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Managing Mental Representations During Narrative Comprehension

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Three experiments investigated how readers manage their mental representations during narrative comprehension. The first experiment investigated whether readers' access to their mental representations of the main character in a narrative becomes enhanced (producing a "benefit") when the character is rementioned; the first experiment also investigated whether readers' access to the main character in a narrative becomes weakened or interfered with (producing a "cost") when a new character is introduced. The purpose of the second experiment was to ensure that there was nothing unusually salient about the accessibility of names; thus, we assessed readers' access to an object associated with the main character rather than the character's name. Again, readers demonstrated increased accessibility to the main character when it was rementioned in the narrative, and readers demonstrated reduced accessibility to the main character when a new character was introduced. A third experiment com-

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pared more-skilled and less-skilled readers' abilities to manage these mental representations during narrative comprehension. Findings were consistent with research suggesting that more-skilled readers are more skilled at attenuating interfering information (i.e., suppression). Data from all 3 experiments suggest that successful narrative comprehension involves managing mental representations of salient and often times interfering characters.

To successfully read and comprehend a story, readers must keep track of narrative details: Who is the main character? What does he or she look like? What is his or her role in the story? and so on. Moreover, most narratives are complex: they usually contain more than 1 episode, and more than one character participates in the events. The task of keeping track of an infinite number of characters, mannerisms, places, plots, and subplots seems daunting, yet most readers succeed effortlessly. How do readers accomplish this feat with relatively little exertion?

According to the Structure Building Framework (Gernsbacher, 1990, 1995, 1997b), comprehenders use two general cognitive processes to build mental representations (structures) of texts such as narratives. These two processes are mapping and *shifting*. Through the process of mapping, comprehenders build mental structures by mapping related information onto their representations of previously comprehended information. However, if the incoming information is less related, a comprehender will shift to build a new substructure. These two cognitive processes, mapping and shifting, are enabled by two cognitive mechanisms: enhancement and suppression. Enhancement and suppression contribute to building mental representations by modulating the activation of concepts; *enhancement* increases the activation of relevant concepts, and *suppression* decreases the activation of concepts deemed less relevant (Gernsbacher, 1991; Gernsbacher & Faust, 1991a, 1991b). In this article we shall demonstrate how these general cognitive processes and mechanisms allow comprehenders to keep track of who is doing what to whom when comprehending a narrative.

Intuition suggests that the more often a character is mentioned in a narrative, the more accessible that character will become. We shall present data in this article that support this intuition. Perhaps less intuitive is the prediction that when a new character is introduced in a narrative, comprehenders' mental access to a previously introduced character is weakened. Some data already support this prediction, indirectly. Dell, McKoon, and Ratcliff (1983) presented four-sentence texts; the first three following sentences are examples of the first three sentences of one of their texts:

A burglar surveyed the garage set back from the street.
Several milk bottles were piled at the curb.
The banker and her husband were on vacation.

Dell and colleagues (1983) manipulated the final, fourth sentence. In one condition, the character introduced in the first sentence (e.g., *a burglar)* was rementioned anaphorically in the fourth sentence, as in,

The criminal slipped away from the street lamp.

In another condition, the character introduced in the first sentence was not rementioned in the fourth sentence. The fourth sentences in this 'no remention' condition shared the same predicate as the fourth sentences in the 'remention' condition (e.g., *The criminal slipped away from the street lamp),* for example,

A cat slipped away from the street lamp.

One way to conceptualize this experimental design is that the main character (always introduced in the first sentence) was rementioned in one condition, but in the other condition (what Dell et al., 1983 considered the 'no anaphor' condition) a new character (e.g., *a cat)* was introduced. According to the Structure Building Framework, introducing a new character would be an instance when the incoming information is less related to the previous information, and the comprehender should shift to build a new substructure. After comprehenders have shifted to develop a new substructure, information represented in the previous substructure is less accessible. Therefore, the Structure Building Framework predicts that introducing a new character would interfere with comprehenders' access to a previously mentioned character. The data by Dell and colleagues supported this prediction.

Dell and colleagues (1983) measured accessibility of the main character using a probe verification task: Participants were shown a probe word and asked to verify rapidly and accurately whether the word had occurred in the text that they were currently reading. On experimental trials, the probe word was the name of the main character. In one experiment, Dell and colleagues presented the probe words at two points in the fourth sentence, illustrated by the following asterisk and caret.

*The *criminal slipped away from the ^street lamp.*
*A*cat slipped away from the^street lamp.*

The asterisk marks an early test point, before either the main character was rementioned anaphorically or a new character was introduced. The caret marks a late test point, a few words downstream after either the main character was rementioned anaphorically or a new character was introduced. Verification latencies for the main character (e.g., *burglar)* did not differ at the early test point; at the late test point, verification latencies were slower when a new character was introduced. These data could be interpreted as demonstrating that rementioning a character (even anaphorically) improves its accessibility in readers' mental representa-

tions. Or these data could be interpreted as demonstrating that introducing a new character interferes with the accessibility of a previously introduced character. Without a neutral baseline, we cannot be sure whether this effect is a benefit—for rementioning a main character—or a cost—for introducing a new character (cf. Long & de Ley, 2000; Nordlie, Dopkins, & Johnson, 2001). One of the main goals of the research presented here was to provide such a neutral condition and tease apart these two interpretations.

Similarly, data from Gernsbacher (1989), using single sentences, are somewhat ambiguous about whether rementioning a main character leads to a benefit (the main character is more accessible in comprehenders' mental representations) and introducing a new character leads to a cost (the main character is less accessible in comprehenders' mental representations). In Gernsbacher's (1989) experiment, participants read sentences such as,

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

in which a main character *(Bill)* was rementioned. Or they read sentences such as,

Bill handed John some tickets to a concert but Mark took the tickets back immediately,

in which a new character *(Mark)* was introduced. Verification latencies to the main character before versus after the main character was rementioned or the new character was introduced, showed faster verification latencies when the main character was rementioned and hence, slower verification latencies when a new character was introduced. As with the study by Dell and colleagues (1983) we need a neutral condition to allow us to determine whether rementioning a main character leads to a benefit (the main character is more accessible in comprehenders' mental representations) and introducing a new character leads to a cost (the main character is less accessible in comprehenders' mental representations).

We report three experiments here. In all three experiments, we presented participants with a set of narratives; each narrative comprised three paragraphs. In the first paragraph of all of the experimental narratives, one main character was introduced, for example:

Grant checked the control panels of the spacecraft. All the systems were ready. Grant, in his red and white shiny suit, coordinating boots, and special receiver medallion, was equally ready for this next mission of discovery. Just as the spacecraft crossed the border into a new universe, the red light of danger started to flash on the control panel, and the alarm began to scream.

We manipulated three versions of the second paragraph. In one version, the main character from the first paragraph was rementioned in the second paragraph, for example:

Grant, being the well-trained and organized leader, remained calm and began searching the database for information. There was clearly another spaceship within a few light-years away. Grant prepared the computer system to initiate communication with the foreign beings.

In a second version, the main character from the first paragraph was not rementioned in the second paragraph; instead, a new character was introduced in the second paragraph, for example:

Alexa, being the well-trained and organized leader, remained calm and began searching the database for information. There was clearly another spaceship within a few light-years away. Alexa prepared the computer system to initiate communication with the foreign beings.

In a third version, neither the main character from the first paragraph was rementioned, nor was a new character introduced in the second paragraph, for example:

It was necessary to remain calm and begin searching the database for information. There was clearly another spaceship within a few light-years away. The next step was to prepare the computer system to initialize communication with the foreign beings.

Then, all the narratives concluded with a final paragraph, which was not manipulated across versions and served simply to wrap up the narrative.

We used a probe verification task to assess the accessibility of the main character at two experimental test points: immediately after the first paragraph (the paragraph that introduced the main character), and immediately after the second paragraph (the paragraph that rementioned the main character, introduced a new character, or did neither). By measuring participants' speed and accuracy to verify the main character's name (as having occurred in the narrative) at the two test points, we could assess any change in accessibility of the main character. Across all three conditions, we could assess whether any change in accessibility was a benefit (the main character became more accessible in comprehenders' mental representations) or a cost (the main character became less accessible in comprehenders' mental representations), based on a neutral baseline.

In the second experiment, we wanted to rule out the possibility that any change in accessibility observed in the first experiment (costs or benefits) were at a lexical level rather than a more conceptual level. Therefore, for the second experiment we

used as a probe word for the experimental narratives the name of an object that had been associated with the main character rather than the main character's name. In a third experiment, we investigated whether individual differences in comprehension skill influences the way comprehenders manage their mental representations.

EXPERIMENT 1

This first experiment examined how readers keep track of who is doing what to whom while reading a narrative. We expected a boost in accessibility when the main character was rementioned and a decrease in accessibility when a new character was introduced.

Method

Participants. Eighty undergraduates at the University of Wisconsin–Madison participated to earn extra-credit in an introductory psychology course. In all experiments reported here, participants were native American English speakers, and none participated in more than one experiment.

Materials and Procedure. Thirty-two experimental narratives were constructed, each containing three paragraphs. In the first paragraph, a main character was introduced in the first sentence and rementioned in the third sentence. The second and fourth sentences of the first paragraph made no mention of any character. The second paragraph was manipulated in three ways: In what we shall refer to as the *Remention* condition, the main character was rementioned in the first sentence of the second paragraph. In what we shall refer to as the *New* condition, a new character was introduced in the first sentence of the second paragraph. In what we shall refer to as the *Neither* condition, neither the main character was rementioned nor a new character was introduced in the first sentence of the second paragraph.

The characters' names were typical, American first names commonly ascribed to only one gender (e.g., names such as "Pat" were avoided). In each narrative the main character's and the new character's names were matched for perceived familiarity and length in letters and were opposite in gender. Of the experimental main characters, 16 were men and 16 were women.

We used a verification task to assess participants' access to the main character. Within the three paragraph narratives, participants were required to verify whether several probe words, each presented at a various point, had occurred in the narrative they were currently reading. Participants pressed a key labeled "Yes" or a key labeled "No" to indicate their response.

To balance the number of "yes" and "no" responses and the pattern of "yes" and "no" responses within each narrative, 16 filler narratives were created. Experimental and filler narratives were presented in a randomized fixed order. In addition, in each experimental narrative a filler test point was included at the end to avoid a predictable pattern of "yes" and "no" responses and to increase the number of "no" responses without increasing the number of narratives. An example experimental narrative along with its probe words is shown in Table 1.

Four material sets were formed. Across materials, each experimental narrative occurred an equal number of times in all four of its experimental conditions: *before*, when the main character's name was tested before the beginning of the second paragraph; and *remention*, *new*, and *neither*, when the main character's name was tested just after the second paragraph. Twenty participants were randomly assigned to each material set; thus, each participant was exposed to an experimental narrative in only one of its conditions.

Participants read instructions from a computer screen, which told them that the experiment involved reading several short narratives, and that their task was to read each narrative at a natural reading rate. To encourage general comprehension, after 12 of the narratives, participants were asked to write, for a maximum time of 15 sec, a short, one-line continuation of the narrative. Participants didn't know while reading each narrative which narratives they would be required to continue.

TABLE 1.
Example Experimental Narrative From Experiment 1

Introduction

Grant checked the control panels of the spacecraft. All the systems were ready. Grant, in his red and white shiny suit, coordinating boots, and special receiver medallion, was equally ready for this next mission of discovery. Just as the spacecraft crossed the border into a new universe, the red light of danger started to flash on the control panel, and the alarm began to scream.

Experimental Probe Word: GRANT [for before condition]; **HEATHER** [for after condition]

Remention condition

Grant, being the well-trained and organized leader, remained calm and began searching the database for information. There was clearly another spaceship within a few light-years away. Grant prepared the computer system to initiate communication with the foreign beings.

New Condition

Alexa, being the well-trained and organized leader, remained calm and began searching the database for information. There was clearly another spaceship within a few light-years away. Alexa prepared the computer system to initiate communication with the foreign beings.

Neither Condition

It was necessary to remain calm and begin searching the database for information. There was clearly another spaceship within a few light-years away. The next step was to prepare the computer system to initialize communication with the foreign beings.

Experimental Probe Word: ALEXA [for before condition]; **GRANT** [for after condition]

Conclusion

Alexa turned on the monitor. Their hail was being answered. Hopefully, they would be cooperative. Often times they were, but there was no guarantee.

Filler Probe Word: HEATHER [for before condition]; **ALEXA** [for after condition]

The experimental session began with general instructions, which contained two practice trials. Each experimental trial began when the participant, after seeing the word "READY?" in the center of the screen and concurrently hearing the word "READY?" through headphones, pressed the "Advance" key. When participants pressed the "Advance" key, the "READY?" message disappeared. Then each paragraph of each narrative appeared in the center of the screen. Participants read each paragraph at their own pace without any time limit. Participants indicated they were finished reading each paragraph by pressing the "Advance" key. Immediately after the first, second and third paragraphs, a probe word was presented. Participants were required to decide if that probe word had occurred in the narrative, by pressing the "Yes" or "No" key. During the entire experiment, participants were required to keep the index and middle fingers of the hand that they normally write with on the "Yes" and "No" keys.

The complete set of materials for Experiment 1 is available at *http://psych.wisc.edu/lang/materials/charsupnames.html*.

Results

Response times faster than 250 ms were excluded from analysis. An accuracy criterion was established at 62% correct for each type of probe *(before, remention, new, and neither);* 13% of the participants did not reach the criterion and were replaced. Analyses of variance (ANOVA) of the probe verification data were separately conducted on verification errors and verification latency for correct responses. ANOVAs for both dependent variables compared the four different conditions: *before*, *remention*, *new*, and *neither*. Two sets of ANOVAs were conducted; one considering participants as a random effect (which we notate as *F1)* and one considering the probe words as a random effect (which we notate as *F2).*

Verification latencies. A significant main effect was observed, $F1(3, 79) = 71.84, p < .001, F2(3, 31) = 62.60, p < .001$. As shown in Figure 1, participants' verification latencies to the main character's name were faster after reading a second paragraph in which the main character was rementioned ($M = 556$, $SE = 19$) than after reading a second paragraph in which neither the main character was rementioned nor a new character was introduced ($M = 654$, $SE = 23$), $F1(1, 79) = 41.34, p < .001, F2(1, 31) = 32.13, p < .001$. Comparing the data from these two conditions (verification latencies in the remention condition and verification latencies in the neither condition) allows us to gauge a statistically significant benefit: Rementioning the main character increased its accessibility. Thus, in answer to our first experimental question we observed that a character does become *more* accessible in comprehenders' mental representations after the character is rementioned.

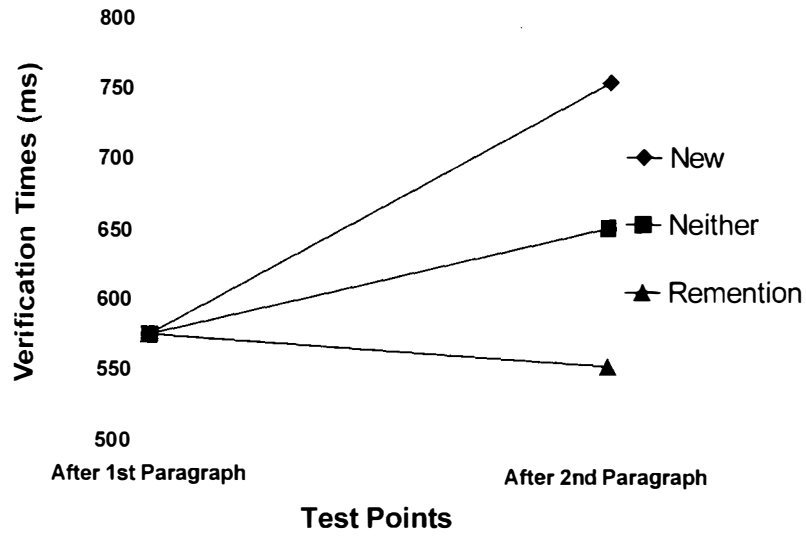

FIGURE 1 Participants' verification latencies (in ms) in Experiment 1.

Our second experimental question was whether a character becomes *less* accessible in comprehenders' mental representations after a new character is introduced. To answer this question we compared participants' verification latencies to the main character's name after reading a second paragraph in which a new character was introduced with their verification latencies to the main character's name after reading a second paragraph in which neither the main character was rementioned nor a new character was introduced. We observed that participants reaped a statistically significant cost: Introducing a new character interfered with the accessibility of an old character. As also shown in Figure 1, participants' verification latencies to the main character's name were slower after reading a second paragraph in which a new character was introduced ($M = 757$, $SE = 25$) than after reading a second paragraph in which neither the main character was rementioned nor a new character was introduced ($M = 654$, $SE = 23$), $F1(1, 79) = 45.58, p < .001, F2(1, 31) = 43.58, p < .001$. Participants' verification latencies to the main character's name were statistically equivalent before reading a second paragraph in which the main character was rementioned ($M = 575$, $SE = 22$) as after reading a second paragraph in which the main character was rementioned ($M = 556$, $SE = 19$).

Verification errors. As shown in Figure 2, the pattern from participants' verification errors was identical to that of their verification latencies. A significant main effect was observed, $F1(3, 79) = 40.36, p < .001, F2(3, 31) = 32.85, p < .001$.

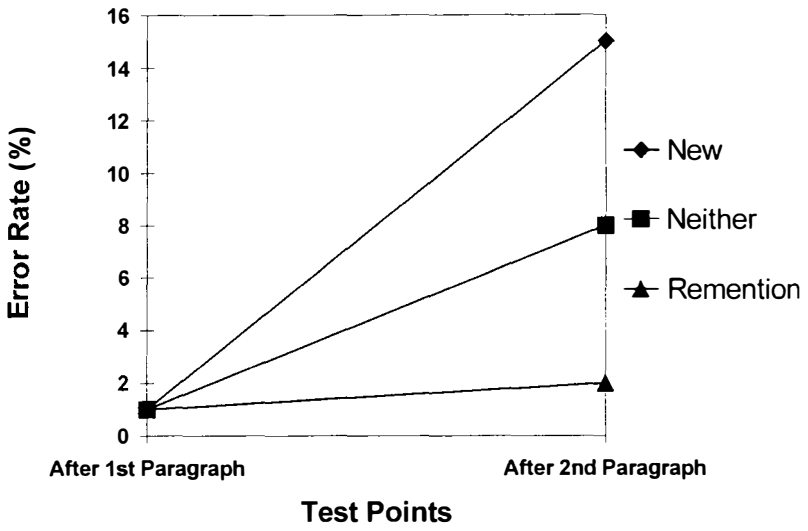

FIGURE 2 Participants' verification error rate (in percentage) in Experiment 1.

As with participants' verification latencies, participants' verification errors demonstrated a statistically significant benefit of rementioning a main character: Participants made fewer errors in verifying the main character's name after reading a second paragraph in which the main character was rementioned (M = 2%, SE = .6%) than after reading a second paragraph in which neither the main character was rementioned nor a new character was introduced (M = 8%, SE = 1.1%), $F1(1, 79) = 14.82, p < .001$, $F2(1, 31) = 12.22, p < .001$. And as with verification latencies, participants' verification errors demonstrated a statistically significant cost of introducing a new character: Participants made more errors when verifying the main character's name after reading a second paragraph in which a new character was introduced (M = 15%, SE = 1.8%) than after reading a second paragraph in which neither the main character was rementioned nor a new character was introduced (M = 8%, SE = 1.1%), $F1(1, 79) = 28.58, p < .001$, $F2(1, 31) = 23.57, p < .001$. As with verification latencies, participants' verification errors to the main character's name were statistically equivalent before reading a second paragraph in which the main character was rementioned (M = 1%, SE = .4%) as after reading a second paragraph in which the main character was rementioned (M = 2%, SE = .6%).

Discussion

The Structure Building Framework accounts for the results of Experiment 1 in the following way: When we read a narrative we have to keep track of who is doing what to whom. The first-mentioned character lays the mental foundation for the narrative and must be kept accessible to build a coherent text structure. According to the Structure Building Framework, a mapping process occurs during reading; through the process of mapping, related information is mapped on to previously comprehended information. When a previously introduced character is rementioned, he or she gains further accessibility by being mapped and further enhanced. However, if the incoming information is less related, a comprehender will shift to build a new substructure. When a new character is introduced, he or she is less related to the previous character, even if their syntactic and semantic features overlap. A new character interferes with the previous one, and readers must attenuate (i.e., suppress) the interference to focus on the new information and shift to build a new substructure.

EXPERIMENT 2

The goal of our second experiment was to further investigate the effects observed in our first experiment. In particular, we wanted to rule out the possibility that the results from Experiment 1 depended on a specific probe word (the character's name) rather than the readers' mental representation of that character (cf. Gordon, Hendrick, & Foster, 2000, who recently suggested caution in using probe verification tasks to assess anaphoric reference). Therefore, we wanted to extend the previous results by testing the accessibility of an object associated with the main character rather than the main character.

Method

Participants. Eighty-eight native American English speakers participated in this experiment; about half were members of Madison community who received a cash payment, and the other half were University of Wisconsin–Madison undergraduates who earned extra credit in an introductory psychology course.

Materials and procedure. The main difference between Experiment 1 and Experiment 2 was most prominently the probe words and less prominently the content of the narratives. The narratives used in Experiment 2 were slightly modified from those used in our first experiment to introduce an object and to express a relation between that object and the main character. An example experimental narrative along with its probe words is shown in Table 2. All probe words, even filler probe words were object names rather than character names.

All procedures remained identical to those outlined in Experiment 1. The complete set of materials for Experiment 2 can be found at http://psych.wisc.edu/lang/materials/charsupnouns.html.

TABLE 2
Example Experimental Narrative From Experiment 2

Introduction

Grant entered some numbers into the portable keypad attached to his wrist and then began to check the control panels of the spacecraft. All the systems were ready. Grant was equally ready for this next mission of discovery. Just as the spacecraft crossed the border into a new universe, the red light of danger started to flash on the control panel, and the alarm began to scream.

Experimental Probe Word: KEYPAD [for before condition]; **LASER** [for after condition]

Remention Condition

Grant, being the well-trained and organized leader, remained calm and began searching the database for information. There was clearly another spaceship within a few light-years away. Grant prepared the computer system to initiate communication with the foreign beings.

New Condition

Alexa, being the well-trained and organized leader, remained calm and began searching the database for information. There was clearly another spaceship within a few light-years away. Alexa prepared the computer system to initiate communication with the foreign beings.

Neither Condition

It was necessary to remain calm and begin searching the database for information. There was clearly another spaceship within a few light-years away. The next step was to prepare the computer system to initialize communication with the foreign beings. Once the computer was ready, the identity of the aliens could be established.

Experimental Probe Word: SPACESHIP [for before condition]; **KEYPAD** [for after condition]

Conclusion

Alexa turned on the monitor. Their hail was being answered. Hopefully, they would be cooperative. Often times they were, but there was no guarantee.

Filler Probe Word: LASER [for before condition]; **SPACESHIP** [for after condition]

Results

The same accuracy criteria were applied from the previous experiment: 45% of the participants were replaced because they did not satisfy the accuracy criteria. This high percentage of inadequate performances was most likely attributable to the fact that the object names in the narratives were mentioned only once in each narrative (in the first sentence of the first paragraph); in contrast, in Experiment 1 the character names were mentioned twice in the first paragraph (in the first and third sentence) and possibly rementioned in the second paragraph. Indeed, participants in Experiment 2 committed more errors, with the object names as probe words, than did participants in Experiment 1, with the character names as probe words, even at the baseline test point (i.e., 12% more errors at the *before* test point). In addition, participants' average verification latency in Experiment 2 was almost double that of Experiment 1 (575 ms vs. 918 ms at the *before* test point). In sum, Experiment 2 provided a harder task.

The design of the ANOVAs was the same as in the Experiment 1, and the results were similar, albeit attenuated slightly for the reasons just mentioned.

Verification latencies. A significant main effect was observed, $F1(3, 87) = 6.66, p < .001$, $F2(3, 31) = 4.43, p < .01$. As shown in Figure 3, the pattern was very

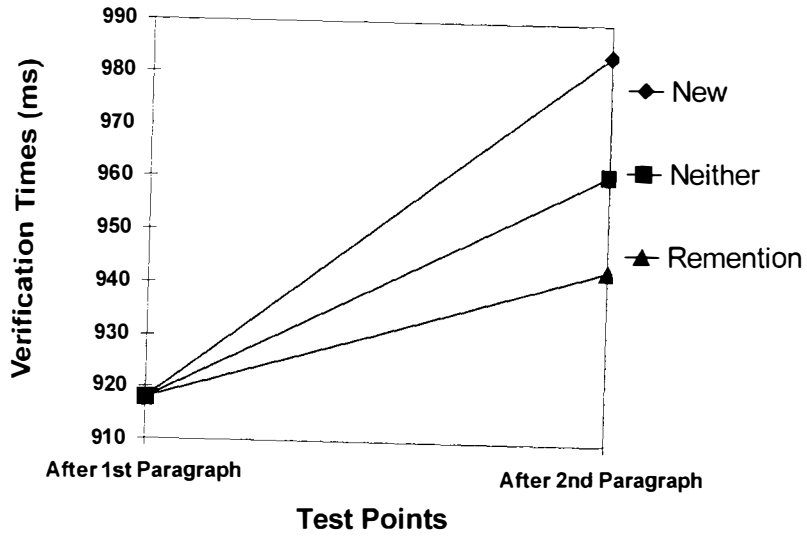

FIGURE 3 Participants' verification latencies (in ms) in Experiment 2.

similar to that of Experiment 1. In particular, we found that introducing a new character diminished the accessibility of the original character, even though the participants were tested on only an object closely associated with the main character and not the main character's actual name. Participants' verification latencies to an object associated with the main character were slower after reading a paragraph in which a new character was introduced ($M = 984$, $SE = 18$) than prior to reading a paragraph in which a new character was introduced ($M = 918$, $SE = 17$), $F(1, 87) = 18.571, p < .001$, $F2(1, 31) = 12.28, p < .001$. Participants' verification latencies to an object associated with the main character were also faster after reading a paragraph in which the main character was rementioned ($M = 943$, $SE = 17$) than after reading a paragraph in which a new character was introduced ($M = 984$, $SE = 18$), $F(1, 87) = 6.89, p < .001$, $F2(1, 31) = 3.72, p < .06$. As in Experiment 1, participants' verification latencies to the objects associated with the main character were statistically equivalent before reading a paragraph in which the main character was rementioned ($M = 918$, $SE = 17$) as after reading a paragraph in which the main character was rementioned ($M = 943$, $SE = 17$).

Verification errors. A significant main effect was observed when participants were considered a random effect, $F(3, 87) = 3.00, p < .05$, although not when probe words were considered a random effect, $F2(3, 31) = 2.18, p < .10$. Participants made more verification errors to an object associated with the main character after reading a paragraph in which a new character was introduced ($M = 18\%$, $SE =$

1%) than prior to reading a paragraph in which a new character was introduced (M = 13%, SE = 1%), $F(1, 87) = 4.74$, $p < .04$, $F2(1, 31) = 3.45$, $p < .06$.

Discussion

In Experiment 1, we observed that introducing a new character in a narrative produces a cost: An aforementioned character becomes less accessible. In Experiment 2, we observed that this reduction of accessibility is not specific to the main character's name, but can also be assayed by probing an object associated in the mental representation with the main character. Therefore, the results obtained in Experiment 2 allow us to rule out the possibility that results obtained in Experiment 1 were due to the remention of a specific character's name or to the introduction of a specific new character's name.

According to the Structure Building Framework, two mechanisms facilitate the cognitive processes of mapping and shifting, and hence the development of mental representations, during comprehension. The cognitive mechanism of enhancement increases the activation of related information; the cognitive mechanism of suppression decreases the activation of inappropriate or interfering information. Indeed, Gernsbacher (1997a) defined the cognitive mechanism of suppression as a mechanism that attenuates interference.

Gernsbacher (1997a) also reviewed numerous laboratory studies demonstrating the crucial role of suppression in attenuating the interference that often arises naturally during comprehension. These phenomena include lexical access, during which comprehenders often need to attenuate interfering lexical or phonological forms (Gernsbacher & Faust, 1991b; Gernsbacher, Robertson, & Werner, in press); anaphoric reference, during which comprehenders often need to attenuate other potential referents for anaphors such as pronouns (Gernsbacher, 1989, see also replications in English (MacDonald, & MacWhinney, 1990; Garnham Traxler, Oakhill, & Gernsbacher, 1996), Chinese (Sun, 1997), Korean (Lee, 1992), and American Sign Language (Emmorey, 1997); figurative language understanding, during which comprehenders often need to attenuate literal understandings (Gernsbacher, Keysar, Robertson, & Werner, in press; Gernsbacher & Robertson, 1999); and simultaneous interpretation, during which interpreters often need to attenuate interfering information such as cognates (Gernsbacher & Shlesinger, 1997).

Gernsbacher and others also reported that persons who are more skilled at comprehension (e.g., as assessed on a comprehension battery, such as the Nelson Denney) are more able to attenuate the interference that often arises during comprehension (De Beni, Palladino, Pazzaglia, & Cornoldi, 1998; Faust, Balota, Duchek, Gernsbacher, & Smith, 1997; Gernsbacher, 1997a, 1993, in press; Gernsbacher & Faust, 1991b; 1995; Gernsbacher, Varner, & Faust, 1990; Long, Seely, & Oppy, 1999; Palladino, Cornoldi, De Beni, & Pazzaglia, in press). In the final experiment that we report here, we explored whether more-skilled readers, who in previous research have been found to be more-skilled at suppression (i.e., attenuating interference), are also more skilled at attenuating the interference caused by introducing a new character into a narrative. Whereas previous research has investigated more- versus less-skilled comprehenders' ability to suppress interfering information at the lexical (Gernsbacher & Faust, 1991b) or sentence level, Experiment 3 investigated this distinction during narrative comprehension.

EXPERIMENT 3

The third experiment capitalized on the findings observed in our first two experiments, namely that introducing a new character into a narrative often leads to interference with (reduced accessibility of) a previously mentioned character. More- and less-skilled readers performed the experimental task of Experiment 1 so that we could examine whether more- and less-skilled readers differ in how well they can keep track of who is doing what to whom while reading a narrative.

Method

Participants. Ninety-six undergraduate students at the University of Wisconsin–Madison participated in the experiment to earn extra credit for an introductory psychology course.

Materials and Procedure. Participants completed a reading comprehension test, followed by the experimental task outlined in Experiment 1. The comprehension test (Gernsbacher & Varner, 1988) comprised four narratives, each one followed by 12 multiple-choice questions. Narratives and questions were presented on a computer screen. Of the participants, 48 were classified as more-skilled readers (one third), and 48 were classified as less-skilled readers on the basis of their performance on the reading comprehension test (one third). The 48 more-skilled readers scored higher than 79% on the comprehension test, whereas less-skilled readers scored lower than 67%. Selection criteria were fixed at 50% for verification accuracy and greater than 250 ms for verification latency: 5% of skilled and less-skilled readers were eliminated because they did not satisfy the criteria.

Following the completion of the reading comprehension test, subsequent materials and procedures were identical to those outlined in Experiment 1.

Results

Analyses of the data were again conducted separately for verification errors and verification latency. Reading skill was included as a between- variable.

Verification latencies. A significant main effect was observed for test point, $F(3, 94) = 80.81$, $p < .001$. As in Experiment 1, participants' verification latencies to the main character's name were faster after reading a second paragraph in which the main character was rementioned ($M = 514$, $SE = 19$) than after reading a second paragraph in which neither the main character was rementioned nor a new character was introduced ($M = 621$, $SE = 23$), $F1(1, 95) = 76.00$, $p < .001$. Comparing the data from these two conditions (verification latencies in the remention condition and verification latencies in the neither condition) allows us to gauge that participants reaped a statistically significant benefit: Rementioning the main character increased its accessibility.

In addition, as in Experiment 1, participants in Experiment 3 reaped a statistically significant cost, when indexed by their verification latencies. Participants' verification latencies to the main character's name were slower after reading a second paragraph in which a new character was introduced ($M = 704$, $SE = 28$) than after reading a second paragraph in which neither the main character was rementioned nor a new character was introduced ($M = 621$, $SE = 23$), $F1(1, 95) = 29.41$, $p < .001$. Participants' verification latencies to the main character's name were statistically equivalent before reading a second paragraph in which the main character was rementioned ($M = 523$, $SE = 19$) as after reading a second paragraph in which the main character was rementioned ($M = 514$, $SE = 19$).

Using verification latencies as a dependent variable, we also observed a significant main effect for reading skill, $F(1, 94) = 10.73$, $p < .01$: More-skilled readers' verification latencies($M = 524$, $SE = 14$) were an average 132 ms faster than less-skilled readers' verification latencies ($M = 656$, $SE = 19$). However, there were no interactions with reading skill observed when considering the verification latencies as dependent variable.

Verification errors. A significant main effect was observed for test point, $F(3, 94) = 19.82$, $p < .001$, but no main effect was observed for reading skill. Rather, we observed a significant interaction between reading skill and test point, $F(3, 94) = 4.18$, $p < .01$. As shown in Figure 4, less-skilled readers (indicated by the solid lines) showed a statistically significant cost: Less-skilled readers made 9% more errors when verifying the main character's name after reading a paragraph in which a new character was introduced ($M = 16\%$, $SE = 2.1\%$) than after reading a paragraph in which neither a new character was introduced nor the main character was rementioned ($M = 7\%$, $SE = 1.6\%$), $F(1, 47) = 17.80$, $p < .001$. In contrast, as shown in Figure 4, more-skilled readers (as indicated by the dashed

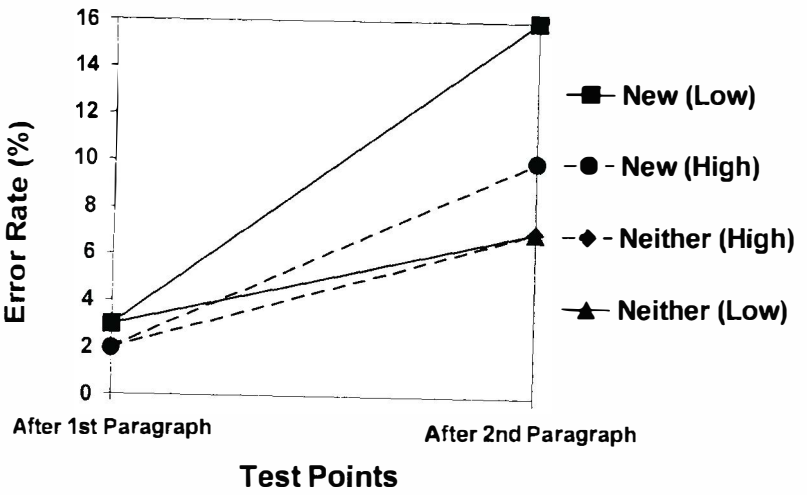

FIGURE 4 Participants' verification error rate (in percentage) in Experiment 3. "Low" refers to the less-skilled readers and "high" refers to the more-skilled readers.

line) did not show a statistically significant cost: More-skilled readers did not make statistically more errors when verifying the main character's name after reading a paragraph in which a new character was introduced ($M = 9.9\%$, $SE = 1.7\%$) than after reading a paragraph in which neither a new character was introduced nor the main character was rementioned ($M = 7\%$, $SE = 1.4\%$), $F(1, 47) < 2.0$.

Discussion

Experiment 3 demonstrated that less-skilled readers showed high cost, in their accuracy, when a new character was introduced. In contrast, more-skilled readers seemed to be little affected, in terms of their accuracy, when a new character was introduced. If introducing a new character causes interference, as we have suggested, these data support the hypothesis that more-skilled readers are more skilled at attenuating interference (i.e., suppression).

CONCLUSIONS

The experiments reported here suggest that successful narrative comprehension involves taking advantage of rementioned information and reducing the costs associated with interfering information. In each experiment, participants read narratives

in which a main character was introduced. In a subsequent section of the narrative, the main character was either rementioned, a new character was introduced, or no character was mentioned (anaphorically or otherwise). Results from all three experiments provide evidence that mental access to the main character is strengthened when that character is rementioned, and interfered with when a new character is introduced. When asked to verify whether they had seen the main character's name in a narrative, readers were consistently faster and more accurate to say that they had when the main character's name had been rementioned. In contrast, readers were consistently slower and less accurate to verify that they had seen the main character's name when the narrative introduced a new character. We were able to unambiguously interpret these results as benefits and costs because (unlike previous experiments) we included a neutral 'condition.' We also were able to investigate whether the effect we observed was specific to our probe words being names by testing the accessibility of an object associated with the main character. As with the main character, per se, we found that an object associated with the main character increased in accessibility when that main character was rementioned and decreased in accessibility when a new character was introduced. Lastly, we explored whether reading skill affected the ability to attenuate the interference caused by the introduction of a new character. We found that more-skilled readers, who have previously been shown to be more skilled at attenuating interference during comprehension (i.e., suppression) did not show in their verification accuracy a cost when a new character was introduced.

These data were consistent with studies on the mental representation created when reading individual sentences (Gernsbacher, 1989) and extend these findings to the level of the narrative. Moreover, these data were consistent with the tenets of the Structure Building Framework, which assumes that once readers have laid a foundation based on the most relevant textual information (in this case, the main character of each narrative), subsequent information is either perceived as relevant or irrelevant; if relevant, the information is mapped onto the existing information; if less relevant comprehenders shift to build a new substructure. In Experiment 1, readers were significantly faster and more accurate to identify the main character (e.g., *Grant*) when he or she was rementioned than when a new character (e.g., *Alexa*) was introduced. According to the Structure Building Framework, readers would have constructed a mental representation of the narrative based on the main character; the introduction of a new character poses as an interference to this representation, thus, the increase in verification latencies that we see in the present experiments when a new character is introduced. Conversely, by rementioning the main character, it becomes enhanced in the reader's mental representation, accounting for the faster verification latencies when the main character was rementioned. As shown in Experiment 2, these findings persisted even when the probe word was an object associated with that character rather than the name of the actual character. This is also consistent with the Structure Building Framework, as

it assumes that an object associated with the main character would be mapped onto the mental representation founded on the main character. The data collected with more and less-skilled comprehenders in Experiment 3 is equally consistent with the Structure Building Framework: More-skilled comprehenders are characterized by more efficient suppression.

The experiments reported here illustrate that readers must keep track of who is doing what to whom to successfully read and comprehend a narrative. This narrative tracking results in a mental representation that is built on the most relevant textual information, with subsequent information being either relevant or irrelevant to the preexisting foundation. Skilled readers are therefore able to filter through narrative details with relatively little exertion by capitalizing on the benefits gained from relevant information, and minimizing the costs incurred by less-relevant information.

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