receiving the bouquet, Julie/she liked the way it smelled.

Danny splashed Larry with the garden hose.
After setting down the hose, Danny/he ran off across the lawn.
After getting completely soaked, Larry/he ran off across the lawn.

James passed the football to Keith.
After watching the touchdown, James/he envisioned the possibility of victory.
After running for a touchdown, Keith/he envisioned the possibility of victory.

Paula helped Patty across the stream.
After offering assistance, Paula/she looked back across the stream.
After being kindly assisted, Patty/she looked back across the stream.

Peggy saved a place in line for Maria.
After standing in line for an hour, Peggy/she hoped the play was enjoyable.
After taking the saved place in line, Maria/she hoped the play was enjoyable.

Lilly read Denise the tragic novel.
After finishing the story, Lilly/she began reflecting upon life's hardships.
After hearing the story, Denise/she began reflecting upon life's hardships.

Frank scolded the puppy for chewing a shoe that belonged to Wayne.
After scolding the dog, Frank/he examined the torn up shoe.
While hearing the scolding, Wayne/he examined the torn up shoe.

Clark embarrassed Ralph in a group of people.
Watching his friend's cheeks turn red, Clark/he wished nothing had ever been said.
Feeling his cheeks begin to turn red, Ralph/he wished nothing had ever been said.

Richard called the firemen to save Charles.
After calling for the rescue, Richard/he was eager for their arrival.
Waiting to be rescued, Charles/he was eager for their arrival.

Steve showed Randy how to build a fire.
Having known how for years, Steve/he appreciated a good warming fire.
Never having known how, Randy/he appreciated a good warming fire.

Sam bought a birthday present for Ray.
Wrapping the present, Sam/he was pleased with the selection.
Opening the present, Ray/he was pleased with the selection.

Sue poured a cup of coffee for Jan.
Filling the cup too full, Sue/she spilled the coffee all over.
Reaching for the cup too soon, Jan/she spilled the coffee all over.

Diane fixed a martini for Betty.
Pretending to be a bartender, Diane/she playfully stabbed a cocktail olive.
Enjoying being waited on, Betty/she playfully stabbed a cocktail olive.

Jane expected Mary to arrive at 8:00.
After waiting for over an hour, Jane/she was ready for dinner.
After arriving at 9:00 instead, Mary/she was ready for dinner.

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Yekovich, F.R., Walker, C.H. integrating sentences. *J*

Résumé

Deux mécanismes, la *suppress* gmentation améliore l'accessibi la suppression améliore l'acces cepts. On peut supposer que c Six expériences ont évalué cett

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Résumé

Deux mécanismes, la *suppression* et l'*augmentation* sont proposés pour améliorer l'accès référentiel. L'augmentation améliore l'accessibilité de concepts déjà mentionnés en accroissant ou accentuant leur activation; la suppression améliore l'accessibilité de certains concepts en diminuant ou atténuant l'activité d'autres concepts. On peut supposer que ces mécanismes sont déclenchés par le contenu informationnel des anaphores. Six expériences ont évalué cette proposition en utilisant une référence anaphorique constituée soit d'un nom

très explicite ou d'un pronom moins explicite. Les sujets lisaient des phrases qui présentaient deux participants dans leur première proposition; par exemple, "*Ann* annonça que *Pam* perdrait la course" et se réfèraient à l'un des deux participants dans leur seconde proposition, "mais *Pam/elle* arriva très facilement la première." Pendant la lecture de chaque phrase, le niveau d'activation des deux participants était mesuré par un test de vérification de cible. Les deux premières expériences ont démontré que les anaphores constituées de noms explicites répétés déclenchent immédiatement l'activation de leurs propres antécédents et la suppression des autres participants (non-antécédents). La troisième expérience a démontré que les anaphores constituées de pronoms moins explicites déclenchent également la suppression des autres non-antécédents, mais qu'ils le font plus lentement, même lorsque, comme dans la quatrième expérience, l'information sémantique nécessaire pour identifier les antécédents se situe avant les pronoms (ex.: "Ann annonça que Pam perdrait la course. Mais après avoir gagné la course, *elle* ..."). La cinquième expérience a démontré que des pronoms plus explicites—pronoms qui correspondent au genre d'un seul participant—provoquent la suppression de manière plus efficace. La dernière expérience a montré que les participants qui avaient déjà été cités n'étaient pas les seuls à améliorer leur accès référentiel par le déclenchement de la suppression des autres participants, les participants venant d'être présentés provoquant le même phénomène (ex., "Ann annonça que Pam perdrait la course, mais *Kim* ..."). Ainsi, la suppression et l'augmentation améliorent l'accès référentiel et la contribution de ces deux mécanismes dépend du caractère plus ou moins explicite de la référence. Le rôle de ces deux mécanismes dans d'autres phénomènes relatifs à l'accès référentiel est également discuté.

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Abstract

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