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Cataphoric Devices in Spoken Discourse

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We propose that speakers mark key words with *cataphoric* devices. Cataphoric devices are counterparts to anaphoric devices: Just as anaphoric devices enable backward reference, cataphoric devices enable forward reference. And just as anaphoric devices mark concepts that have been mentioned before, cataphoric devices mark concepts that are likely to be mentioned again. We investigated two cataphoric devices: spoken stress and the indefinite *this*. Our experiments demonstrated three ways that concepts marked by cataphoric devices gain a privileged status in listeners' mental representations: Cataphoric devices enhance the activation of the concepts that they mark; cataphoric devices suppress the activation of previously mentioned concepts; and cataphoric devices protect the concepts that they mark from being suppressed by subsequently mentioned concepts. © 1995 Academic Press, Inc.

When people communicate, they talk about actions, events, ideas, other people, and a host of topics. We shall refer to these topics as "concepts" in a discourse. Some concepts are introduced but never referred to again; other concepts play a key role in the discourse. Speakers would benefit if those key concepts achieved a privileged status in their listeners' mental representations because speakers could refer to key concepts assured that their listeners could easily access them. Listeners would benefit, too: They could use key concepts as cornerstones when developing their mental representations.

In this paper, we propose that speakers mark key concepts with certain discourse devices, what we call *cataphoric devices*. In this paper, we also

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demonstrate how concepts marked by cataphoric devices gain a privileged status in the mental representations that listeners build when comprehending discourse.

WHAT ARE CATAPHORIC DEVICES?

We envision cataphoric devices as counterparts to anaphoric devices. Anaphoric devices enable backward reference. For instance, English speakers use anaphoric devices like the pronoun *she* or the definite noun phrase *the woman* to refer to a previously mentioned female. Speakers master the use of anaphoric devices as they are mastering communication. On the receiving end, listeners also master the use of anaphoric devices as they are mastering communication; for instance, listeners familiar with English interpret the pronoun *she* or the definite noun phrase *the woman* as a reference to a previously mentioned female.[1]

Just as anaphoric devices enable **backward** reference, we propose that cataphoric devices enable **forward** reference. We have adopted from linguists the term *cataphoric* because it denotes forward reference. As Quirk and Greenbaum (1978, p. 302) write, certain expressions "point backward (anaphoric) or forward (cataphoric) in discourse." Cataphoric devices include, but are broader than, cataphoric pronouns. The communality among cataphoric pronouns and what we are proposing as cataphoric devices lies in the denotation of cataphoric as forward.

Therefore, just as anaphoric devices mark concepts that have been mentioned **before**, we propose that cataphoric devices mark concepts that are likely to be mentioned **again**. And just as speakers learn to produce and listeners learn to interpret anaphoric devices, we propose that speakers learn to produce and listeners learn to interpret cataphoric devices. Our research investigated two cataphoric devices: spoken (contrastive) stress and the indefinite article *this*.

Spoken Stress

Speakers deliberately accentuate or stress certain words (Bolinger, 1972; Cruttenden, 1986; Levelt, 1989). When speakers stress words, they produce them with a higher fundamental frequency; therefore, stressed words are perceived as higher pitched. When speakers stress words, they also produce them at a higher intensity; therefore, stressed words are perceived as louder. Furthermore, stress words have longer durations than unstressed words (Fry, 1955; Gay, 1978; Lieberman, 1960).

What words do speakers intentionally stress? Many concepts are

[1] Because many anaphoric devices, such as pronouns and noun phrases, occur in written as well as spoken discourse, our comments about speakers should hold for writers, and our comments about listeners should hold for readers.

stressed when they are mentioned for the first time (Brown, 1983). In fact, comprehension proceeds more smoothly when speakers stress new concepts, as opposed to previously mentioned or "given" concepts (Bock & Mazzella, 1983; Terken & Nooteboom, 1987). English listeners depend more on spoken stress as a cue that the stressed information is new than they depend on other cues, such as word order (MacWhinney & Bates, 1978).

Speakers also stress prominent or focal concepts. For instance, stressing the word *bag* in the sentence, "The woman with the bag went into the dentist's office" has the same effect on listeners as preceding the sentence with the focusing question, "Which woman went into the office?;" both manipulations attract listeners' attention to the word *bag* (Cutler & Fodor, 1979). Because spoken stress marks new and important concepts, we propose that it operates as a cataphoric device.

The Indefinite "This"

We also propose that the unstressed indefinite article *this* operates as a cataphoric device. Most of us are familiar with the indefinite *this*. We hear it in the introductions to jokes, for instance, "So, *this* man walks into a bar" or "So, a man walks into a bar with *this* parrot on his shoulder."

The indefinite *this* is a relative newcomer to English, and it occurs considerably more often in informal spoken dialects than formal or written ones (Wald, 1983). Because it is an indefinite article, *this*—like *a* or *an*—introduces new concepts into a discourse. But in contrast to *a/an*, the indefinite *this* typically introduces concepts that will play a key role in the upcoming discourse.

For instance, when Wright and Givón (1987) recorded 8- and 10-year olds telling one another jokes and stories, they found that the concepts that children introduced with the indefinite *this* were referred to an average of 5.32 times in the children's next 10 clauses. In contrast, the concepts that the children introduced with the indefinite *a/an* were referred to only .68 times in the next 10 clauses. So, children use the indefinite *this* to introduce concepts that are likely to be mentioned again. Adults also use the indefinite *this* to introduce key concepts. Of the 243 concepts introduced with the indefinite *this* in Terkel's (1974) book *Working*, 86% were referred to again (Prince, 1981).

In addition to these descriptive data, we also have laboratory data which demonstrate that concepts introduced with the indefinite *this* are likely to be mentioned again. In Gernsbacher and Shroyer (1989), we auditorily presented the beginnings of informal narratives to college-aged subjects, telling them that at some point in each narrative the narrator would stop talking; then, it would be the subjects' job to continue telling the narrative. We constructed our narratives so that each introduced a

new concept prior to the point where subjects continued telling the narrative. We manipulated whether the new concepts were introduced with the indefinite *this* or the indefinite *a/an*. When our subjects continued telling the narratives, they were much more likely to talk about concepts that had been introduced with the indefinite *this* than concepts that had been introduced with the indefinite *a/an;* indeed, our subjects often mentioned concepts that had been introduced with the indefinite *this* in the first clauses that they produced, and they did so using less marked forms of reference (e.g., they referred to *this boy* as *he,* rather than as *the boy*).

Because the indefinite *this* marks new concepts that are likely to be mentioned again, it is a good candidate for what we are calling a cataphoric device. Indeed, Prince (1981) suggests that the indefinite *this* parallels a device in American Sign Language in which signers establish an absent third party on their right so that they can later refer to that individual; an absent third party who is not going to be rementioned is not established this way. This American Sign Language device probably also operates cataphorically.

HOW DO CATAPHORIC DEVICES IMPROVE THEIR CONCEPTS' REPRESENTATIONAL STATUS?

We propose that cataphoric devices, such as spoken stress and the indefinite *this,* do more than signal that certain concepts are likely to be mentioned again. In the same way, anaphoric devices do more than signal that certain concepts have been mentioned before. Anaphoric devices affect the mental representations that listeners build during discourse comprehension.

What are the mental representations like that listeners build during discourse comprehension? We have described those mental representations as structures, and we have proposed several general cognitive processes and mechanisms that enable comprehenders to build mental structures during comprehension (Gernsbacher, 1990; 1991). According to the Structure Building Framework, comprehenders build coherent mental structures by first laying foundations (Carrieras, Gernsbacher, & Villa, 1995; Gernsbacher & Hargreaves, 1988; 1992; Gernsbacher, Hargreaves, & Beeman, 1989). Comprehenders then develop their mental structures by mapping incoming information onto their developing mental structures, when that incoming information coheres with or relates to the previous information (Deaton & Gernsbacher, in press; Foertsch & Gernsbacher, 1994; Gernsbacher, in press; Gernsbacher & Robertson, 1992). However, if the incoming information is less related to the previous information, comprehenders employ another process: They shift and develop a new substructure (Gernsbacher, 1985; Gernsbacher, Varner, & Faust, 1990).

We have also proposed that the building blocks of mental structures are memory nodes. Memory nodes are activated by incoming stimuli. Once activated, the information represented by memory nodes becomes accessible for comprehension. In addition, patterns of activated memory nodes transmit processing signals; these processing signals suppress or enhance the activation of other memory nodes. In this way, patterns of activated memory nodes modulate the activation of other memory nodes. Memory nodes that are enhanced in activation become even more accessible; memory nodes that are suppressed become less accessible (Faust & Gernsbacher, in press; Gernsbacher & Faust, 1991a; 1991b; Gernsbacher & Faust, 1994).

Several experiments suggest that anaphoric devices improve the accessibility of the concepts to which they refer by triggering enhancement. Consider the sentence, "John beat Steve in a game of tennis, and *Steve*. . . ." The rementioned name *Steve* in the second clause is an anaphoric device that refers to the introduction of Steve in the first clause. Shortly after subjects hear or read the anaphoric device, they more rapidly and more accurately verify that the name of its referent (e.g., Steve) occurred in the sentence they just heard or read (Corbett & Chang, 1983; Gernsbacher, 1989; Dell, McKoon, & Ratcliff, 1983; MacDonald & MacWhinney, 1990). According to the Structure Building Framework, anaphoric devices trigger processing signals that enhance the activation of their antecedents, which is why concepts to which anaphoric devices refer are more accessible in comprehenders' mental representations, and are, therefore, verified more rapidly and more accurately (Gernsbacher, 1989).

Anaphoric devices also improve their referents' accessibility through the mechanism of suppression. Consider again the sentence, "John beat Steve in a game of tennis, and *Steve*. . . ." Shortly after subjects hear or read the rementioned name *Steve,* they less rapidly and less accurately verify that the name *John* occurred in the sentence (Gernsbacher, 1989; MacDonald & MacWhinney, 1990; O'Brien, Duffy, & Meyers, 1986). According to the Structure Building Framework, anaphoric devices trigger processing signals that suppress the activation of other concepts, which is why concepts to which the anaphoric devices do not refer are verified less rapidly and less accurately (Gernsbacher, 1989). By triggering the suppression of other concepts, anaphoric devices improve the accessibility of the concepts to which they refer.

Because we envision cataphoric devices as counterparts to anaphoric devices, we propose that cataphoric devices, like anaphoric devices, also trigger the mechanisms of enhancement and suppression to improve their concepts' accessibility. In the experiments reported here, we manipulated two cataphoric devices, spoken stress and the indefinite *this,* to test three

hypotheses concerning how cataphoric devices improve the accessibility of the concepts that they mark. Two hypotheses were motivated by analogy to anaphoric devices. First, like anaphoric devices, cataphoric devices could trigger processing signals that enhance activation. If cataphoric devices trigger processing signals that enhance the activation of the concepts that they mark, then a concept should be more activated when it is marked by a cataphoric device than when it is not marked by a cataphoric device.

Second, like anaphoric devices, cataphoric devices could also trigger processing signals that suppress the activation of previously mentioned concepts. If cataphoric devices trigger processing signals that suppress the activation of previously mentioned concepts, then a previously mentioned concept should become less activated following the introduction of a cataphorically marked concept than following the introduction of a concept that is not cataphorically marked. By enhancing the activation of the concepts that they mark (our first hypothesis) and by suppressing the activation of the previously mentioned concepts (our second hypothesis), cataphoric devices will improve their concepts' accessibility.

In addition, because the purpose of cataphoric devices is to enable future reference—reference that occurs later in discourse—cataphoric devices might also improve their concepts' accessibility in a way that we have not observed with backward-referring anaphoric devices. Cataphoric devices might "protect" the concepts that they mark from being suppressed by subsequently mentioned concepts. In this way, concepts that are marked by cataphoric devices would be more accessible for subsequent reference. If cataphoric devices protect the concepts that they mark from being suppressed by subsequently mentioned concepts, then a cataphorically marked concept should remain more activated than a noncataphorically marked concept, after the introduction of a new concept.

Therefore, we tested three hypotheses concerning how cataphoric devices improve the accessibility of their concepts. We tested the hypothesis that cataphoric devices enhance the activation of the concepts that they mark; we tested the hypothesis that cataphoric devices suppress the activation of previously mentioned concepts; and we tested the hypothesis that cataphoric devices protect the concepts that they mark from being suppressed by subsequently mentioned concepts.

To test these hypotheses we constructed 48 experimental narratives. These narratives were short, ranging from 30 to 80 words and averaging about 50 words. Actually, they seemed more like excerpts or the beginnings of longer conversational accounts. All were spoken informally, complete with colloquial refrains, false starts, and hesitations; in Schober and Clark's (1989) term, they were "unsanitized." We constructed these

narratives to revolve around events and activities with which we suspected our undergraduate subjects would be familiar, for example:

> *I swear, my friend Vicky, every time we go to a garage sale, she just, uh, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy an ashtray, 'n y'know, . . .*

As this example illustrates, each narrative introduced several concepts, for example, *Vicky*, a *garage sale*, an *ashtray*. In each narrative, one of these concepts was our experimental concept; it was the concept we manipulated. We manipulated whether the word that referred to our experimental concept was marked with a cataphoric device (e.g., whether *ashtray* in the above narrative was spoken with stress).

We measured the accessibility of these experimental concepts using a laboratory task frequently used to estimate the activation of discourse concepts (MacDonald & Just, 1989; McKoon & Ratcliff, 1980; Ratcliff, Hockley, & McKoon, 1985). We presented the name of our experimental concept visually, and we measured how rapidly and accurately subjects verified that the concept represented by the visually presented test word had occurred in the narrative. For example, during the narrative given as an example above, we visually presented the test word **ashtray**, and we measured subjects' speed and accuracy to respond "yes" (that *ashtray* had occurred in the narrative to which they were listening). Presumably, the more rapidly and accurately subjects respond, the more activated the concept is.

This laboratory task is ideal for examining how accessible concepts are in listeners' mental representations of discourse. Several studies suggest that subjects' response times and error rates reflect more than how well they can remember a superficial representation of the test word. For example, the test word **bread** is verified more rapidly and accurately after subjects read the sentence, "Almost every weekend, Elizabeth bakes *some* bread," than after subjects read the sentence, "Almost every weekend, Elizabeth bakes *no* bread." Notice that in both sentences the word *bread* occurs, but when the concept is negated (as it is in the second sentence), the concept of *bread* should be less accessible in comprehenders' mental representations. That is why subjects respond less rapidly and less accurately to the test word **bread** after reading the second sentence (MacDonald & Just, 1989).

Similarly, the word *sweatshirt* occurs in the sentence, "After doing a few warm-up exercises John *put on* his sweatshirt and jogged halfway around the lake." The word *sweatshirt* also occurs in the sentence, "After doing a few warm-up exercises John *took off* his sweatshirt and jogged halfway around the lake." However, the test word **sweatshirt** is verified

more rapidly and more accurately after subjects read that "John *put on* his sweatshirt and jogged halfway around the lake" than after they read that "John *took off* his sweatshirt and jogged halfway around the lake" (Glenberg, Meyer, & Linden, 1987).

In concert with others (Glenberg et al., 1987; McKoon & Ratcliff, 1980; McKoon, Ratcliff, Ward & Sproat, 1993), we argue that subjects' response times and accuracy rates in the verification task index how accessible concepts are in the subjects' mental representations of a discourse. We further suggest that these response times and accuracy rates indicate the activation levels of memory nodes, which is why we used the verification task to test our experimental hypotheses. Indeed, we specifically avoided other laboratory tasks that do not directly assay comprehenders' mental representation of a written text or a spoken discourse (e.g., a lexical decision or naming task on the word representing the experimental concept, or a lexical decision or naming task on a word representing a semantic associate of the experimental concept). Rather than asking subjects to decide whether a letter string forms an English word, and instead of asking subjects to name a letter string as rapidly as possible, we wanted to obtain a more direct measure of how memorable the experimental concepts were. Therefore, we used a laboratory task that explicitly requires subjects to examine their mental representations of the narratives in order to respond. We shall return to discuss our choice of experimental tasks in our final conclusions section.

EXPERIMENT 1A[2]

In our first experiment, we tested the hypothesis that cataphoric devices trigger processing signals that enhance the activation of the concepts that they mark. We tested this hypothesis by manipulating the cataphoric device, spoken stress. A female speaker recorded two versions of each of our 48 experimental narratives. In the first version, she was told to "emphasize the experimental concept as if it was very important" (e.g., *ASHTRAY*); in the second version, she was told to "produce the experimental concept without giving it undue emphasis" (e.g., *ashtray*).[3] These two versions are illustrated in Table 1A. The version in which our speaker stressed the experimental concept we shall call the "stressed" version, and the version in which our speaker did not stress the experimental concept we shall call the "unstressed" version.

To control other acoustic factors that might differ when speakers stress

[2] Experiments 1A and 1B were conducted concurrently, but for clarity, we describe them separately.

[3] We shall adopt the convention of capitalizing words that received spoken stress.

TABLE 1A
Example Narratives for Experiment 1A

I swear, my friend Vicky, every time we go to a garage sale, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy an *ASHTRAY*, 'n y'know,[ashtray]. . .

I swear, my friend Vicky, every time we go to a garage sale, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy an *ashtray*, 'n y'know,[ashtray]. . .

certain words—for instance, different intonation contours preceding the stressed word (Cutler, 1976)—we digitized these recordings. Then using a cross-splicing procedure that we shall describe more fully in the methods section, we created two versions of each narrative that were acoustically identical except for the stressed versus unstressed experimental concepts.

Each experimental concept was followed in its narrative by a filler phrase, for instance, " 'n she just had to buy an *ASHTRAY, 'n y'know,*" "he's been learnin' to use a *COMPUTER, 'n man,*" or "so I decided to order a *PIZZA, but 'uh.*" Typically, these filler phrases were two- or three-syllable colloquial refrains, although occasionally they were locatives (e.g., "I've been lookin' for an *APARTMENT farther south*"). It was after these filler phrases that we presented the test words. For example, after subjects heard *an ASHTRAY, 'n y'know,* or after they heard *an ashtray, 'n y'know,* we visually presented the test word **ashtray.** We presented the test words after their filler phrases because we knew that the stressed words would have longer durations, and we did not want faster reaction times to stressed words to occur simply because subjects had more time to respond.

To encourage our subjects to comprehend the narratives, we required them to write a logical continuation to half of them. We also included 32 "lure" narratives, which were similar to our experimental narratives, including having one stressed word. However, the concept that was stressed in each lure narrative was not represented by the test word for that narrative. Rather, the concept represented by the test word for each lure narrative had not occurred in that narrative; so the correct answer was "no."

To summarize: We presented two versions of 48 conversational narratives. In one version, our experimental concept was stressed (*ASHTRAY*); in the other version it was unstressed (*ashtray*). We presented the visual test word (**ashtray**) immediately after subjects heard the experimental concept's filler phrase (*'n y'know*). We tested the hypothesis that cataphoric devices trigger processing signals that enhance the activation

of the concepts that they mark. If cataphoric devices enhance the activation of their concepts, then subjects should have responded more rapidly and more accurately to the visually presented test words **(ashtray)** when the experimental concepts were marked by the cataphoric device, spoken stress (*ASHTRAY*) than when they were not marked by the cataphoric device, spoken stress (*ashtray*).

Method

Materials. We constructed two versions of 48 narratives, as illustrated in Table 1A. In one version, the experimental concept was stressed, while in the other version, it was unstressed. Both versions were initially recorded on audio tape and then digitized at a sampling rate of 11 KHz. We edited the wave forms in ways that we shall describe shortly. We also visually and aurally inspected the wave forms so that we could place a 250-ms 5.5 KHz square-wave tone at the point where we wanted the test word to appear. To present the narratives during the experiment, we re-recorded the speech onto one channel of an audio tape and the square-wave tone onto another channel. During the experiment, the subjects heard only the speech, and the tone was fed into a relay, which when activated caused the test words to appear on the subjects' individual computer monitors.

We edited the original versions of each narrative in the following steps: First, we randomly chose a carrier narrative. Half the time the carrier narrative was the beginning of the narrative in which the experimental concept was stressed, and half the time it was the beginning of the narrative in which the experimental concept was unstressed. By "beginning of the narrative," we mean the part of the narrative that included the introduction of the experimental concept and its filler phrase. For example, we used as a carrier:

> *I swear, my friend Vicky, every time we go to a garage sale, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy an ashtray, 'n y'know*

Next, we excised from the carrier narrative the acoustic signal corresponding to the experimental concept. Then, we marked the offset of the experimental concept's filler phrase with a 5.5 KHz tone. We made two copies of each carrier narrative (including the tone). Finally, into one copy of the carrier narrative we spliced a copy of the acoustic signal corresponding to the experimental concept when it was stressed, and into the other copy of the carrier narrative we spliced a copy of the acoustic signal corresponding to the experimental concept when it was unstressed.

After the filler phrases, we appended more of the narratives. When the experimental concept was stressed, we appended another segment of the narrative in which the speaker continued talking about the experimental concept, for example:

> *. . . 'n she just had to buy an ASHTRAY, 'n y'know, she really wanted it bad, but I didn't see the attraction. I mean it had a picture of Lady Di on it, and I guess it only cost a quarter, but . . .*

When the experimental concept was unstressed, we appended another segment of the narrative in which the speaker talked about something else, for example:

> *. . . 'n she just had to buy an ashtray, 'n y'know, she even wanted to buy some clothes. But man I was gettin' real hungry 'cuz I hadn't eaten any breakfast, 'n so I said, "Hey, . . .*

We made the narratives diverge (after the experimental concepts occurred) to mimic what

normally happens in discourse: Concepts that are marked with spoken stress are typically talked about. Of course, we measured activation before the two versions diverged.[4]

We also created 32 lure narratives that were similar in style and content to the experimental narratives, but whose test words had not occurred (so the subjects should have responded "no" to these test words). One word in each lure narrative was stressed. We randomly ordered the 32 lure narratives and the 48 experimental narratives. Because we added two more experimental versions that we shall describe in Experiment 1B, we needed to create four experimental tapes. On each tape, each experimental narrative occurred in only one of its four experimental versions, and an equal number of narratives occurred in each of the four experimental conditions. Furthermore, on each tape an equal number of narratives within each of the four experimental conditions had been originally produced with the experimental concept stressed as with the experimental concept unstressed (although through our cross-splicing procedure, the acoustic signal corresponding to the stressed experimental concept had been replaced with the acoustic signal corresponding to the unstressed experimental concept, and vice versa).

Twenty subjects were randomly assigned to each of the four tapes. In this way, each subject heard only one version of each narrative. By adding the other two versions (which we shall describe in Experiment 1B), we decreased to 15% the proportion of test words that represented stressed concepts. Thus, on only 15% of the trials did a test word represent a concept that had been spoken with stress. Given the low proportion of stressed concepts that were represented by the test words, and given the much higher proportion of stressed concepts that were not represented by the test words—namely, 55%—subjects would not have benefited by assuming that a stressed concept would be a test word.

Prior to the experiment, we performed three manipulation checks. First, because one characteristic of stressed words is their longer duration, we measured the duration of the stressed versus unstressed experimental concepts. The unstressed concepts averaged 448 ms, and the stressed concepts averaged 945 ms. These lengths included both the concept's

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[4] Typically the two versions did not diverge until after the first word of the "divergent" final segments. For example, *she just had to buy an ASHTRAY, 'n y'know, she/really wanted it bad, . . .* versus *she just had to buy an ashtray, 'n y'know, she/even wanted to buy some clothes*. In addition, an approximate 500 ms pause intervened between the last word of the filler phrase (e.g., 'n y'know) and the first word of the divergent segments (e.g., "she" as in *she really wanted it bad* or *she even wanted to buy some clothes*). Because the test word's visual appearance (on the subjects' computer monitors) was triggered by the offset of the last word of the filler phrases, because there was an approximate 500 ms pause between the last word of the filler phrase and the first word of the divergent segments, and because the divergent segments typically did not diverge until after the first word of the final segments, most subjects had made their responses by the time the narratives really diverged. Furthermore, we compared the data from the first versus second halves of the experiment to discern whether subjects "caught on" to the fact that the stressed concepts would subsequently be discussed. If so, the subjects might have adopted the strategy of responding more rapidly and accurately to the stressed concepts only because they would subsequently be discussed. However, the pattern we observed in Experiments 1A and 1B was just the opposite of what this strategy would predict: The experimental manipulation was stronger in the first half of the experiment than in the second half of the experiment. This is a typical pattern observed in our experiments (i.e., the experimental manipulation is stronger at the beginning than the end of the experiment); therefore, we doubted that it reflected any strategy particular to dealing with the fact that the stressed words were discussed in the final segments of our experimental narratives.

actual duration and any pause prior to the next word. Thus, the stressed words were longer, as the literature on spoken stress suggests they should have been.

Second, we compared whether other speakers would stress the experimental concepts to the same degree as the speaker who produced our experimental materials. We asked three additional speakers to record a subset of our experimental narratives; two of these speakers were naive to our experimental hypotheses. These other speakers lengthened their stressed concepts by 110, 104, and 103%. These values did not differ reliably from the 117% lengthening produced by the speaker who recorded our experimental materials (all $ts < 1$).

Third, we asked eight subjects, who did not participate in any of the experiments reported here, to listen to the experimental and lure narratives and simply write down any word that they "perceived as being really stressed (or emphasized)." An equal number of subjects heard each of the 48 experimental narratives with its experimental concept stressed as heard each experimental narrative with its experimental concept unstressed (i.e., an equal number of subjects heard each of the two versions presented in Table 1A). Furthermore, each subject heard an equal number of experimental narratives with stressed (24) versus unstressed (24) experimental concepts (i.e., each subject heard an equal number of the two versions presented in Table 1A). The subjects also heard the 32 lure narratives arranged in the same order as the actual subjects did. All eight subjects were 100% accurate at detecting as stressed each experimental concept when we intended it to be stressed, and no subject detected as stressed any experimental concept when we did not intend it to be stressed. Furthermore, all subjects were 100% accurate at detecting the stressed words in the lure narratives.

Procedure. Subjects were tested in groups of six or fewer in a session lasting about 50 min. Each subject occupied an individual sound-attenuated booth. Subjects heard the prerecorded narratives and instructions over headphones. Subjects were told that they would hear the beginnings of many conversation-like stories. Each story would be preceded by the spoken word, "Ready," and 2 s later the story would begin. Subjects were told that their primary task was to listen to and comprehend each story. As a test of their comprehension, they would often have to continue telling the story. They were told that whenever the words, "Please continue the story," appeared on the computer monitor in front of them, they should pick up the pencil provided in their booth and write a suitable continuation on the ruled pages also provided in their booth. They were given 25 s to write each continuation; after 20 s they heard a single tone, which was their cue to wrap up what they were writing. After another 5 s they heard a double tone, which was their cue to cease writing completely and prepare for the next narrative. Five seconds later, the next narrative began. Subjects were required to write continuations for 20 lure narratives and 20 experimental narratives (five in each of the four experimental conditions).

Subjects were also told that they were to perform a secondary task: During each story, a test would appear on the computer monitor in front of them, and their task was to decide rapidly and accurately whether that word had occurred in the story they were currently hearing. Subjects responded to each test word by pressing either a key labeled "yes" or a key labeled "no." To accustom subjects to the experimental task, they practiced responding to test words and writing continuations for four practice narratives.

Subjects. Eighty undergraduates at the University of Oregon participated as one means of fulfilling a course requirement. As in all of the experiments we report here, the subjects were native American English speakers. Subjects were replaced if they responded incorrectly to more than 15% of the test words or if they wrote illogical continuations.

Results

If cataphoric devices, such as spoken stress, trigger processing signals that enhance the activation of the concepts they mark, then the experi-

mental concepts should have been responded to more rapidly and more accurately when they were marked by spoken stress than when they were not marked by spoken stress. Figure 1A displays subjects' responses to the experimental test words (**ashtray**) when the experimental concepts were stressed (*ASHTRAY*) versus unstressed (*ashtray*), and when the experimental concepts were tested immediately after they were introduced (literally, after their filler phrases). The bars illustrate the subjects' average correct reaction times (with the scale on the left), and the squares illustrate the subjects' average error rate (with the scale on the right).

As Fig. 1A illustrates, when the experimental concepts were stressed, the test words representing those concepts were responded to more rapidly (848 vs 1017 ms), $minF'(1,84) = 52.00$, $p < .0001$, and more accurately (2 vs 4% errors), $F_1(1,79) = 3.36$, $F_2(1,47) = 2.40$ (although this difference in error rates was only marginally reliable when items were considered a random effect, most likely because subjects made few errors). These data demonstrate that stressed concepts are more activated than unstressed concepts. So, these data support one of our hypotheses about how concepts marked with cataphoric devices gain a privileged status in the mental structures that listeners build during discourse comprehension: Cataphoric devices trigger processing signals that enhance the activation of the concepts that they mark.

EXPERIMENT 1B

In our first experiment, we also tested another hypothesis about how concepts marked with cataphoric devices gain a privileged status in the mental structures that listeners build during discourse comprehension. We tested the hypothesis that cataphoric devices trigger processing signals that suppress the activation of other, previously mentioned concepts.

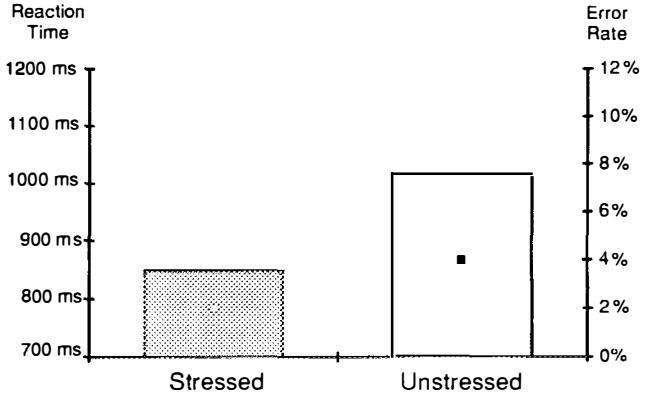

FIG. 1A. Subjects' average reaction times and error rates from Experiment 1A.

By reducing the activation of other, previously mentioned concepts, cataphoric devices will improve their own concepts' accessibility. We tested this hypothesis again by manipulating the cataphoric device, spoken stress.

We constructed two more versions of our 48 experimental narratives. In both of the two new versions, we again introduced our experimental concept (e.g., *ashtray*), but in only its unstressed form. Following this first experimental concept, we introduced a second experimental concept. For example, we introduced the concept *vase* in the following narrative:

> *I swear, my friend Vicky, every time we go to a garage sale, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy an ashtray, 'n y'know, then she saw a vase, 'n I swear, . . .*

The same female speaker recorded these two additional versions in two ways. In one version, she was told to emphasize the second experimental concept (*VASE*); in the other version, she was told to produce the second experimental concept without giving it undue stress (*vase*). These two versions are illustrated in Table 1B. Again, to control for differences in intonation contour, we digitized these two versions and cross-spliced them (as we shall describe in the method section).

Each second experimental concept (e.g., *VASE/vase*) was followed by a filler phrase (e.g., *'n I swear*). It was after these filler phrases that we measured activation of the first experimental concepts. For example, after subjects heard *a VASE, 'n I swear,* or after they heard *a vase, 'n I swear,* we visually presented the test word **ashtray** (as illustrated in Table 1B). So, although we manipulated the stress of the second concepts (*VASE* vs *vase*), we presented the first concepts as test words (**ashtray**).

To summarize: We tested the hypothesis that cataphoric devices trigger processing signals that suppress the activation of other, previously mentioned concepts. We tested this hypothesis by introducing a second experimental concept that was either marked by the cataphoric device, spoken stress (*VASE*) or it was not marked by the cataphoric device,

TABLE 1B
Example Narratives for Experiment 1B

I swear, my friend Vicky, every time we go to a garage sale, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy an ashtray, 'n y'know, then she saw a *VASE*, 'n I swear,$^{\text{ashtray}}$. . .
I swear, my friend Vicky, every time we go to a garage sale, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy an ashtray, 'n y'know, then she saw a *vase*, 'n I swear,$^{\text{ashtray}}$. . .

spoken stress (*vase*), and we measured the effect that marking this second concept with spoken stress had on the activation of the first concept (ashtray). If cataphoric devices trigger processing signals that suppress the activation of other, previously mentioned concepts, then subjects should have responded less rapidly and less accurately to the test words representing the first concepts (**ashtray**) when the second concepts were stressed (*VASE*) than when the second concepts were unstressed (*vase*).

Method

We constructed two more versions of our 48 narratives, as illustrated in Table 1B. In both versions, the first experimental concept was unstressed, and a second experimental concept was introduced. In one version, the second experimental concept was stressed, while in the other version, it was unstressed. In both versions, we measured the activation of the first concepts after the second concepts had been introduced.

To construct these two experimental versions, we began with an initial segment of each narrative in which the first experimental concept was originally recorded unstressed. This first segment included the first experimental concept and its filler phrase (e.g., *I swear, my friend Vicky, every time we go to a garage sale, she just, uh, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy an ashtray, 'n y'know*). Then, we appended to the first segment a second segment that included the second experimental concept and its filler phrase (e.g., *then she saw a vase, 'n I swear*). These second segments were randomly selected from the original recordings. Half the time we selected the segment in which the second experimental concept was originally recorded stressed, and half the time we selected the segment in which the second experimental concept was originally recorded unstressed. We excised the acoustic signal corresponding to the second experimental concept from these second segments, and we marked the offset of the second experimental concept's filler phrase with a 5.5-KHz square-wave tone.

We made two copies of each carrier narrative built so far (which included the tone). Into one copy of each carrier narrative we spliced a copy of the acoustic signal corresponding to the second experimental concept when it was stressed, and into the other copy of each carrier narrative we spliced a copy of the acoustic signal corresponding to the second experimental concept when it was not stressed. In this way, the same number of carrier narratives that originally contained stressed as opposed to unstressed second concepts was used to create the experimental versions that presented the stressed experimental concepts; similarly, the same number of carrier narratives that originally contained stressed as opposed to unstressed second concepts was used to make the experimental versions that presented the unstressed experimental concepts.

Finally, we appended a third segment to each experimental narrative so that when the second concept was stressed, the narrative continued discussing that concept; when the second concept was unstressed, the narrative discussed something else. As described in Experiment 1A, we recorded four experimental tapes. On each tape, each experimental narrative occurred in only one of its four experimental versions (the two versions from Experiment 1A and the two versions from Experiment 1B). Furthermore, on each tape an equal number of narratives occurred in each of the four experimental conditions. Twenty subjects were randomly assigned to each of the four tapes, so that each subject heard only one version of each narrative.

Results

If cataphoric devices, such as spoken stress, trigger processing signals

that suppress the activation of previously mentioned concepts, then subjects should have responded less rapidly and less accurately to the test words representing the first experimental concepts (**ashtray**) when the second experimental concepts were stressed (*VASE*) than when the second experimental concepts were unstressed (*vase*). Figure 1B displays subjects' responses; the bars illustrate their average reaction times, and the squares illustrate their average error rates.

As Fig. 1B illustrates, when the second concepts were stressed, the test words representing the first experimental concepts were responded to less rapidly (1136 vs 1081 ms), $minF'(1,76) = 3.963$, $p < .05$, and less accurately (12 vs 6% errors), $minF'(1,122) = 8.064$, $p < .01$. In other words, because the second concepts were stressed, the first concepts became less activated. We propose that the first concepts became less activated when the second concepts were stressed, because the cataphoric device of spoken stress triggers processing signals that decrease the activation of previously mentioned concepts. Therefore, we conclude that these data support another of our three hypotheses about how concepts marked with cataphoric devices gain a privileged status in the mental structures that listeners build during discourse comprehension: Cataphoric devices trigger processing signals that suppress the activation of previously mentioned concepts.

EXPERIMENT 2

Experiments 1A and 1B demonstrated two ways that cataphoric devices improve their concepts accessibility: Cataphoric devices enhance the activation of the concepts they mark, and cataphoric devices suppress the activation of previously mentioned concepts. In Experiment 2 we

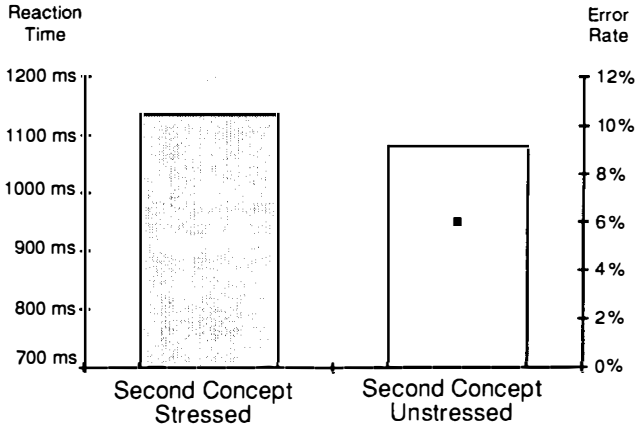

FIG. 1B. Subjects' average reaction times and error rates from Experiment 1B.

tested a third hypothesis about how cataphoric devices improve their concepts' accessibility; we tested the hypothesis that cataphoric devices protect the concepts they mark from being suppressed by subsequently mentioned concepts. If cataphoric devices protect the concepts that they mark from being suppressed by subsequently mentioned concepts, then cataphorically marked concepts would be more accessible for future reference. We tested this hypothesis again by manipulating the cataphoric device, spoken stress.

In Experiment 2, each of our 48 experimental narratives occurred in four versions. Two of the four versions were identical to the two versions we presented in Experiment 1A. These two versions are illustrated as the top two examples in Table 2. In both of these versions, we measured the first experimental concepts' activation immediately after they were introduced. In one version, the first concepts were stressed (*ASHTRAY*), and in the other version, they were unstressed (*ashtray*). Comparing these two versions showed us how activated the first concepts were before we introduced the second concepts. This is the comparison we made in Experiment 1A; making this comparison again also allowed us to replicate support for the hypothesis that cataphoric devices enhance the activation of the concepts that they mark.

The other two versions that we presented in Experiment 2 are illustrated as the bottom two examples in Table 2. In both versions, we introduced a second concept, for example, *a vase*. In both versions, these second concepts were unstressed, and we measured activation of the first experimental concepts after the second concepts' filler phrases. Across these two versions, we manipulated whether the first experimental concepts were stressed (*ASHTRAY*) or unstressed (*ashtray*). Comparing all four versions allowed us to examine how a stressed versus unstressed first concept (*ASHTRAY* vs *ashtray*) was affected by the introduction of a second concept (*vase*). If cataphoric devices improve their concepts' accessibility by protecting them from being suppressed by subsequently mentioned concepts, then stressed first concepts should be less affected by the introduction of second concepts.

TABLE 2
Example Narratives for Experiment 2

I swear, my friend Vicky, every time we go to a garage sale, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy
an *ASHTRAY*, 'n y'know,[ashtray]. . .
an *ashtray*, 'n y'know,[ashtray]. . .
an *ASHTRAY*, 'n y'know, then she saw a vase, 'n I swear,[ashtray]. . .
an *ashtray*, 'n y'know, then she saw a vase, 'n I swear,[ashtray]. . .

Method

We constructed four versions of our 48 experimental narratives in the following way. We borrowed three versions from those we had used in Experiments 1A and 1B. Those three versions were (1) when the first concepts were stressed and the test words representing those first concepts were presented immediately after the first concepts' filler phrases, as illustrated by the top example in Table 2; (2) when the first concepts were unstressed and the test words representing those first concepts were presented immediately after the first concepts' filler phrases, as illustrated by the second example in Table 2; and (3) when the first concepts were unstressed, the second concepts were unstressed, and the test words representing the first concepts were presented immediately after the second concepts' filler phrases, as illustrated by the bottom example in Table 2. These three versions correspond to the two versions presented in Experiment 1A, and one of the versions presented in Experiment 1B.

We created a new version, as illustrated by the third example in Table 2. In this new version, the first concept was stressed, the second concept was unstressed and the test word, which represented the first concept, was presented immediately after the second concept's filler phrase. We created this version by randomly choosing a carrier narrative. Half the time it was a narrative in which the first concept was originally stressed, and half the time it was a narrative in which the first concept was originally unstressed. We excised from the carrier narrative the acoustic signal corresponding to the first concept, marked the offset of the first concept's filler phrase with a tone, and spliced a copy of the acoustic signal corresponding to the first concept when it was stressed. In this way, the same number of carrier narratives that originally contained stressed as unstressed first concepts was used to make this third experimental version.

We randomly ordered the 48 experimental narratives and the 32 lure narratives (that we had used in Experiments 1A and 1B), and we created four experimental tapes (with the same counterbalancing constraints as we used for Experiments 1A and 1B). Eighteen subjects were randomly assigned to each of the four tapes so that each subject heard only one version of each narrative.

Results

Figure 2 displays the subjects' responses to test words representing the first concepts when those first concepts were stressed (the filled squares) versus unstressed (the unfilled squares). These responses were measured at two points: immediately after the first concepts' filler phrases (and, therefore, before the second concepts were introduced) and immediately after the second concepts' filler phrases (and, therefore, after the second concepts were introduced). Subjects' average reaction times are illustrated in the left-hand panel, and their average error rates are illustrated in the right-hand panel.

First, we can examine the data that re-test our first hypothesis that cataphoric devices enhance the activation of the concepts that they mark. If cataphoric devices, such as spoken stress, enhance their concepts' activation, then when subjects were tested immediately after they heard the first concepts, they should have responded more rapidly and more accurately when those first concepts were stressed (*ASHTRAY*) versus unstressed (*ashtray*). As illustrated in Fig. 2, when activation of the first

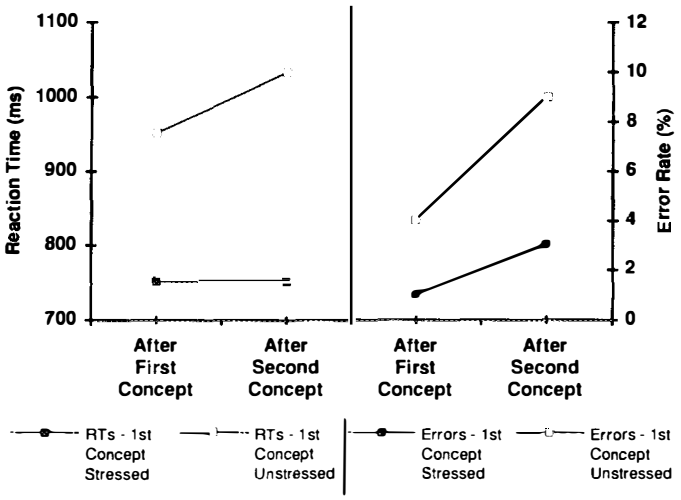

FIG. 2. Subjects' average reaction times and error rates from Experiment 2.

experimental concepts was measured immediately after those first concepts were introduced, test words representing those first concepts were responded to more rapidly (752 vs 952 ms), $minF'(1,95) = 74.35$, $p < 0.0001$, and more accurately (1 vs 4% errors), $minF'(1,114) = 9.130$, $p < .005$, when the first concepts were stressed (the filled squares) than when the first concepts were not stressed (the unfilled squares). These data replicate those of our first experiment. They again support the hypothesis that cataphoric devices, such as spoken stress, enhance their concepts' activation.

Next, we can examine the data that test our third hypothesis that cataphoric devices protect their concepts from being suppressed by subsequently mentioned concepts. To test this hypothesis, we manipulated whether our first experimental concepts were stressed (*ASHTRAY*) versus unstressed (*ashtray*), and we measured those first concepts' activation before versus after we introduced a second unstressed concept (*vase*). If cataphoric devices, such as spoken stress, protect their concepts from being suppressed by subsequently mentioned concepts, then stressed first concepts should be less affected by the introduction of second concepts.

As the unfilled squares in Fig. 2 illustrate, when the first concepts were not stressed they were greatly affected by the introduction of second concepts: Subjects' average reaction times to the test words representing the first concepts increased from 952 to 1068 ms, $minF'(1,73) = 11.32$, $p < .001$, and their average error rate increased from 4 to 9%, $minF'(1,111) = 9.510$, $p < .005$. These data extend those of Experiment 1B and suggest

that the unstressed first concepts were suppressed by the introduction of the second concepts.[5]

In contrast, as the filled squares in Fig. 2 illustrate, the stressed first concepts were considerably less affected by the introduction of second concepts: Subjects' average reaction times to the test words representing the first concepts did not increase (752 ms in both conditions), both Fs < 1, and subjects' average error rates increased only from 1 to 3%, $minF'(1,116) = 4.901$, $p < .05$. Thus, when the first concepts were not stressed, they lost activation when a second concept was introduced; we suggest they were suppressed. But when the first concepts were stressed, they were protected from this suppression. The difference between how much the stressed versus unstressed first concepts were affected by the introduction of the second concepts was manifested in an interaction, $minF'(1,79) = 6.431$, $p < .025$ for subjects' average reaction times, and $minF'(1,108) = 3.648$, $p < .06$, for subjects' average error rates. Therefore, our second experiment supported another hypothesis about how concepts marked with the cataphoric device, spoken stress, gain a privileged status in the structures that listeners build during discourse comprehension: Cataphoric devices protect the concepts they mark from being suppressed by subsequently mentioned concepts.

EXPERIMENT 3

Our first two experiments supported three hypotheses about the cataphoric device, spoken stress: The cataphoric device, spoken stress, enhances the activation of the concepts that it marks; it suppresses the activation of previously mentioned concepts, and it protects the concepts that it marks from being suppressed by subsequently mentioned concepts. In our third experiment, we wanted to extend these results to a more subtle cataphoric device—the unstressed indefinite article *this*. Our goal for Experiment 3 was to replicate Experiment 2, substituting the indefinite *this* for spoken stress.

In Experiment 3, each of our 48 experimental narratives occurred in four versions, as illustrated in Table 3. In all four versions, both the first

[5] An alternative account of these data draws on a decay, not a suppression, mechanism. Perhaps the activation of unstressed concepts decays faster than the activation of stressed concepts. However, such a decay mechanism would have to be very intelligent; it would have to draw on various "external" information to prescribe its rate of decay. All decay mechanisms of which we are aware are much simpler: Concepts decay (in activation) when they lack stimulation. Proposing a decay mechanism that takes account of whether *other* concepts are stressed or whether *other* concepts are introduced with the indefinite *this* comes very close to proposing an active suppression mechanism. But, with a suppression mechanism, one can trace the cause: The cataphoric device (such as spoken stress or the indefinite *this*) transmits suppression signals to reduce the activation of other concepts.

TABLE 3
Example Narratives for Experiment 3

I swear, my friend Vicky, every time we go to a garage sale, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy
this ashtray, 'n y'know,[ashtray]. . .
an ashtray, 'n y'know,[ashtray]. . .
this ashtray, 'n y'know, then she saw a vase, 'n I swear,[ashtray]. . .
an ashtray, 'n y'know, then she saw a vase, 'n I swear,[ashtray]. . .

and second concepts were unstressed. And in all four versions, the test words represented the first concepts (e.g., **ashtray**); thus, we measured the activation of the first concepts. The critical differences among the four versions were (1) whether the first concepts were introduced with the indefinite *this* versus the indefinite *a/an* and (2) whether we measured the first concepts' activation after those first concepts were introduced or after second concepts were introduced.

In two versions, we measured the first concepts' activation after they were introduced (literally, immediately after their filler phrases). These two versions are illustrated by the top two examples in Table 3. In one of these two versions, the first concepts were introduced with the indefinite *this* (*this ashtray*); in the other version, the first concepts were introduced with the indefinite *a/an* (*an ashtray*). Comparing these two versions allowed us to test the hypothesis that the cataphoric device of the indefinite *this* enhances its concepts' activation.

The remaining two versions are illustrated as the bottom two examples in Table 4. In these two versions, we also measured the activation of the first concepts (e.g., we presented the test word **ashtray**), but we measured these first concepts' activation after we introduced a second concept. As illustrated in Table 4, in both of these versions, the second concepts were unstressed and introduced with the indefinite *a/an* (*a vase*). Across these two versions, we manipulated whether the first concepts had been introduced with the indefinite *this* (*this ashtray*) versus the indefinite *a/an* (*an ashtray*).

Comparing all four versions allowed us to test the hypothesis that the

TABLE 4
Example Narratives for Experiment 4

I swear, my friend Vicky, every time we go to a garage sale, she just goes crazy. I mean like last Saturday we went to one near campus, 'n she just had to buy
an *ashtray*, 'n y'know, then she saw a *VASE*, 'n I swear,[ashtray]. . .
an *ashtray*, 'n y'know, then she saw a *VASE*, 'n I swear,[vase]. . .
an *ASHTRAY*, 'n y'know, then she saw a *VASE*, 'n I swear,[ashtray]. . .
an *ASHTRAY*, 'n y'know, then she saw a *VASE*, 'n I swear,[vase]. . .

cataphoric device, the indefinite *this*, protects the concepts it marks from being suppressed by subsequently mentioned concepts. If the indefinite *this* protects its concepts from suppression, then first concepts should be less affected by the introduction of second concepts when those first concepts are marked with the indefinite *this* (*this ashtray*) than when those first concepts are marked with the indefinite *a/an* (*an ashtray*).

Marking concepts with the indefinite *this* versus the indefinite *a/an* is a subtle manipulation. Many native speakers are unaware of their frequent use of this device. Our undergraduate research assistants, whom we typically keep blind to our experimental manipulations and hypotheses, were later stymied in their attempts to guess our manipulation—even after they had heard the experimental tapes numerous times. Therefore, we anticipated that the effects of the indefinite *this* would be more subtle than the effects of the more salient cataphoric device, spoken stress.

Method

We constructed the four experimental versions of our 48 narratives in the following way. We began with a segment of each narrative in which the first concept was originally recorded unstressed. This first segment included the first experimental concept and its filler phrase. We made two copies of this first segment. We put one copy aside to create the two versions of the experimental narratives illustrated by the third and fourth examples in Table 3. We used the other copy to create the two versions illustrated by the first and second examples. On this copy we marked the offset of the first experimental concept's filler phrase with a 5.5 KHz tone. Then, we made another copy of this segment, so that we had two copies of the first segment, including the tone that marked the offset of the first concept's filler phrase.

The next step involved modifying one of these two copies. We electronically replaced the acoustic signal corresponding to the indefinite article *a/an* that preceded the first experimental concept with an acoustic signal corresponding to an unstressed indefinite article *this*. The speaker who had recorded our experimental materials recorded several tokens of an unstressed *this*. We selected the acoustic signal corresponding to *this* that best matched the acoustic environment of the first experimental concept. We chose to splice *this* into narratives originally recorded with *a/an*, as opposed to recording half the narratives with *this* and half with *a/an* and then cross-splicing them (as we did with the stressed versus unstressed concepts), because many efforts at constructing pilot stimuli demonstrated the difficulty (and near impossibility) of cleanly excising the indefinite *this*. Complete removal of the final *s* of the indefinite *this* required cutting too far into the experimental concept. This was not a problem when the concept was preceded by *a/an*.

Because we electronically spliced the indefinite *this* into our narratives, but not the indefinite *a/an*, we conducted a follow-up study. The speaker who recorded our experimental narratives re-recorded a random half (24) of them with the indefinite *this* preceding the first experimental concept (i.e., she made 24 original, unspliced indefinite-*this* narratives). Then, a group of eight subjects (who did not participate in any of the experiments reported here) listened to one of two versions of these 24 narratives. Half the subjects heard the version of each narrative into which the indefinite *this* was spliced, and half heard the version of each narrative in which the indefinite *this* was originally recorded. The subjects' task was to classify each narrative as "spliced" versus "natural," and they were told that half were of each type (which was true). The subjects performed no more accurately than chance at identifying the spliced versus natural versions.

The final step in constructing the two versions illustrated by the top two examples in Table 3 was to append a final segment. These final segments were taken from the original recordings. To the version in which the first experimental concept was introduced with the indefinite *this*, we appended a final segment in which the first experimental concept was discussed further; to the version in which the first concept was introduced with the indefinite *a/an*, we appended a final segment in which something else was discussed further.

Next, we constructed the two other versions, illustrated by the third and fourth examples in Table 3. We began with the previously set aside copy of the first segment, which included the first experimental concept and its filler phrase. Then, we appended a second segment, from the original recordings, that included the second experimental concept and its filler phrase. We used the original recording in which the second experimental concepts were unstressed. We marked the offset of the second experimental concept's filler phrase with a 5.5 KHz tone.

We made two copies of each carrier narrative built so far, so that we had two copies of each entire carrier including the tone that marked the offset of the second concept's filler phrase. The next step again involved electronically replacing the acoustic signal corresponding to the indefinite article *a/an* preceding the second experimental concept with an acoustic signal corresponding to an indefinite *this*. Again we selected from a large set of tokens the acoustic signal corresponding to *this* that best matched the acoustic environment of the second experimental concept. Finally, we appended a third segment to each narrative so that when the second concept was introduced with the indefinite *this*, the narrative continued discussing that concept; when the second concept was introduced with the indefinite *a/an*, the narrative discussed something else.

We also modified our lure narratives by electronically replacing one instance of the indefinite *a/an* within each lure narrative with an acoustically matched token of the indefinite *this*. We recorded four experimental tapes as we had before. On each tape, each experimental narrative occurred in only one of its four experimental versions, and an equal number of narratives occurred in each of the four experimental conditions. Twenty-six subjects were randomly assigned to each of the four tapes, so that each subject heard only one version of each experimental narrative.

Results

Figure 3 displays the subjects' responses to test words representing the first concepts when those first concepts were marked with the indefinite *this* (the filled squares) versus the indefinite *a/an* (the unfilled squares). Subjects' responses were measured at two points: immediately after the first concepts' filler phrases (and, therefore, before the second concepts were introduced), and immediately after the second concepts' filler phrases (and, therefore, after the second concepts were introduced). Subjects' average reaction times are illustrated in the left-hand panel, and their average error rates are illustrated in the right-hand panel.

First, we can examine the data that test our first hypothesis: Cataphoric devices enhance the activation of the concepts that they mark. If the cataphoric device, the indefinite *this*, enhances its concepts' activation, then when subjects were tested immediately after they heard the first concepts, they should have responded more rapidly and more accurately when those first concepts were marked with the indefinite *this* (*this ashtray*) than when those first concepts were marked with the indefinite *a/an*

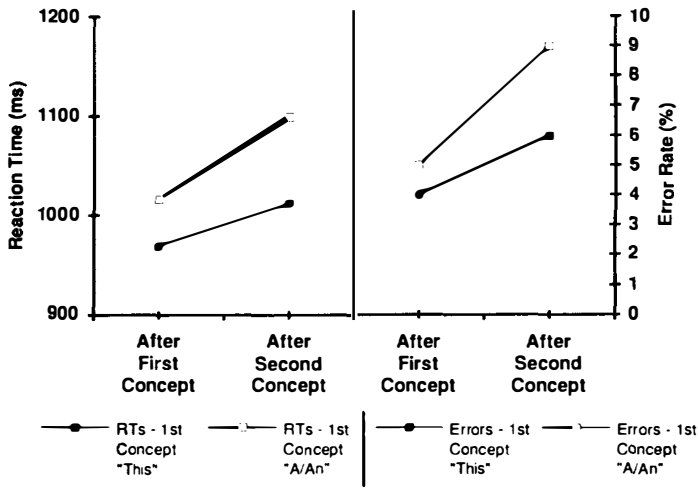

FIG. 3. Subjects' average reaction times and error rates from Experiment 3.

(*an ashtray*). As illustrated in Fig. 3, when activation of the first experimental concepts was measured immediately after those first concepts were introduced, test words representing those first concepts were responded to more rapidly (968 vs 1016 ms), $minF'(1,86) = 3.226$, $p < .07$, and slightly more accurately (4 vs 5% errors), both Fs ~ 2.0, when the first concepts were marked with the indefinite *this* than when the first concepts were marked with the indefinite *a/an*. These data replicate our first experiment; however, they also demonstrate that the indefinite *this* is considerably more subtle than the more salient cataphoric device of spoken stress.

Next, we can examine the data that test the hypothesis that the cataphoric device, the indefinite *this*, protects its concepts from being suppressed by subsequently mentioned concepts. As the unfilled squares in Fig. 3 illustrate, when the first concepts were introduced with the indefinite *a/an* they were greatly affected by the introduction of second concepts: Subjects' average reaction times to the test words representing the first concepts increased from 1016 to 1099 ms, $minF'(1,84) = 13.71$, $p < .001$, and their average error rate increased from 5 to 9%, $minF'(1,111) = 9.510$, $p < .005$. These data also replicate those of Experiment 1B and Experiment 2 and suggest that concepts that are not marked by a cataphoric device are greatly affected by the introduction of a second concept.

In contrast, as the filled squares in Fig. 3 illustrate, when the first concepts were marked by the indefinite *this*, they were less affected by the introduction of second concepts: Subjects' average reaction times to

test words representing the first concepts increased only from 968 to 1011 ms, $minF'(1,95) = 2.607$, and the subjects' average error rate increased only from 4 to 6%, $minF'(1,107) = 1.809$. This difference between how much the introduction of second concepts affected the activation of indefinite *this*- versus indefinite *a/an*-marked first concepts was manifested in a marginally reliable interaction for subjects' reaction times, $F_1(1,103) = 3.50$, $p < .05$, $F_2(1,47) = 2.17$, and a reliable interaction for subjects' error rates, $minF'(1,128) = 3.871$, $p < .05$.

Thus, our third experiment supported two hypotheses about how concepts marked by the indefinite *this* gain a privileged status in the structures that listeners build during discourse comprehension: The cataphoric device, the indefinite *this*, enhances its concepts' activation, and the cataphoric device, the indefinite *this*, better protects the concepts it marks from being suppressed by subsequently mentioned concepts.

EXPERIMENT 4

The experiments we have reported thus far support our three hypotheses about how concepts marked by both spoken stress and the indefinite *this* achieve a privileged status in listeners' mental representations. These experiments also demonstrate the important role that the mechanisms of enhancement and suppression play in language comprehension. Although the notion of enhancement of activation is widely utilized in models of language comprehension, the notion of suppression is less widely appreciated. We envision suppression as an active dampening of activation. In addition to its role in cataphoric access, suppression plays vital roles in other language comprehension phenomena. During anaphoric access, suppression dampens the activation of concepts not referred to by the anaphoric device (Gernsbacher, 1989; MacDonald & MacWhinney, 1990). During word understanding, suppression dampens the activation of contextually inappropriate meanings (e.g., the playing card meaning of the word *spade* in the sentence, "He dug in the garden with the *spade*," Gernsbacher, 1993; Gernsbacher & Faust, 1991a, 1991b, 1994). During metaphor comprehension, suppression dampens the activation of the literal meaning of the metaphorical expression (Keysar, 1994). Indeed, suppression plays such a fundamental role in comprehension, that comprehension skill is marked by efficient suppression (Gernsbacher, 1993; Gernsbacher & Faust, 1991a; Gernsbacher et al., 1990).

However, the effects that we have attributed to the mechanisms of enhancement and suppression might arise from a different mechanism. For instance, we concluded that Experiment 1A supported the hypothesis that cataphoric devices trigger processing signals that enhance the activation of their concepts; we concluded that Experiment 1B supported the hypothesis that cataphoric devices trigger processing signals that sup-

press the activation of other, previously mentioned concepts; and we concluded that Experiments 2 and 3 supported the hypothesis that cataphoric devices make their concepts more resistant to being suppressed. Perhaps those results were not due to the mechanisms of suppression and enhancement; perhaps instead they arose from a mechanism we shall refer to as *competitive inhibition*.

In competitive inhibition, mental representations compete for a fixed amount of activation. If one concept increases in activation, the other concept must decrease. Like a seesaw, when one concept's activation goes up, the other must come down. According to a competitive inhibition explanation, a concept not marked by a cataphoric device might lose activation following the introduction of a concept that is marked by a cataphoric device—not because the cataphoric device triggers processing signals to suppress the previously mentioned and unmarked concept—but because the two concepts compete for a fixed amount of activation. According to this explanation, if a concept marked by a cataphoric device becomes more activated, less activation is available for the concept not marked by a cataphoric device.

We ruled out this explanation in our last experiment. We manipulated whether two concepts were marked by the cataphoric device, spoken stress, or only one concept was. Each of our 48 experimental narratives occurred in four versions, as illustrated in Table 4. In two versions, illustrated by the top two examples in Table 4, only the second concepts were stressed. In one of these two versions, we measured activation of the first concepts (the unstressed concepts); in the other version, we measured activation of the second concepts (the stressed concepts). In both versions, we measured activation after the second concepts' filler phrases. We predicted that the second concepts would be more activated than the first concepts, for two reasons. First, because the second concepts were marked by the cataphoric device, spoken stress, the cataphoric device should have triggered processing signals to enhance the activation of the second concepts (as Experiments 1A and 2 demonstrated). Second, also because the second concepts were marked by the cataphoric device, spoken stress, the cataphoric device should have triggered processing signals to suppress the activation of the first concepts (as Experiment 1B suggested).

The bottom two examples in Table 4 illustrate the other two versions we presented in Experiment 4. In both versions, both the first and second concepts were marked by the cataphoric device, spoken stress. In one version, we measured activation of the first concepts; in the other version, we measured activation of the second concepts. As in all four versions, we measured activation after the second concepts' filler phrases.

If the effects that we have attributed to the mechanisms of suppression

and enhancement arose instead because the two concepts were competing for a fixed amount of activation, then the second concepts should have been more activated when they alone were stressed (as in the second example) than when both the first and second concepts were stressed (as in the fourth example). In contrast, if the effects we have observed in our previous experiments were not due to two concepts competing for a fixed amount of activation, then when both the first and second concepts were marked by spoken stress (as in the fourth example), both concepts should have been more activated, for two reasons. First, because both concepts were marked by the cataphoric device, spoken stress, the cataphoric device should have triggered processing signals to enhance both concepts' activation (as Experiments 1A and 2 demonstrated). Second, even though the cataphoric device marking the second concept would also trigger processing signals to suppress the previously mentioned concept (i.e., the first concept, as Experiment 1B demonstrated), the cataphoric device should also protect the previously mentioned, first concept from being suppressed by the subsequently mentioned, second concept (as Experiment 2 demonstrated).

Method

The four versions of our 48 experimental narratives were produced by crossing two spoken versions of the narratives with two sets of test words. For example, the four versions illustrated in Table 4 are two spoken versions (illustrated by the first and third example) crossed with two test words (ashtray and vase). The two spoken versions of each narrative comprised (1) a version in which only the second concept was stressed (as illustrated by the first and second examples) and (2) a version in which both the first and second concepts were stressed (as illustrated by the third and fourth examples). The test word for each experimental narrative represented either the first or second concept.

We constructed the two spoken versions in the following way. We began with a segment of each narrative that included the first experimental concept and its filler phrase. These initial segments were taken from the original recordings. Half the time we used the initial segment in which the first experimental concept was stressed (when recorded), and half the time we used the initial segment in which the first experimental concept was unstressed (when recorded). We excised the acoustic signal corresponding to the first experimental concept and made two copies of each initial segment. Into one copy we spliced a copy of the acoustic signal corresponding to the first experimental concept when it was stressed, and into the other copy we spliced a copy of the acoustic signal corresponding to the first experimental concept when it was not stressed. In this way, the same number of initial segments that originally contained stressed versus unstressed first concepts were used to make the experimental versions that presented stressed first concepts, and the same number of initial segments that originally contained stressed versus unstressed first concepts were used to make the experimental versions that presented unstressed first concepts.

Next, we constructed a second segment for each narrative, which included the second experimental concept and its filler phrase. These second segments were taken from the original recordings, and all were originally recorded with the second experimental concept stressed. Before making two copies of each second segment, we marked the offset of the second concepts' filler phrase with a 5.5 KHz tone. After we appended these second seg-

ments to each first segment, we appended a third segment. To the version in which only the second experimental concept was stressed, we appended a third segment in which the speaker continued talking about the second experimental concept; to the version in which both the first and second experimental concepts were stressed, we appended a third segment in which the speaker continued talking about both the first and second experimental concepts.

We also modified half of our lure narratives so that they contained two stressed concepts (although neither concept was represented by the lure narrative's test word). We recorded two experimental tapes. On each tape, each experimental narrative occurred in only one of its two experimental versions, and an equal number of narratives occurred in each of the two experimental conditions. Furthermore, on each tape an equal number of narratives within each of the two experimental conditions had been originally produced with the first experimental concept stressed as with the first experimental concept unstressed. We created the two lists of test words by randomly selecting either the first or second concept as the test word. Each list of test words contained an equal number of test words representing the first versus second concepts. Twenty subjects were randomly assigned to a combination of one of the two tapes and one of the two lists of test words. In this way, each subject listened to only one version of each narrative and saw only one test word per narrative.

Results

If the effects that we have attributed to the mechanism of suppression are instead due to competitive inhibition, then the second concepts should have been more activated when they alone were stressed than when both the first and second concepts were stressed. Figure 4 presents the subjects' responses to test words representing the first and second concepts. The bars illustrate subjects' reaction times, and the squares illustrate their average error rates. The left panel presents subjects' responses to the first and second concepts when only the second concepts were stressed; the right panel presents subjects' responses to the first and second concepts when both the first and second concepts were stressed. All responses

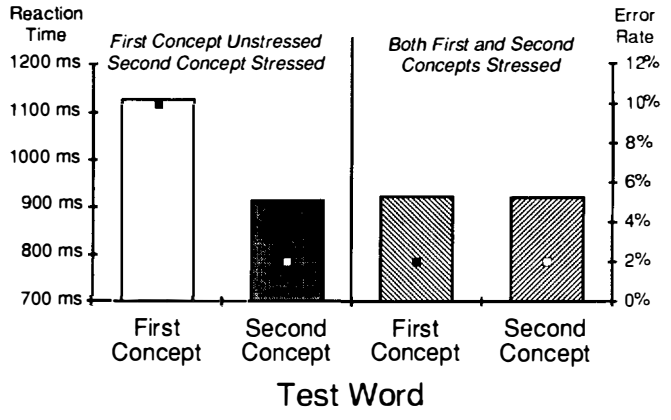

FIG. 4. Subjects' average reaction times and error rates from Experiment 4.

were measured after the second concepts were introduced (literally, after their filler phrases).

First, we can examine what happened when only the second concepts were stressed, as illustrated by the left panel of Fig. 4. When only the second concepts were stressed, the test words representing the second concepts were responded to more rapidly (912 vs 1127 ms), $minF'(1,93) = 80.99$, $p < .0001$, and more accurately (2 vs 10% errors), $minF'(1,103) = 25.20$, $p < .0001$. Next, we can examine what happened when both the first and second concepts were stressed, as illustrated by the right panel of Fig. 4. When both the first and second concepts were stressed, the test words representing both the first and second concepts were responded to equally rapidly (921 vs 919 ms) and equally accurately (2% errors for both conditions), all Fs < 1. Furthermore, the test words referring to the second concepts were responded to just as rapidly and just as accurately when the second concepts were the only concepts that were stressed as when both they and the first concepts were stressed, all Fs < 1. These data argue against a competitive inhibition explanation of the effects we have attributed to suppression. One concept does not decrease in activation just because another one increases. Two concepts can be activated at the same (enhanced) level. Therefore, we suggest that the decreases in activation, which we observed in our previous experiments, were caused by the mechanism of suppression, not competitive inhibition.[6]

CONCLUSIONS

This series of experiments demonstrated three ways that concepts marked by cataphoric devices, such as spoken stress and the indefinite *this*, gain a privileged status in listeners' mental representations: Cataphoric devices enhance the activation of the concepts that they mark; cataphoric devices suppress the activation of previously mentioned concepts; and cataphoric devices protect the concepts that they mark from being suppressed by subsequently mentioned concepts.

[6] It is possible that only two stressed concepts fail to exceed this fixed amount of activation. But if two stressed concepts do not exceed the limits, then a competitive inhibition explanation of the results of Experiments 1B and 2 is untenable. In Experiments 1B and 2, only one concept was stressed; according to a competitive inhibition explanation, that single stressed concept's greater activation is what "stole" activation from another unstressed concept. But as Experiment 4 demonstrates, one stressed concept does not steal activation from another stressed concept. An explanation similar to the competitive inhibition account is one based in attentional terms. According to this explanation, attention is attracted to the stressed concept, leaving less attention for the unstressed concept. In other words, the stressed concept interferes with the unstressed concept. But for the same reasons that an activation-capacity limitations explanation cannot account for the results of Experiments 1B and 2, an attentional-capacity limitations explanation cannot account for those results.

As we mentioned in our introduction, we specifically chose the verification task for our experiments because we believe it is one of the most direct ways to measure how activated concepts are in subjects' mental representations. In Ratcliff's (1978) terms, our test words served as "tuning forks" and our subjects' verification latencies and accuracies indexed the strength of the resonance that the tuning forks evoked. Similarly, in Hintzman's (1988) terms, our test words served as probes, and our subjects' verification latencies and accuracies indexed the strength of the "echoes" that these probes evoked. However, as we also mentioned in our introduction, the "echoes" and "resonance" that we elicited with our test word "probes" reflected a gradient of how activated the concepts were in our subjects' mental representations, rather than only the existence of those concepts in our subjects' mental representations. Just as subjects verify the test word **bread** more rapidly and accurately after reading that, "Almost every weekend, Elizabeth bakes *some* bread," than after reading that, "Almost every weekend, Elizabeth bakes *no* bread," and just as subjects verify the test word **sweatshirt** more rapidly and accurately after reading that, "John *put on* his sweatshirt and jogged halfway around the lake," than after reading that, "John *took off* his sweatshirt and jogged halfway around the lake," our subjects verified the test word **ashtray** more rapidly after hearing that, "Vicky wanted to buy *this* ashtray," than after hearing that, "Vicky wanted to buy *an* ashtray."

We also chose to use as test words the names of our experimental concepts, rather than the names of concepts that—independently of the context of the narrative—might be associatively related to the experimental concepts. For example, in the narrative about Vicky wanting to buy an ashtray at a garage sale, we presented **ashtray** as a test word, rather than **cigarette**. Because we assume that the function of cataphoric devices is to enable listeners to access cataphorically-marked concepts more easily when speakers re-mention those concepts in subsequent discourse, we wanted to assess the activation level of the cataphorically marked concepts—not their semantic associates.

Indeed, we do not propose that the processing signals that cataphoric devices trigger also enhance the activation of concepts that are associatively related to the cataphorically marked concepts, unless those associations are relevant to the discourse. This proposal is supported by three separate studies. First, although MacDonald and Just (1989) observed that verification (and naming) latencies to test words like **bread** were affected by whether the concepts represented by those test words had been negated, naming latencies to associates of those concepts, for example, **butter**, were unaffected. Similarly, although we observed that verification latencies to test words like **ashtray** were affected by whether the

concepts represented by those test words had been marked by spoken stress, Marron (1991), who conducted an experiment in our lab using the same materials as we used in Experiment 1A, observed that lexical decisions to test words that were semantic associates of our experimental concepts, for example, **cigarette,** were unaffected.

Most recently, Birch and Garnsey (1995) observed that verification latencies to test words like **lion** were affected by whether the concepts represented by those test words had been syntactically marked by an it-cleft construction (e.g., "It was the lion that stole the show at the circus this year"). However, Birch and Garnsey (1995) also observed that verification latencies to test words that were semantic associates of the syntactically marked concepts, for example, **tiger,** were unaffected. All of these null results make sense: It was the lion, not a tiger, that stole the show; it was bread, not butter, that Elizabeth baked; and it was an ashtray, not a cigarette, that Vicky wanted to buy at the garage sale.

As the Birch and Garnsey (1995) study suggests, other devices, besides spoken stress and the indefinite *this,* might operate as cataphoric devices. Birch and Garnsey's (1995) study suggests that syntactic focusing constructions such as the it-cleft construction, illustrated above, or there-insertion (e.g., "There was this needle on the floor just waiting to be stepped on"), might operate as a cataphoric device. Similarly, McKoon et al. (1993) demonstrated that placing an adjective, such as "demanding," in a predicate position (e.g., "George's critical boss is *demanding*") rather than a prenominal position (e.g., "George's *demanding* boss is critical") facilitated verification times for the test word, **demanding.** Perhaps these syntactic constructions (it-cleft, there-insertion, and predicate-raising) also operate as cataphoric devices.

As a final possibility, we have noticed speakers of colloquial English using a rising intonation to introduce certain concepts. Rising intonation typically marks questions, not statements. But recently we have heard undergraduates say things such as, "So, y'know what? I have a pro^{fessor}, 'n he . . ." where *professor* is spoken in the same intonation as it would be in the question, "Have you ever seen my professor?" Perhaps the rising intonation operates as a cataphoric device.

The present research demonstrated that cataphoric devices vary in how powerfully they improve their concepts' accessibility. Spoken stress operates more powerfully than the indefinite *this*. This variation among cataphoric devices parallels a variation among anaphoric devices. Some anaphoric devices trigger processing signals that powerfully enhance their antecedents' activation and suppress other concepts' activation; other anaphoric devices trigger processing signals that only slightly enhance their antecedents' activation and suppress other concepts' activation.

More marked forms of anaphora, such as repeated proper names, trigger the most powerful processing signals; less marked forms, such as zero anaphora (as in "John went to the store and Ø bought a quart of milk"), trigger the least powerful processing signals (Gernsbacher, 1989).

In a similar way, how powerfully a cataphoric device triggers processing signals appears to be a function of markedness: More marked cataphoric devices trigger more powerful processing signals. Of the two cataphoric devices we explored here, spoken stress is clearly more marked. Indeed, spoken stress is relatively iconic. To emphasize a concept when we draw it, we can amplify our drawing by drawing the object larger. To emphasize a concept when we write its name, we can amplify our script by writing the word larger or with a darker or bolder print. If we are unable to increase the word's written size or its darkness, we can underline or italicize it. In these ways we can iconically mark the word as special. Spoken stress does the same thing; it literally amplifies the word. The indefinite *this* also marks concepts, but it does so less iconically and considerably more subtly. And in relation to spoken stress, the indefinite *this* less powerfully triggers processing signals to improve its concept's accessibility. So, the present research demonstrates a relation between the markedness of cataphoric devices and their effect on accessibility.

How consciously do speakers use cataphoric devices? We share Clark's perspective that spoken communication involves collaboration; speakers and listeners actively collaborate to arrive at a shared meaning (Clark & Schaefer, 1987; Clark & Wilkes-Gibbs, 1986). But whether speakers consciously select and use cataphoric devices as a collaborative strategy is unclear. Also unclear is whether listeners are consciously aware of speakers' use of cataphoric devices. While we often feel aware of speakers' use of spoken stress, speakers' use of indefinite *this* typically goes unnoticed. Nevertheless, in the experiments we have reported here, we have demonstrated that both cataphoric devices, spoken stress and the indefinite *this*, affect listeners' mental representations: Both devices improve their concepts' accessibility.

REFERENCES

Bock, K. J., & Mazzella, J. R. (1983). Intonational marking of given and new information: Some consequences for comprehension. *Memory & Cognition*, 11, 64–76.

Birch, S. L., & Garnsey, S. M. (1995). The effect of focus on memory for words in sentences. *Journal of Memory and Language*, 34, 232–267.

Bolinger, D. L. (1972). Accent is predictable (if you're a mind-reader). *Language*, 48, 633–644.

Brown, G. (1983). Prosodic structure and the given/new distinction. In A. Cutler & D. R. Ladd (Eds.), *Prosody: Models and measurements* (pp. 67–77). New York: Springer-Verlag.

Carrieras, M. C., Gernsbacher, M. A., & Villa, V. (1995). The advantage of first mention in Spanish. *Psychonomic Bulletin and Review*, 2, 124–129.

Clark, H. H., & Schaefer, E. F. (1987). Collaborating on contributions to conversation. *Language and Cognitive Processes,* **2,** 19–41.

Clark, H. H., & Wilkes-Gibbs, D. (1986). Referring as a collaborative process. *Cognition,* **22,** 1–39.

Corbett, A. T., & Chang, F. R. (1983). Pronoun disambiguation: Accessing potential antecedents. *Memory & Cognition,* **11,** 283–294.

Cruttenden, A. (1986). *Intonation.* Cambridge: Cambridge Univ. Press.

Cutler, A. (1976). Phoneme-monitoring reaction time as a function of preceding intonation contour. *Perception & Psychophysics,* **20,** 55–60.

Cutler, A., & Fodor, J. A. (1979). Semantic focus and sentence comprehension. *Cognition,* **7,** 49–59.

Deaton, J. A., & Gernsbacher, M. A. (in press). Causal conjunctions and implicit causality cue mapping in sentence comprehension. *Journal of Memory and Language.*

Dell, G. S., McKoon, G., & Ratcliff, R. (1983). The activation of antecedent information during the processing of anaphoric reference in reading. *Journal of Verbal Learning and Verbal Behavior,* **22,** 121–132.

Faust, M. E., & Gernsbacher, M. A. (in press). Cerebral mechanisms for suppression of inappropriate information during sentence comprehension. *Brain and Language.*

Foertsch, J., & Gernsbacher, M. A. (1994). In search of complete comprehension: Getting "minimalists" to work. *Discourse Processes,* **18,** 271–296.

Fry, D. B. (1955). Duration and intensity as physical correlates of linguistic stress. *Journal of the Acoustic Society of America,* **27,** 765–769.

Gay, T. (1978). Physiological and acoustic correlates of perceived stress. *Language and Speech,* **21,** 347–353.

Gernsbacher, M. A. (1985). Surface information loss in comprehension. *Cognitive Psychology,* **17,** 324–363.

Gernsbacher, M. A. (1989). Mechanisms that improve referential access. *Cognition,* **32,** 99–156.

Gernsbacher, M. A. (1990). *Language comprehension as structure building.* Hillsdale, NJ: Erlbaum.

Gernsbacher, M. A. (1991). Cognitive processes and mechanisms in language comprehension: The structure building framework. In G. H. Bower (Ed.), *The psychology of learning and motivation* (pp. 217–263). New York: Academic Press.

Gernsbacher, M. A. (1993). Less skilled readers have less efficient suppression mechanisms. *Psychological Science,* **4,** 294–298.

Gernsbacher, M. A. (in press). Coherence cues mapping during comprehension. In J. Costermans & M. Fayol (Eds.), *Processing interclausal relationships in the production and comprehension of text.* Hillsdale, NJ: Erlbaum.

Gernsbacher, M. A., & Faust, M. (1991a). The mechanism of suppression: A component of general comprehension skill. *Journal of Experimental Psychology: Learning, Memory, and Cognition,* **17,** 245–262.

Gernsbacher, M. A., & Faust, M. (1991b). The role of suppression in sentence comprehension. In G. B. Simpson (Ed.), *Comprehending word and sentence* (pp. 97–128). Amsterdam: North Holland.

Gernsbacher, M. A., & Faust, M. (1994). Skilled suppression. In F. N. Dempster & C. N. Brainerd (Eds.), *Interference and inhibition in cognition* (pp. 295–327). San Diego, CA: Academic Press.

Gernsbacher, M. A., & Hargreaves, D. (1988). Accessing sentence participants: The advantage of first mention. *Journal of Memory and Language* **27,** 699–717.

Gernsbacher, M. A., & Hargreaves, D. (1992). The privilege of primacy: Experimental data

and cognitive explanations. In D. L. Payne (Ed.), *Pragmatics of word order flexibility* (pp. 83–116). Philadelphia: John Benjamins.

Gernsbacher, M. A., Hargreaves, D., & Beeman, M. (1989). Building and accessing clausal representations: The advantage of first mention versus the advantage of clause recency. *Journal of Memory and Language*, **28**, 735–755.

Gernsbacher, M. A., & Robertson, R. R. W. (1992). Knowledge activation versus sentence mapping when representing fictional characters' emotional states. *Language and Cognitive Processes*, **7**, 353–371.

Gernsbacher, M. A., & Shroyer, S. (1989). The cataphoric use of the indefinite *this* in spoken narratives. *Memory & Cognition*, **17**, 536–540.

Gernsbacher, M. A., Varner, K. R., & Faust, M. (1990). Investigating differences in general comprehension skill. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **16**, 430–445.

Glenberg, A., Meyer, M., & Lindem, K. (1987). Mental models contribute to foregrounding during text comprehension. *Journal of Memory and Language*, **26**, 69–83.

Hintzman, D. L. (1988). Judgments of frequency and recognition memory in a multiple-trace memory model. *Psychological Review*, **95**, 528–551.

Keysar, B. (1994). Contextual effects on metaphorical and literal interpretations in discourse. *Discourse Processes*, **18**, 247–269.

Levelt, W. J. M. (1989). *Speaking. From intention to articulation*. Cambridge, MA: MIT Press.

Lieberman, P. (1960). Some acoustic correlates of word stress in American English. *Journal of the Acoustic Society of America*, **32**, 451–454.

MacDonald, M. C., & Just, M. A. (1989). Changes in activation levels with negation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **15**, 633–642.

MacDonald, M. C., & MacWhinney, B. (1990). Measuring inhibition and facilitation from pronouns. *Journal of Memory and Language*, **29**, 469–492.

MacWhinney, B., & Bates, E. (1978). Sentential devices for conveying givenness and newness: A cross-cultural developmental study. *Journal of Verbal Learning and Verbal Behavior*, **17**, 539–558.

Marron, M. A. (1991). *Exploring the limits of spoken stress*. Unpublished senior honors thesis. University of Oregon, Eugene, OR.

McKoon, G., & Ratcliff, R. (1980). The comprehension processes and memory structures involved in anaphoric reference. *Journal of Verbal Learning and Verbal Behavior*, **19**, 668–682.

McKoon, G., Ratcliff, R., Ward, G., & Sproat, R. (1993). Syntactic prominence effects on discourse processing. *Journal of Memory and Language*, **32**, 593–607.

O'Brien, E. J., Duffy, S. A., & Myers, J. L. (1986). Anaphoric inference during reading. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, **12**, 346–352.

Prince, E. F. (1981). On inferencing of the indefinite-this NPs. In A. Joshi, B. Webber, & I. Sag (Ed.), *Elements of discourse understanding* (pp. 231–250). Cambridge: Cambridge University Press.

Quirk, R., & Greenbaum, S. (1978). *A concise grammar of contemporary English*. New York: Harcourt Brace Jovanovich.

Ratcliff, R. (1978). A theory of memory retrieval. *Psychological Review*, **85**, 59–108.

Ratcliff, R., Hockley, W. E., & McKoon, G. (1985). Components of activation: Repetition and priming effects in lexical decision and recognition. *Journal of Experimental Psychology: General*, **114**, 435–450.

Schober, M. F., & Clark, H. H. (1989). Understanding by addressees and overhearers. *Cognitive Psychology*, **21**, 211–232.

Terkel, S. (1974). *Working*. New York: Avon.

Terken, J., & Nooteboom, S. G. (1987). Opposite effects of accentuation and deaccentuation on verification latencies for given and new information. *Language and Cognitive Processes,* **2,** 145–163.

Wald, B. (1983). Referents and topics within and across discourse units: Observations from current vernacular English. In S. Klen-Andrew (Ed.), *Discourse perspectives on syntax* (pp. 91–116). New York: Academic Press.

Wright, S., & Givón, T. (1987). The pragmatics of indefinite reference: Quantified text-based studies. *Studies in Language,* **11,** 1–33.

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