

# How does background information improve memory for text content?

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In two experiments, we investigated whether reading background information benefits memory for text content by influencing the amount of content encoded or the organization of the encoded content. In Experiment 1, half of the participants read background information about the issues to be discussed in the text material, whereas half did not. All the participants were then tested for free recall and cued recall of text content. Free recall was greater for individuals who read issue information than for those who did not. The groups did not differ on cued recall, suggesting that background information did not facilitate the encoding of more text content. Measures of representational organization indicated that increased recall in the issue information group resulted from better organization of content in memory. Experiment 2 extended these findings, using background information about text sources, and demonstrated that the efficacy of background information depends on the semantic relationship between that information and text content.

Instructional texts and classroom lectures often begin by providing background information about the to-be-presented topic, in hopes of improving memory for the content of the subsequent material. Background information can be defined as material presented prior to a text that provides information related to but not contained within the text. Several different types of background information have been investigated previously, including text titles (Bransford & Johnson, 1973; Dooling & Lachman, 1971; Dooling & Mullet, 1973; Wiley & Rayner, 2000), factual information (Barnett, 1984; Dooling & Christiaansen, 1977; Mayer, Cook, & Dyck, 1984; Slater, Graves, & Piché, 1985), informational outlines (Glynn, Britton, & Muth, 1985; Mannes & Kintsch, 1987), and advance organizers (Ausubel, 1960; Corkill, 1992; Corkill, Glover, Bruning, & Krug, 1988; Dinnel & Glover, 1985; Dunlosky, Rawson, & Hacker, 2002; Mayer, 1978, 1979a, 1979b, 1983).<sup>1</sup>

In general, the bulk of previous research has demonstrated that providing readers with background information about a text topic can improve memory for the subsequently presented text content. However, the nature of the effect is less well understood. Mayer (1983) suggested two plausible accounts for the effect of advance organizers that can reasonably be extended to the class of background information (as defined above). According to the *quantitative* hypothesis, background information encourages the en-

coding of more text content. By this account, reading background information improves free recall of text content by increasing the *availability* of content in memory. Another possibility is that background information influences the *organization* of encoded content. Specifically, background information may support a more highly organized representation, which can serve as a retrieval structure by which text information can be readily retrieved (Hunt & McDaniel, 1993; cf. Radvansky & Zacks, 1991). By this account, reading background information improves free recall of text content by improving the *accessibility* of content in memory.

Mayer (1983) has reported some evidence to support each of these nonexclusive alternatives. In one experiment, individuals listened to a taped lecture about radar, preceded by brief study of a diagrammatic advance organizer for half of the participants. Free recall of the lecture content was greater for individuals who studied the advance organizer than for those who did not, which Mayer (1983) stated "provided evidence that an advance organizer can exert quantitative effects: that is, can increase the overall amount learned" (p. 45). Mayer (1983) also reported that recall of ideas that were central to the text (e.g., related to the principles of radar) was greater for those who studied the advance organizer than for those who did not, which he took as evidence for an organizational difference in encoding between the two groups.

Although Mayer (1983) interpreted the greater free recall for the advance organizer group as evidence that a greater amount of text content had been encoded, improved free recall could also have been the result of an influence on the organization of the encoded content. Specifically, if background information encourages the formation of an organized representation, the free recall difference between groups may have been due to improved accessibil-

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ity of the text content in memory, rather than to more text content having been available in memory. Similarly, on the basis of an improved recall of central ideas, Mayer concluded that the advance organizers also influenced representational organization, but this effect also bears alternative interpretation. If a text representation is considered in terms of a network consisting of weighted nodes and links (Kintsch, 1998), an organizational effect implies differences in the links established between nodes. However, Mayer's (1983) background information may have influenced the weighting of nodes corresponding to main ideas without influencing the links between nodes. Finally, Mayer (1983) obtained his results by using background information in the form of a diagram and a taped lecture, leaving open the possibility that the findings would be less evident with text materials. In fact, using text materials, Mayer et al. (1984) reported mixed results for recall of important text information when individuals read background information versus when they did not.

Accordingly, the primary goal of the present research was to provide further evidence for how background information influences memory for text content. The research was designed to evaluate three nonexclusive hypotheses. First, as was stated above, the quantitative hypothesis is that background information influences the amount of text content encoded (e.g., reading background information could preactivate relevant concepts that would facilitate subsequent encoding, or it could encourage more active rehearsal of text content). The other two hypotheses pertain to organizational processes. The *organizational likelihood* hypothesis states that background information influences the likelihood that organizational processes are engaged (i.e., whether or not a reader attempts to identify the central ideas in a text for the linking of subordinate information). The *organizational effectiveness* hypothesis assumes that, above and beyond any influence on whether organizational processes are engaged, background information influences the effectiveness of those processes (i.e., given that central ideas are identified, how much of the subordinate information that is encoded is successfully linked to them).

To evaluate these nonexclusive hypotheses, we made two modifications to the methods typically used to demonstrate the effect of background information on text memory. First, to evaluate the quantitative hypothesis, a cued recall test was administered in addition to the standard free recall test. Whereas free recall depends on both the availability and the accessibility of content in memory, providing a retrieval cue reduces accessibility constraints and permits a better assessment of the amount of text content available in memory. If background information promotes the encoding of more text content, more will be available in memory, and hence, cued recall of content will be greater for groups receiving background information.

The second modification was the use of multiple related texts, rather than a single experimental text, to evaluate the two organizational hypotheses. Measures of representational organization that have been well established

in basic memory research (described below) rely on defined categories, and the use of multiple texts afforded the definition of such categories. Specifically, four texts dealt with the same general topic of government intervention in the labor market. Each text contained opinion statements about various controversial forms of government intervention (i.e., *issues*), which were attributed to various fictional persons (i.e., *sources*). Thus, measures of representational organization could be used by defining *categories* of text content either by issues (Experiment 1) or by sources (Experiment 2).

To summarize, our primary question of interest was the following: Given that background information improves memory for text content, to what extent is the effect due to an influence on the amount encoded, the likelihood of engaging in organizational processing, and/or the effectiveness of organizational processing?

## EXPERIMENT 1

As was described above, each text included statements made by various sources concerning their opinions on various issues (e.g., Regarding benefit mandates, "National Bank put thousands of employees on part-time status the same year it posted \$1.4 billion in profits. Extending coverage to part-time workers would discourage such corporate greed," contends Lloyd Jones). Prior to reading the texts, half of the participants read background information about each of the issues (e.g., Benefit mandates require large businesses to provide benefits for full-time employees), and half did not. After study was completed, all the participants completed a free recall test and a cued recall test. Each cued recall prompt consisted of a segment of the stated opinion (e.g., "National Bank put thousands of employees on part-time status the same year it posted \$1.4 billion in profits"). The participants were asked to recall the remainder of the opinion ("Extending coverage to part-time workers would discourage such corporate greed") and to identify which of the four issues it concerned (benefit mandates) and who had said it (Lloyd Jones).

We examined five measures in order to evaluate the three hypotheses for how background information improves memory. Although no psychological measure of learning is "process-pure," we attempted to select measures that had been established by previous research to primarily reflect the particular processes of interest and measures that would provide a pattern of converging results.

As was described above, the quantitative hypothesis was evaluated by examining levels of cued recall for text content. Note that recalling one half of an opinion when cued with the other half depends primarily on whether the opinion was encoded and can be performed regardless of whether the opinion has also been organized via linking to a category.

With respect to the two hypotheses that concern organizational processing, we first examined clustering in recall (i.e., the extent to which content related to the same category appears together in free recall), a measure that

has been taken to indicate the degree of representational organization (e.g., Burns & Brown, 2000; Hunt & Einstein, 1981; Lorch & Lorch, 1995, 1996). Greater clustering for those who read background information than for those who did not would provide evidence that background information had influenced organizational processing. However, this finding would be consistent with both the organizational likelihood and the organizational effectiveness hypotheses: Greater clustering could result from better identification of topical superordinates or from more successful linking of content to those superordinates. Thus, although clustering scores are informative with respect to whether background information influences organizational processing, additional measures must be examined to discern the nature of that influence.

As further evidence for the organizational likelihood hypothesis, we examined category access, a measure adopted from previous research in which representational organization had been examined (e.g., Burns & Brown, 2000; Lorch & Lorch, 1995, 1996). Category access refers to the number of categories (i.e., issues) for which at least one statement is recalled, indicating that the category was accessed. As has been reviewed by Burns and Brown, studies have shown that category access increases with manipulations that promote the identification and use of category superordinates.

As further evidence for the organizational effectiveness hypothesis, we examined statements per category—that is, given that a content category is accessed, the number of relevant statements recalled from that category (e.g., Burns & Brown, 2000; Hunt & Einstein, 1981; Lorch & Lorch, 1995, 1996). The idea is that if a category superordinate is accessed at time of retrieval, it in turn facilitates the retrieval of any text content linked to it. Thus, as the success with which text content is linked to category superordinates increases, statements per category recalled will increase. Finally, as a converging measure of the success with which text content had been linked to category superordinates, we examined cued recall for issues. The logic here is that, to the extent that text content is linked to category superordinates defined by issues, identification of the relevant issues when cued with that content will increase.

## Method

**Participants and Design.** Forty-eight undergraduates from the University of Colorado participated to partially satisfy course requirements for introductory psychology. Twenty-four participants were randomly assigned to each of two groups (background information or control).

**Materials.** All instructions and materials were presented by computer. Materials were adapted from a political science textbook. The general topic of the material set was government intervention in the labor market (see the Appendix for materials). Within this general topic, we identified four *issues*, or specific ways in which the government can intervene in the labor market. For each issue, a background information item was written describing what that form of government involvement entailed. We also created four *sources*, or fictional persons to whom opinions about the issues were attributed.

One opinion about each issue was attributed to each of the four sources, resulting in 16 *content statements* (from which texts were

constructed, as will be described below). Each content statement included an issue label denoting which issue was being discussed, an opinion in the form of a quote, and a source label denoting who made the statement. Note that although each content statement named the identity of the relevant issue, these issue labels were unelaborated (i.e., the issues were not defined further within the statement).

The quoted opinion portion of each content statement argued either for or against government intervention. Of the four content statements on each issue, two were pro-intervention and two were anti-intervention. Of the four statements attributed to each source, two were pro-intervention and two were anti-intervention. Although each source was thus described as being favorable on two issues and opposed on two issues, this is not an unrealistic situation—for example, an individual could support programs that do not require businesses to pay for them (e.g., training programs, labor laws) but oppose programs that do (e.g., benefit mandates, minimum wage).

Each of four texts was created by concatenating the four content statements pertaining to one issue (e.g., all four statements pertaining to benefit mandates appeared in one text). Within each content statement, the issue label appeared first, followed by the quoted argument, followed by the source label (as in the Appendix).

Cued recall prompts were developed from 10 of the content statements (see the Appendix). Each prompt consisted of half of the quoted opinion portion of a content statement. For each prompt, the participants were asked to recall the other half of the quoted opinion, the source who said it, and the issue they were discussing when they said it.

**Procedure.** The participants were told that they were to read four short, argumentative texts on the general topic of government intervention in the labor market and were instructed to study in order to be able to recall the material later. The participants in the background information group were told that information pertaining to the issues to be discussed would be presented prior to the texts. They were told that they would not be tested on this information; however, they were encouraged to read the descriptions carefully, since the information would help them to remember the text material.

The participants in the background information group were first presented with one of the background information items for self-paced study. When the participant terminated study with a keypress, the information was replaced by the next information item, and so on until all four had been presented in random order. For all the participants, texts were presented one at a time in random order for self-paced study, each preceded by a numerical text title. After reading all of the materials once, each participant was then given a second study trial, to help avoid potential floor effects in free recall. This included a second presentation of the issue information items prior to the second study trial for the participants in the background information group.

Each participant was then given a free recall test. An empty text field appeared on the computer screen, and the participant was prompted to type in as much as he or she could recall from all of the texts. The amount of time permitted for recall was not restricted. After the participant made a keypress to indicate that he or she had finished recalling the texts, the cued recall test was administered. The prompts were presented one at a time in random order for completion.

## Results and Discussion

**Free recall of text content.** For scoring purposes, the quoted argument portion of each content statement was propositionalized (Bovair & Kieras, 1985; Kintsch, 1998), resulting in 39 complex propositions composed of 348 propositionalelements (i.e., words denoting the constituent concepts and relations in the complex propositions). For each participant, the percentage of elements recalled was computed for each statement, with equal weighting for

central elements (e.g., verbs) and peripheral elements (e.g., modifiers). A mean percentage across statements was then calculated for each participant. Verbatim recall or close paraphrases were scored as correct (e.g., for the original text, "Extending coverage to part-time workers would discourage such corporate greed," credit would be given for a response such as "Part-time employees should get benefits too, to stop the greed of large commercial businesses making too much money," whereas no credit would be given for a response such as "Everybody needs benefits from rich employers"). Mean free recall across individual percentages in each group is reported in Table 1.

Free recall was greater for those who read background information than for those who did not [ $t(46) = 3.21, p < .01$ ]. This finding adds to the large body of research demonstrating that background information can improve text memory. More important, to what extent was this effect due to an influence on the amount encoded, the likelihood of engaging in organizational processing, and/or the effectiveness of organizational processing?

**Reading times.** Before addressing these three hypotheses of interest, we rule out a less interesting alternative: Improved recall for the group reading issue information resulted from more time spent processing the texts. For each individual, reading times (in seconds) for the two trials were summed, and the mean across the four texts was calculated. Individuals who read background information did not spend significantly more time studying than those who did not [ $M = 123, SEM = 9$ , and  $M = 117, SEM = 9$ , respectively;  $t(46) = 0.44$ ]. Thus, the free recall advantage that accrued from reading background information did not result from increased time spent on task.

**Cued recall for text content.** To evaluate the quantitative hypothesis, a cued recall score for each participant was calculated on the basis of the mean percentage of propositional elements correctly recalled to each content prompt. Cued recall did not differ significantly for those who read background information ( $M = 15.6, SEM = 2.6$ ) and those who did not [ $M = 13.2, SEM = 2.0; t(46) =$

$0.73$ ].<sup>2</sup> Although a trend for greater cued recall for those who read background information was evident, it was not significant and was not evident in Experiment 2. Thus, any influence of background information on the amount of content encoded appears to have contributed minimally to the overall improvement in free recall.

An alternative explanation for the minimal differences in cued recall is that the free recall test that preceded cued recall interfered with cued recall performance. To rule out this possibility, we conducted a follow-up in which the design, materials, and procedure were identical to Experiment 1, except that only the cued recall test was administered. Twenty-six undergraduate participants were randomly assigned to each of the two groups. Cued recall did not differ significantly for those who read background information ( $M = 15.1, SEM = 2.9$ ) and those who did not [ $M = 17.5, SEM = 2.6; t(50) = 0.62$ ]. Thus, no advantage in cued recall was observed for those who read background information even when the cued recall test was not preceded by free recall, further supporting the conclusion that background information minimally influences the amount of text content encoded.

**Clustering.** To explore whether background information influences organizational encoding, we examined clustering in recall. For each participant, each complex proposition recalled was coded according to the complex proposition from the original texts that it most closely matched semantically. Recalled propositions that referred only to an issue description or that contained only elaborative information were not included in the analysis.

Clustering was assessed by using the adjusted ratio of clustering (or ARC; Roenker, Thompson, & Brown, 1971, Equation 1), which indicates how frequently (relative to chance) items sharing a superordinate appear together in recall. Zero indicates clustering at chance level, and 1 indicates perfect clustering. For this analysis, category superordinates were defined by the four issues (hereafter referred to as *issue ARC*). Means across individual ARCs for each group are reported in Table 1.

Issue ARCs were significantly greater than chance for both the background information group [ $t(20) = 62.22, p < .01$ ] and the control group [ $t(22) = 9.55, p < .01$ ]. Of greater interest, issue ARCs were marginally higher in the background information group than in the control group, ceiling effects notwithstanding [ $t(42) = 1.87, p < .07$ ], suggesting that background information promoted organizational processing.

**Category access.** We next examined category access in order to evaluate the hypothesis that background information influenced the likelihood of organizational processing. For each participant, the number of categories represented in recall was calculated (i.e., for how many of the four issues was at least one statement recalled). Group means are reported in Table 1. Category access did not significantly differ for participants who read background information and those who did not [ $t(45) = 1.23$ ], suggesting that background information did not influence the likelihood of developing category superordinates. How-

**Table 1**  
Experiment 1: Group Means for Free Recall and Measures of Representational Organization

Measure	Group			
	Background Information		Control	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Free recall	22.5	2.6	13.0	1.4
Issue ARC	.97	.02	.81	.08
Category access	3.4	0.2	3.1	0.2
Statements per category	2.5	0.2	1.9	0.1
Cued recall of issues	63	6	36	3
Cued recall of sources	3	1	8	3

Note.—Free recall is reported as percentages. ARC refers to the adjusted ratio of clustering, where 0 represents chance and 1 represents perfect clustering. Category access (the number of categories for which at least one statement was recalled) and statements per category (the number of statements recalled per category recalled) are out of a possible four. Cued recall of issues and sources is presented as percentages.

ever, this finding should be interpreted with caution, given potential ceiling effects in the background information group.

**Statements per category recalled.** To evaluate the organizational effectiveness hypothesis, we first examined statements per category recalled. Given that an issue category was accessed in recall, the number of statements recalled for that category was calculated. A mean across accessed categories was then calculated for each participant. For this analysis, any portion of a statement correctly recalled was counted as one statement. If portions of the same statement were recalled separately, that statement was only counted once. Thus, four was the total possible number of statements per category recalled. Group means are presented in Table 1. Statements per category was significantly greater for those who read background information than for those who did not [ $t(45) = 2.55, p = .01$ ], suggesting that individuals who read background information were more successful at linking text content to category superordinates.<sup>3</sup>

**Cued recall of issues and sources.** An examination of cued recall of issues provided converging evidence for this conclusion. On the basis of responses from the cued recall task, in which the participants were asked to identify the relevant issue and source for each content prompt, we calculated the percentage of issues correctly recalled and the percentage of sources correctly recalled for each participant. Group means are presented in Table 1.

Cued recall of issues was significantly greater for those who read background information than for those who did not [ $t(46) = 3.28, p < .01$ ]. Although the participants in both groups were able to link some opinion content to issues,<sup>4</sup> reading background information appeared to increase the amount of opinion content successfully linked to relevant issues. An examination of cued recall of sources suggests that the influence of background information was specific to the linking of content to issues, rather than a general influence on the tagging of content with identifying information: Cued recall of sources did not differ significantly for the background information and the control groups [ $t(46) = 1.72, p = .09$ ], and the trend was in the opposite direction.

The overall pattern of findings across measures in Experiment 1 suggests that the effect of background information on text memory is due primarily to an influence on the success with which readers are able to link text content to topical categories. Any influence of background information on the amount of text content encoded or on the likelihood that readers use topical categories to organize text content appears to contribute minimally to increases in text memory.

## EXPERIMENT 2

Experiment 2 was intended to extend the major findings of Experiment 1, using different background information—namely, by providing the participants with information about the sources to which the opinions in the

texts were attributed, rather than about the issues discussed. In a pilot study conducted to develop these materials, one group of participants ( $n = 18$ ) read information describing the professional affiliation of each source, followed by a text containing all four statements made by that source. A control group ( $n = 18$ ) did not read the source information prior to reading the texts. Free recall was not significantly greater for individuals who read source information ( $M = 13, SEM = 2$ ) than for those who did not ( $M = 10, SEM = 2; t < 1$ ).

Although initially surprised, we realized that the professional affiliations for the sources described in the background information were arbitrarily related to the kind of statement made by each source. This observation suggested that the efficacy of background information may be limited by the semantic relation it shares with subsequent text content. As Britt, Perfetti, Sandak, and Rouet (1999) have suggested, “a more semantically elaborated source would enable a reader to build a model of the knowledge and motives of the author, thus supporting inferences about likely claims and evidence mentioned by the author” (pp. 222–223). Research on relational processing has provided indirect empirical support for this semantic relation hypothesis. Organizational processing of word lists improved recall when this processing involved discerning semantic relationships between those words and conceptual category superordinates (e.g., Hunt & Einstein, 1981). However, organizational processing did not improve recall when words were sorted according to nonsemantic categories (e.g., the first letter of each word; Einstein & Hunt, 1980).

Thus, in addition to extending the findings of Experiment 1, Experiment 2 also explored whether the semantic relationship between the background information and text content defines a boundary condition for the effect of background information on text memory. To this end, we developed two sets of background information for Experiment 2. In both sets, information described the professional affiliation of the sources. *High-semantic* information described each source as being pro-intervention or anti-intervention, depending on their professional affiliation (e.g., an anti-intervention source was described as “Lloyd Jones is a business owner who resents government interference in the profitable operation of his business”). The following text contained all of the statements attributed to that source, and importantly, they were all consistent in valence with the position declared in the description (e.g., all four statements made by business owner Jones argued against intervention). *Low-semantic* information described a neutral affiliation for each source, in that it did not indicate whether that individual would tend to be pro-intervention or anti-intervention (e.g., “Lloyd Jones is a professor of economics and public affairs at Stanford University”). This group read the same texts as in the high-semantic information group.

Finally, the control group did not read background information but did read texts in which all four statements were of the same valence (either pro- or anti-intervention)

as in the other groups. We predicted greater free recall for those reading high-semantic information than for the control group, but equivalent free recall for the low-semantic and the control groups. These predictions were evaluated by using planned comparisons (Judd & McClelland, 1989; Rosenthal & Rosnow, 1985).

## Method

**Participants and Design.** Eighty-four undergraduates from the University of Colorado participated to partially satisfy course requirements for introductory psychology. Twenty-eight participants were randomly assigned to each group (high semantic, low semantic, and control).

**Materials.** The two sets of source information used the same fictional names to which the various opinions were attributed in Experiment 1 (see the Appendix). For low-semantic sources, an information item was written for each source, describing a valence-neutral professional affiliation. For high-semantic sources, each affiliation was associated with an argument valence (either pro-intervention or anti-intervention), and the information items described the associations.

The 16 content statements from Experiment 1 were used. For the high-semantic group, each of the four texts was composed of 4 content statements so that (1) 1 statement pertaining to each issue appeared, (2) all 4 statements were attributed to the same source, and (3) all 4 statements were either pro-intervention or anti-intervention. Within each content statement, the source label appeared first, followed by the quoted argument, followed by the issue label. The source label included both proper surname and professional affiliation (e.g., "Business-owner Jones contends . . ."). Texts for the low-semantic group were identical to those in the high-semantic group, except that the low-semantic affiliation appeared along with the proper surname at the beginning of each content statement (e.g., "Professor Jones contends . . .").

For the control group, each of the four texts was composed of four content statements so that (1) one statement pertaining to each issue appeared, (2) one statement attributed to each source appeared, and (3) all four statements were either pro-intervention or anti-intervention. Within half of the content statements in each text, the source label appeared before the quoted argument, and the issue label appeared after the quoted argument, with the reverse order for the other half of the statements. Source labels included proper surnames and the professional affiliations from the low-semantic sources.

**Procedure.** The participants in the high- and the low-semantic groups were presented with a numerical text title and one of the background information items appropriate to their group. When they advanced with a keypress, the information was replaced on the

screen by the corresponding text (i.e., the text including all of the statements made by that source). The next keypress presented the next background information item on the screen, and so on. Each text for the control group was preceded only by a numerical text title. The rest of the procedure was identical to that in Experiment 1.

## Results and Discussion

**Free recall of text content.** Mean free recall across individual percentages is reported in Table 2. Free recall for the low-semantic group did not differ from that for the control group ( $F < 1$ ). However, source information with a stronger semantic relationship to the text content did benefit free recall of that content: Free recall was significantly greater for the high-semantic group than for the control group [ $F(1,80) = 7.02$ ,  $MS_e = 86.97$ ,  $p < .01$ ].

Although we attribute this free recall advantage in the high-semantic group to background information, we note that both background information groups also differed from the control group in that their texts contained the same source name in the same position within each statement. The free recall advantage in the high-semantic group could be attributed to this difference in source name and position, rather than to the background information. However, if the consistency of the source name and position had been the critical factor, a free recall advantage also should have been observed in the low-semantic group, since both information groups were equivalent in this respect. That no such advantage for the low-semantic group was obtained suggests that background information was the critical factor instead. Further support for this conclusion came from comparison of the high- and low-semantic groups, which were equivalent in all respects, except for the preceding information: Free recall was significantly greater in the high-semantic group than in the low-semantic group [ $F(1,80) = 5.24$ ,  $MS_e = 86.97$ ,  $p = .01$ ]. Thus, the overall pattern is most consistent with the conclusion that the background information improved memory for text content, to the extent that it was semantically related to the subsequent content.

The comparison of interest for subsequent measures is between the high-semantic source and the control groups, since this was where the effect of background information

**Table 2**  
Experiment 2: Group Means for Free Recall and Measures of Representational Organization

Measure	High-Semantic Information		Low-Semantic Information		Control	
	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>	<i>M</i>	<i>SE</i>
Free recall	18.7	2.2	12.1	1.5	12.0	1.5
Source ARC	.57	.08	.43	.12	.30	.09
Category access	3.6	0.1	3.2	0.2	3.2	0.2
Statements per category	2.2	0.1	1.8	0.1	1.7	0.1
Issue recall	26	5	30	7	26	4
Source recall	48	5	25	5	14	4

Note—Free recall is reported as percentages. ARC refers to the adjusted ratio of clustering, where 0 represents chance and 1 represents perfect clustering. Category access (the number of categories for which at least one statement was recalled) and statements per category (the number of statements recalled per category recalled) are out of a possible four. Cued recall of issues and sources is presented as percentages.

on free recall was observed. Comparisons of the low-semantic and the control groups will be reported for completeness.

**Reading times.** Mean reading time (in seconds) did not differ significantly for either the high-semantic group ( $M = 133$ ,  $SEM = 9$ ) or the low-semantic group ( $M = 132$ ,  $SEM = 11$ ) from that for the control group ( $M = 139$ ,  $SEM = 10$ ;  $F_s < 1$ ), indicating that improved free recall for the high-semantic group did not result from increased time on the task.

**Cued recall of text content.** Mean cued recall of content for the high-semantic group ( $M = 14.8$ ,  $SEM = 2.9$ ) and the control group ( $M = 16.6$ ,  $SEM = 2.7$ ) did not significantly differ ( $F < 1$ ). Thus, as in Experiment 1, background information appears to have had a minimal influence on the amount of text content encoded. Cued recall of content for the low-semantic source group ( $M = 17.3$ ,  $SEM = 3.1$ ) also did not differ from that for the control group ( $F < 1$ ).

**Clustering.** Clustering was computed as in Experiment 1, except that category superordinates were defined by the four sources (referred to subsequently as *source ARC*). Group means are reported in Table 2. Source ARCs were significantly greater than chance for the high-semantic group [ $t(25) = 7.63$ ,  $p < .01$ ], the low-semantic group [ $t(24) = 3.46$ ,  $p < .01$ ], and the control group [ $t(23) = 3.45$ ,  $p < .01$ ]. Source ARCs for the low-semantic source group did not differ significantly from those for the control group ( $F < 1$ ). Most important, source ARCs were greater for the high-semantic group than for the control group [ $F(1,72) = 3.92$ ,  $MS_e = 0.24$ ,  $p = .05$ ], suggesting that background information influenced organizational processing.

**Category access.** Category access was calculated as in Experiment 1, except that categories were defined by sources rather than by issues. Group means are reported in Table 2. Category access was marginally greater for the high-semantic source group than for the control group [ $F(1,74) = 3.72$ ,  $MS_e = 0.63$ ,  $p < .06$ ]. This trend, which may have been constrained by ceiling effects, does provide some evidence that background information influences the likelihood of organizational processing. Category access for the low-semantic group and the control group did not differ significantly ( $F < 1$ ).

**Statements per category recalled.** As is reported in Table 2, mean statements per category recalled was significantly greater for the high-semantic group than for the control group [ $F(1,74) = 5.66$ ,  $MS_e = 0.41$ ,  $p < .05$ ], again suggesting that background information influenced the success with which content was linked to category superordinates. The low-semantic source group and the control group did not differ significantly ( $F < 1$ ).

**Cued recall of sources and issues.** Group means are presented in Table 2.<sup>5</sup> Cued recall of sources was significantly greater for the high-semantic group than for the control group [ $F(1,81) = 24.97$ ,  $MS_e = 6.19$ ,  $p < .01$ ], providing converging evidence that high-semantic information increased the linking of text content to source super-

ordinates. The low-semantic and control groups did not differ significantly [ $F(1,81) = 2.76$ ,  $MS_e = 6.19$ ]. Cued recall of issues was not significantly greater for either of the background information groups than for the control group ( $F_s < 1$ ), suggesting that source information specifically influenced the linking of content and sources, rather than influencing the tagging of content with identifying information in general.

Experiment 2 provided further evidence that background information improves memory for text content primarily by influencing the success with which text content is linked to topical category superordinates. Any influence of background information on the amount of text content encoded or on the likelihood of using superordinates for organizing content appears to be minimal. Experiment 2 also established the semantic relationship between background information and text content as an important boundary condition for the effect of that information on text memory.

## GENERAL DISCUSSION

The present research provides further evidence that background information can improve memory for text content. More important, three explanations for why background information improves memory were evaluated. First, background information appears to have a minimal influence on the amount of text content encoded, given the statistically equivalent levels of cued recall for content in background information and control groups. The latter result makes sense in light of the reading time outcomes. One way in which background information could have promoted the encoding of more text content would have been to encourage more active rehearsal of the information, thus strengthening that content in long-term memory. However, such rehearsal would require spending additional time on the task, which was not evident in patterns of reading times. Second, only tentative support was found for the hypothesis that background information influences the likelihood that readers identify and use category superordinates to organize text content. Although the present results do not rule out this possibility, neither do they definitively rule it in.

In contrast, strong support was found for the third hypothesis, that background information influences the amount of text content successfully linked to category superordinates. Such differences in the effectiveness of superordinate use may arise as a function of how early in the study session individuals in the various groups identify superordinates. Background information provided prior to reading may engage organizational processing relatively early in study trials. Text content may then be linked to superordinates from the outset of study. In the absence of signals to induce organizational processing, possible organizational schemes may be less apparent initially, and organizational processing may be delayed. To the extent that organizational superordinates are not developed until further into the study trials, fewer opportunities to link

content to those superordinates would be available. This proposal is consistent with research on repeated reading, which indicates that expository text is typically processed in a rote fashion (similar to a list of facts) during the first trial, with sensitivity to important ideas more apparent on subsequent study trials (Mayer, 1983; Millis, Simon, & tenBroek, 1998).

Some potential limitations to our conclusions should be noted. First, although we replicated the basic pattern of results by using two different kinds of background information and two different text organizations, the texts were of the same genre in both cases (argumentative exposition). Thus, further research will be needed to definitively establish the generality of our conclusions for other texts. Notably, however, the primary finding of improved free recall with background information conceptually replicates many earlier studies that have used different materials, which provides some tentative confidence in the generality of our conclusions.

Second, the present research has focused on exploring the effect of background information on text memory. Given the important distinction between memory for text content and deeper comprehension of that content (Kintsch, 1994), additional research is needed to explore the extent to which the various processes examined here also underlie any effects of background information on comprehension. Interestingly, Mannes and Kintsch (1987) showed that informational outlines that only minimally benefited text memory improved performance on tests of deeper comprehension, suggesting that incorporating both comprehension and memory measures in future research in which underlying processes are explored may be fruitful.

Finally, although each of the hypotheses examined above assumes that the locus of the influence of background information on text memory is at encoding, another possibility is that the influence of background information is entirely upon constructive processes that occur at the time of retrieval. However, findings from a recent study by Wiley and Rayner (2000) support the assumption that background information influences encoding. Individuals who were provided with titles for ambiguous passages (cf. Bransford & Johnson, 1973) made fewer regressive fixations (i.e., returns to previously examined text) and had shorter sentence wrap-up times (i.e., gaze duration on the last word of a sentence) than did participants who did not read text titles, indicating that titles exerted an influence on encoding. In addition, Wiley and Rayner argued that these two eye movement measures were influenced specifically by integrative processes, which suggests that participants without titles encountered more difficulty establishing links between text content. This interpretation is consistent with our interpretation of the present results.

The present research also revealed an important boundary condition for the effect of background information on content memory—namely, the semantic relationship between background information and text content. In Experiment 2 and in an earlier pilot study, background informa-

tion did not benefit text memory when that information indicated an arbitrary relationship between the identity of a source and the source's opinions. However, Experiment 2 demonstrated that source information indicating a nonarbitrary relationship did improve content memory.

Why might the influence of background information on memory for text content depend on its semantic relationship to the text content? One explanation of these effects may be derived from the construction-integration model of comprehension (Kintsch, 1988, 1998). According to this model, construction processes build a network of text propositions with weighted links between them. Among other factors, semantic relatedness may influence whether or not particular propositions are linked. The construction phase also involves the selection of important text propositions to serve as macropropositions. During the integration phase, the resulting network undergoes a spreading activation process. Nodes that are highly interconnected tend to accumulate activation, whereas less well connected or weaker nodes lose activation and drop from the network. Texts are processed in cycles, with one text segment (roughly corresponding to a sentence) processed at a time. To maintain coherence across segments, one or two nodes most highly weighted at the end of a cycle are held over to participate in the subsequent cycle. Later recall of particular propositions is assumed to be a function of the activation that each proposition acquired from the cycle(s) in which it participated. The likelihood that a recalled proposition retrieves other text propositions is partly a function of the link strengths between those propositions.

Background information presented prior to a text may induce the selection of topical information, such as issues or sources, to serve as macropropositions. Links are then established between these macropropositions and text content, in part on the basis of the semantic relatedness between them. If macropropositions garner enough activation during integration to be selected to continue in subsequent cycles, these macropropositions will continue to be linked to relevant content. By virtue of participation in multiple cycles, these macropropositions will also be readily retrieved and will have sufficient link strengths with related content to retrieve that content as well. If only a few weak links are established between the macroproposition and the content (owing to impoverished semantic relationships), the macroproposition will not garner enough activation during spreading activation to be carried through subsequent cycles.

Although descriptive, this account provides plausible explanations for the influence of background information on content memory and an attendant boundary condition, in terms of a widely accepted model of comprehension processes.

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## NOTES

1. Other kinds of information presented prior to reading have also been investigated, such as topic outlines and topic headers (e.g., Lorch & Lorch, 1995, 1996). In most cases, these *signaling devices* list the topics and subtopics that are discussed in the text. However, they do not typically present information that is not also explicit in the text and, thus, do not provide background information as presently defined.

2. Unlike the modal finding in memory research, cued recall for content in the present research is often lower than free recall. This finding is not problematic, given the methodological preparation and scoring criteria used here. Both halves of 16 statements could be recalled in the free recall task, whereas only half of 10 statements were eligible to contribute to a cued recall score. In addition, cued recall prompts often elicited correct intrusions that were not included in cued recall scores.

3. Greater statements per category recalled for those who read background information is not inconsistent with the finding that the groups were equivalent in cued recall for content. In contrast to free recall of statements given access to the category, cued recall can be achieved relatively independently of any association between the statement and a category superordinate.

4. A potential limitation to this conclusion is the possibility that the observed levels of recall for issues were due to guessing. Even though the test was not a forced-choice task, with four possible responses for issue, the participants could respond randomly to each prompt and could be expected to answer 25% correctly. Although many participants chose not to respond to prompts rather than to guess, we performed a secondary analysis of issue recall to account for guessing. For each participant, the number of correct responses was divided by the total number of responses made for issues. A mean corrected score for issue recall was then computed for each group, excluding the participants who made no responses. Corrected recall for issues was 82% ( $SEM = 5$ ) for the background information group and 80% ( $SEM = 6$ ) for the control group. Each of these means was significantly better than chance (25%;  $t_s > 6.65$ ). Thus, levels of issue recall are not entirely attributable to correct guessing.

5. Corrected source recall was 66% ( $SEM = 6\%$ ) for the high-semantic group, 72% ( $SEM = 8\%$ ) for the low-semantic group, and 73% ( $SEM = 4\%$ ) for the control group. Each of these means was significantly better than chance (25%;  $t_s > 6.09$ ).

## APPENDIX

### Experimental Materials

#### Issue Information Items (Experiment 1)

Minimum wage is set by the government as the lowest hourly wage that an employer may pay an employee.

Benefit mandates are government regulations that require large businesses to provide benefits for full-time employees.

Labor laws are government policies that dictate hiring and firing practices for businesses.

Job training programs are funded by the government to teach occupational skills to unemployed persons.

#### Low-Semantic Source Information (Experiment 2)

Lloyd Jones is a professor of economics and public affairs at Stanford University.

Jeff Thompson is a policy analyst at the Labor Policy Association in Washington, DC.

Martin Knox is a researcher with the Norton Institute, a public policy research center.

Frank O'Connor is the legal director for the National Association of Manufacturers.

#### High-Semantic Source Information (Experiment 2)

Lloyd Jones is a business owner who resents government interference in the profitable operation of his business.

Jeff Thompson is a labor union leader who believes in government protection of employee rights because he knows how hard it is to get a decent job.

Martin Knox is a Democratic senator who, like many Democrats, believes that government programs promote the well-being of the country and its citizens.

Frank O'Connor is a Republican congressman who, like many Republicans, believes that a "hands-off" government is best for the success of a free-market economy.

#### Content Statements

With respect to minimum wage, "If people can have more money to spend, it increases the demand for goods. This increased demand results in companies hiring more workers to produce those goods," argues Martin Knox.

Regarding minimum wage, "A danger is that workers start to cost more than the goods they produce. Employers respond to these disproportionate labor costs by eliminating jobs," contends Frank O'Connor.

Concerning minimum wage, "Currently, an employee working full-time, year-round still has an income well below the poverty level. As is, no one can support a family with these jobs," maintains Jeff Thompson.

About minimum wage, "Less than 20% of these workers live in poor households—30% are teens working for spending cash. A policy that helps four times more non-poor people than poor people is a sloppy way to fight poverty," says Lloyd Jones.

With respect to benefit mandates, "National Bank put thousands of employees on part-time status the same year it posted \$1.4 billion in profits. Extending coverage to part-time workers would discourage such corporate greed," argues Lloyd Jones.

Regarding benefit mandates, "The cost is too much for many companies to support full-time employees. Employers must use

part-time workers, send jobs overseas, or automatize to stay in business," contends Martin Knox.

Concerning benefit mandates, "Many 'small' businesses stay below the magic number that exempts them from these regulations by hiring temporary rather than full-time workers. All employees of so-called 'small' businesses should be covered," maintains Frank O'Connor.

About benefit mandates, "Many businesses stay small because going over the employee limit requiring them to participate would cost more than any profits from expansion. As most job growth comes from small business, we shouldn't discourage small businesses from taking on employees," says Jeff Thompson.

With respect to labor laws, "The right of private employers to fire workers without a reasonable, performance-related cause is still a significant legal principle in U.S. courts. Workers need better protection from unfair termination," argues Jeff Thompson.

Regarding labor laws, "People can protest termination for anything—if you can breathe, you can sue for unlawful termination, and if you can't, then you qualify as disabled. The difficulty of dismissing unproductive employees is paralyzing U.S. productivity," contends Lloyd Jones.

Concerning labor laws, "The only way to ensure that employers provide equal opportunity employment is to require that employee demographics match those in the local population. A mismatch signals unlawfully discriminatory hiring practices," maintains Martin Knox.

About labor laws, "The right to hire is like the right to marry—private employers should be free to enter an employment relationship with whom they please. Interfering in these decisions violates the rights of private employers," says Frank O'Connor.

With respect to training programs, "Investment in people leads to full employment and economic growth. For example, young people who complete Job Corps earn 15% more, commit fewer crimes, and spend less time on welfare," argues Frank O'Connor.

Regarding training programs, "Most studies show no effect on increasing incomes or lowering unemployment. Tens of thousands of low-income people have had no improvement in job prospects and no gain in earnings," contends Jeff Thompson.

Concerning training programs, "We need to satisfy the rising demand for highly skilled workers. Too many unskilled workers are seeking too few jobs, while too few workers are available for skilled positions," maintains Lloyd Jones.

About training programs, "80,000 'skilled' cosmetologists are produced per year, for a job market that only has room for 17,000. The government is avoiding its responsibility to create jobs for workers and not just workers for jobs," says Martin Knox.

#### Cued Recall Prompts

"... This increased demand results in companies hiring more workers to produce those goods"

"... As is, no one can support a family with these jobs"

"Less than 20% of these workers live in poor households—30% are teens working for spending cash . . ."

"National Bank put thousands of employees on part-time status the same year it posted \$1.4 billion in profits . . ."

**APPENDIX (Continued)**

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“The cost is too much for many companies to support full-time employees . . .”  
“ . . . As most job growth comes from small business, we shouldn’t discourage small businesses from taking on employees”  
“ . . . The difficulty of dismissing unproductive employees is paralyzing U.S. productivity”

“ . . . Interfering in these decisions violates the rights of private employers”  
“Investment in people leads to full employment and economic growth . . .”  
“Most studies show no effect on increasing incomes or lowering unemployment . . .”

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