FACILITATING TEXTUAL INTEGRATION WITH MACRO-STRUCTURE FOCUSING TASKS

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Students are often asked to integrate information derived from reading multiple documents into a consistent story or model. Based on models of comprehending individual text, we predict that the structure and accessibility of earlier texts should influence one’s ability to integrate a new text with previously learned material. In two experiments, we examined the facilitating effect of macro-structure focusing tasks on the integration of information from two texts. Experiment 1 found that having participants summarize a text before reading a subsequent text enhanced integration. Experiment 2 found that both answering macro-level questions and instructions to integrate resulted in a more integrated final representation.

Students routinely learn by reading multiple sources on the same topic such as textbooks, secondary sources, lectures, journal articles, and web sites. The goal of such reading is to acquire a single, integrated representation of situations, processes or objects described by the sources. Cognitively, we view multiple-text learning as involving a series of acquisition periods during which readers mentally represent the information from a source, re-activate related prior knowledge and form connections between the new information and the activated prior knowledge. This view leads one to expect that the extent of integration ought to depend on the amount of prior knowledge and the facility with which it can be activated in the context of the current text. In this paper, we present some results of our efforts to improve integration through the use of an intervening task designed to facilitate activation of prior knowledge.

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Representations of Multiple Texts

Learning by reading multiple texts involves the same processes and structures as single-text reading with a few additions for coordinating separate, possibly discrepant, representations and for handling document-level information. During single-text reading, readers are thought to construct a multi-level representation of the information in the text (Kintsch, 1998; van Dijk & Kintsch, 1983). This representation encompasses information at the literal surface code level as well as more abstract levels that are increasingly embellished through lexical and syntactic expansion (the textbase) and semantic elaboration (the situation model). The textbase itself also represents information at varying levels of abstraction. The represented information can be described propositionally at various levels of abstraction. Propositions that provide literal and specific information make up a text’s microstructure. More abstract propositions that describe global, general, relations (such as those found in headers and topic sentences) of the text form its macrostructure.

Readers of multiple texts on the same topic would presumably construct such representations for each text. Consider the case of a reader encountering a particular text after previously reading a related text as occurs when researching an historical controversy (Perfetti, Britt, & Georgi, 1995; Rouet, Britt, Mason, & Perfetti, 1996) or when reading incremental news articles (Johnson & Seifert, 1996, 1999; Millis & Erdman, 1998; van Oostendorp, 1996; van Oostendorp & Bonebakker, 1999). The reader’s goal is presumably to construct a single, integrated model of all the situations described by the various authors (Perfetti, Rouet, & Britt, 1998). To illustrate, consider the events from two texts presented in Table 1. The table lists the events in chronological order. A reader can form two very distinct representations of the texts with no between-text links, as depicted in Table 1, or a single, well-integrated representation containing many temporal inter-text links that connect the information from the two texts, as depicted in Table 2.

In addition to such interconnections among propositions, readers also acquire information at other levels of awareness. One might observe that a text cites a previously read text or that two books have the same publisher or both use the same type face. Thus, some connections may occur at the document level as well as at the situation and textbase levels. Similarly, the presence of
### TABLE 1. Key Events from the Two Related Experiment 1 Stories by Date of Occurrence and Story Segment.

<table>
<thead>
<tr>
<th>Item</th>
<th>Date</th>
<th>Event</th>
<th>Event presented in</th>
<th>Story segment</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>1804</td>
<td>US trick Indians into signing treaty</td>
<td>Text 1</td>
<td>Setting</td>
</tr>
<tr>
<td>2</td>
<td>Feb 1830</td>
<td>President authorized to remove Indians</td>
<td>Text 1</td>
<td>Setting</td>
</tr>
<tr>
<td>3</td>
<td>April 6, 1832</td>
<td>BlackHawk leads tribe to resist</td>
<td>Text 1</td>
<td>Obstacle</td>
</tr>
<tr>
<td>4</td>
<td>May 14, 1832</td>
<td>BlackHawk kill attackers</td>
<td>Text 1</td>
<td>Obstacle</td>
</tr>
<tr>
<td>5</td>
<td>June 15, 1832</td>
<td>Militia pursues fleeing Indians</td>
<td>Text 1</td>
<td>Climax</td>
</tr>
<tr>
<td>6</td>
<td>Aug 27, 1832</td>
<td>BlackHawk captured</td>
<td>Text 1</td>
<td>Climax</td>
</tr>
<tr>
<td>7</td>
<td>Sept 21, 1832</td>
<td>US signs treaty with Indians</td>
<td>Text 1</td>
<td>Resolution</td>
</tr>
<tr>
<td>8</td>
<td>Early fall 1832</td>
<td>End of conflict in Illinois and Wisconsin</td>
<td>Text 1</td>
<td>Resolution</td>
</tr>
<tr>
<td>1</td>
<td>1812</td>
<td>BlackHawk fought US in war of 1812</td>
<td>Text 2</td>
<td>Setting</td>
</tr>
<tr>
<td>2</td>
<td>July 10, 1830</td>
<td>Sauk Chief sold BlackHawk’s village</td>
<td>Text 2</td>
<td>Setting</td>
</tr>
<tr>
<td>3</td>
<td>June 26, 1831</td>
<td>US militia destroys Indian village</td>
<td>Text 2</td>
<td>Obstacle</td>
</tr>
<tr>
<td>4</td>
<td>May 2, 1832</td>
<td>One surrendering Indians killed by settlers</td>
<td>Text 2</td>
<td>Obstacle</td>
</tr>
<tr>
<td>5</td>
<td>May 19, 1832</td>
<td>Fleeing Indians raid 2 settlements</td>
<td>Text 2</td>
<td>Climax</td>
</tr>
<tr>
<td>6</td>
<td>Aug 1, 1832</td>
<td>Militia kills 850 fleeing Indians</td>
<td>Text 2</td>
<td>Climax</td>
</tr>
<tr>
<td>7</td>
<td>Aug 28, 1832</td>
<td>BlackHawk placed in Sauk Chief’s custody</td>
<td>Text 2</td>
<td>Resolution</td>
</tr>
<tr>
<td>8</td>
<td>Late Sept 1832</td>
<td>Remaining tribes give up lands</td>
<td>Text 2</td>
<td>Resolution</td>
</tr>
</tbody>
</table>

Multiple texts requires new types of connections. Two texts, for instance, might disagree about the date when some event occurred or one might be a more reliable source than another. Thus, inter-text connections must be able to represent tentative truth, discrepancy and other such qualities.

**Inter-Text Integration**

Readers often use information from various sources to aid in interpreting a current story or text. These sources can include prior
TABLE 2. Key Events from the Two Experiment 1 Stories Combined to Form an Integrated Single Story by Date of Occurrence, Story Mentioning the Event, and the Story Segment.

<table>
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<tr>
<td>9</td>
<td>May 19, 1832</td>
<td>Fleeing Indians raid 2 settlements</td>
<td>Text 2</td>
<td>Climax</td>
</tr>
<tr>
<td>10</td>
<td>June 15, 1832</td>
<td>Militia pursues fleeing Indians</td>
<td>Text 1</td>
<td>Climax</td>
</tr>
<tr>
<td>11</td>
<td>Aug 1, 1832</td>
<td>Militia kills 850 fleeing Indians</td>
<td>Text 2</td>
<td>Climax</td>
</tr>
<tr>
<td>12</td>
<td>Aug 27, 1832</td>
<td>BlackHawk captured</td>
<td>Text 1</td>
<td>Climax</td>
</tr>
<tr>
<td>13</td>
<td>Aug 28, 1832</td>
<td>BlackHawk placed in Sauk Chief’s custody</td>
<td>Text 2</td>
<td>Resolution</td>
</tr>
<tr>
<td>14</td>
<td>Sept 21, 1832</td>
<td>U.S. signs treaty with Indians</td>
<td>Text 1</td>
<td>Resolution</td>
</tr>
<tr>
<td>15</td>
<td>Late Sept 1832</td>
<td>Remaining tribes give up lands</td>
<td>Text 2</td>
<td>Resolution</td>
</tr>
<tr>
<td>16</td>
<td>Early fall 1832</td>
<td>End of conflict in Illinois and Wisconsin</td>
<td>Text 1</td>
<td>Resolution</td>
</tr>
</tbody>
</table>

texts (Britt, Perfetti, Sandak, & Rouet, 1999; Catrambone, 2002; Kintsch & Franzke, 1995; Wiley & Voss, 1999), outlines (DeeLucas & Larkin, 1995), and even movies and novels (Britt & Aglinskas, 2002; Seixas, 1994; Wineburg, 2000). Hartman (1995) outlines a general theory of intertextuality that includes five sources of integration: the text, the reader, the writer, the context, and the language. In the present paper, we are interested in examining the first two sources; how a reader’s representation of prior texts might influence the processing of a new text, and the extent to which a single, integrated situation model is constructed. A reasonable starting place for understanding between-text integrative
structures and processes (i.e., connecting representations from multiple sources) is to assume that they parallel within-text integrative structures and processes (i.e., connecting information within a source). With respect to representational structures of a second, related text (referred to hereafter as the target text), there should be a surface form, textbase, and situation model of the text.

Since the surface form is a copy of the verbatim representation, it should be identical to the representation of the same text read in isolation. As for the textbase, there are two levels to consider. A strict sense of the micro-structure of the textbase suggests that it should not be influenced by prior reading material since it is assumed to be relatively unelaborated and constructed without reference to prior information. More difficult to believe, however, is that the material that makes it into the macro-structure textbase is not influenced by prior knowledge. The representation that would be most definitely affected is the situation model of the target text. In the construction of the situation model, the reader incorporates information from various sources as long as it is activated by the information in the target text.

With respect to processes involved in activating prior related knowledge, research has shown that segments within a text are connected by both automatic and strategic mechanisms of integration (Magliano, Trabasso, & Graesser, 1999; Mckoon, Ratcliff, & Seifert, 1989; O’Brien & Myers, 1999). At an automatic level, features of the text can trigger the re-activation of related information in an automatic, bottom-up fashion through a process referred to as resonance (Albrecht & O’Brien, 1993; McKoon & Ratcliff, 1992; O’Brien & Myers, 1999; Ratcliff, 1978). Prior text elements with high contextual overlap with the current phrase can be re-activated, automatically, through resonance. For example, when reading terms like “BlackHawk,” “Indians,” “Northern Illinois,” and “1830,” the reader may automatically activate prior knowledge about these concepts and, if enough time occurs, associated concepts as well. Resonance can be triggered by overlap on situational dimensions such as time, space, causation, motivation, and protagonists (Zwaan & Radvansky, 1998). Such triggering is also sensitive to the time between readings. If the interval between readings of various texts is sufficiently protracted, the concepts in the prior text will require additional activation to reach threshold compared to the situation where the prior text has been read very
recently. The reader can use both the micro- and macrostructure of prior texts to enhance the search and retrieval of prior knowledge during the integration process.

In addition to the passive resonance process, readers can strategically search or construct meaningful relationships among events in the current and prior texts to create a more coherent representation (Graesser, Singer, & Trabasso, 1994). Thus at a strategic level, a reader’s goals or task can cause an active search for relevant prior information that would facilitate within-text integration. When a reader encounters an event that can be explained by an earlier event, coherence may be created by an active search back through the earlier text representation. For example, upon reading “BlackHawk fought the U.S.,” the reader may strategically search for related knowledge that they already know about these events. This search can be a cursory search (e.g., “Do I know anything about this topic?”) or a deep re-activation of specific facts (e.g., “BlackHawk thought that the US tricked the Indians into signing a treaty with the U.S.”). Of course the more detailed search requires more time and resources but will result in a greater degree of integration. Thus, both resonance and strategic search may be important in forming between-text integrative links.

One impediment to forming between-text links is that texts are not typically written to be read in conjunction with other texts, and, as such, they lack explicit clues for facilitating integration. Because authors generally attempt to write coherent texts, they often employ devices to aid the within-text integration process; however, explicit links between texts rarely exist (except in secondary sources). Therefore, the demands on the reader are greater, and the use of strategic mechanisms for integration will play a greater role in between-text integration than in within-text integration.

Enhancing Integration

In addition to considering the representation of the target text, the quality of all three levels of representations of prior text (surface, textbase, and situation model) should influence the potential impact that the prior text will have on the target text. A durable and persistent representation should be more highly accessible later and, as a result, should be more readily activated automatically through resonance. Also, a well-organized representation of
the prior text should lead to more efficient strategic searching during the reading of the target text. We refer to these combined features of the representation (i.e., durable and well-organized) as the Restructuring Hypothesis. According to this hypothesis, constructing a well-structured, elaborated representation of the initial text will aid in the between-text integration process in terms of both resonance and strategic search. A durable macro-structure representation entails organizing events into a compact higher level representation either during or after reading the text. This structure then allows related chunks of events or information to be accessed efficiently without a linear search through the entire text. Integration can be accomplished by accessing information in these chunks either through resonance of lower level information in the chunk spreading activation up to the higher structure unit and back down to related information or by strategically searching through the higher structure units until targets are located.

Prior research on single text comprehension has shown that tasks that focus on the higher level structure of an expository text can facilitate learning by influencing the stability of the representation and readers’ strategic processing. For example, Andre (1990) found that high-level application questions lead to a more stable representation of the text as measured by a delay posttest. Thus, it is reasonable to assume that tasks designed to focus on the higher level representation would enhance the stability of the representation of the initial text. As for the effect of a well-organized representation, Sagerman and Mayer (1987) found that a series of higher level adjunct questions facilitates learning from future texts by adjusting strategic processing. Thus, it is reasonable to assume that tasks that focus on the higher level processing would enhance strategic processing of the texts. Based on these results from single text research, the current experiments will manipulate both task, to enhance the stability and organization of the initial text, and instructions, to enhance strategic processing.

One type of strategic mechanism that is commonly employed within texts is to summarize information. A summary is, in effect, a reactivation of a text’s macrostructure (Kintsch, 1988). One can produce summaries at multiple levels of macrostructure abstraction. For instance, a 2,000-word text can be summarized by a 500-word, 250-word, or 50-word macrostructure summary. All of these summaries will be related hierarchically in terms of degree of
abstraction. To form a summary, the reader selects only the most important information, omits details and less important events, collapses similar events into a single event, and makes inferences from prior knowledge (Kintsch & van Dijk, 1978). Activities that focus a reader’s attention on creating or reactivating a prior text’s macrostructure ought to enhance integration. A highly-structured, coherent representation of the text should allow for more efficient search and retrieval when reading a subsequent related text, thereby facilitating the integration of the current text with information from prior texts.

There are, however, individual differences in readers’ tendency to construct a macrostructure summary of a text. Not all readers do this automatically (Brown & Day, 1983; Lorch & Lorch, 1985). Therefore, aiding readers’ attention to the macrostructure, either by having them write a summary or answer questions about macro-level information in the text ought to ensure the creation of macropropositions or a restructuring of existing ones.

Overview of Experiments

In two experiments we investigated whether giving students an intervening task between the readings of two related texts affects the degree to which they form an integrated representation of the information from the two texts. In both experiments, participants read two texts that describe the same situation from different perspectives. Between readings, participants in Experiment 1 either wrote a macro-structure summary of the first text or continued immediately to the next text. In Experiment 2, all participants received an intervening task that either focused their attention on the macro-structure or the micro-structure of the first text. Experiment 2 also manipulated reading instructions to determine the extent to which integration is spontaneous in college readers. Participants were either asked to read for comprehension or to form an integrated single story. After reading the texts, the participants from both experiments were given a content recognition task wherein they judged whether each event in a series was present in either text. Then they were given a test of integration in which they chronologically ordered the target items (time-line task in Experiment 1) or they selected the event that immediately followed the target event in time (integration task in Experiment 2).
The current experiments examine whether the type of intervening task influences the extent of integration across related texts. According to a Restructuring Hypothesis, tasks or instructions that lead to a more durable, well-structured representation of an initial text will improve integration of multiple texts. Thus, the Restructuring Hypothesis predicts that the Macro-structure summary (Experiment 1) and Macro-structure question answering (Experiment 2) should lead to the highest integration scores by creating an efficient structure for automatic and strategic search. Similarly, the Integration Instruction conditions (Experiment 2) should lead to higher integration scores than the Comprehension Instructions because students will be able to intentionally structure their initial text representation for integration.

Experiment 1

In Experiment 1, participants were given either a Macro-structure intervening task between the readings of two texts or allowed to immediately read the next text with no break. The Macro-structure Summary task requires readers to write a short summary of the first text which should provide both high level restructuring of the first text as well as prolonged attention to the material.

Method

Participants

Twenty-eight undergraduates at Northern Illinois University participated in this experiment and received course credit for participating. The single session lasted approximately one hour.

Texts

Participants read two short narrative texts that were each approximately 600 words in length. Each text described the same historical event, the United States gaining control of the Illinois Territory from the Sauk and Fox Indian tribes, but each text described the events from a different perspective. The first text was critical of the U.S. government’s methods of acquiring the Indian lands. The second text supported the role of the United States in the actions taken to gain control of more land for westward expansion. Each text began with a brief description of the source
of the excerpt including the author’s name, book title, publisher, publication year, and page numbers. This source information was fabricated by the experimenters and was intended to create a sense of authenticity and credibility for the texts. Participants were later informed that the sources were fictitious.

The pair of experimental texts described a common series of events from different perspectives. In order to require between-text integration, the story was segmented into 4 parts (i.e., Setting, Obstacles, Climax, and Resolution), and 4 events were selected as target events for each part. Table 2 lists these 16 target events in correct chronological order. These events were then paired-up chronologically and one event from each pair was randomly assigned to the first text. The other paired event was then included in the second text. For example, the first two early setting events were paired up and the first, “US trick Indians into signing treaty,” was randomly assigned to be mentioned in the first text. This meant that the other event, “BlackHawk fought US in war of 1812,” was mentioned in the second text. The text to which each event was assigned is presented in the 4th column of Table 2. All 8 target items in each text were explicitly marked with a statement including the exact date when the event occurred as shown in column 2. Participants attempting to represent the complete story in correct chronological order would have to merge the information from the two texts at fourteen different points in the story. In addition to the target events, each text contained other necessary common events as well as elaborations to those target events.

PROCEDURE AND DESIGN

Participants were told that they would be reading two texts that presented a different perspective on the same historical event. They were also told that after reading both texts, they would be asked to write an essay as well as answer some questions regarding the information provided in each text. Then all participants were given the first text to read. When they were done reading, participants returned the text to the experimenter and were randomly assigned to one of two conditions: Macro-summary task or No Break. Participants in the Macro-summary condition were given up to 3 minutes to write a 3–4 sentence summary of the first text. When finished, participants turned in their summary, and they were given the second text to read. Participants in the No Break condition
received the second text to read immediately after turning in the first text.

After participants finished reading the second text, it was removed, and they were given a content recognition task in which they had to mark which of 32 events were mentioned in the readings. Half of the events on this list were present in one of the texts (that is, the 16 target events in Table 2) and half were not presented in either text. Half of the target events were mentioned in the first text and half were mentioned in the second text. Then, as a measure of integration, participants were given a time-line task in which they were given the 16 target events in a random order and were asked to put them in the correct chronological order from earliest to latest.

Results and Discussion

CONTENT RECOGNITION

The mean percentage of correctly recognized events for each condition are presented in Table 3. There was no significant difference in the percentage of content recognized for each condition, $t(26) = 1.20$, $p = 0.24$. Thus, the macro-structure intervening task did not improve overall retention of information from the texts.

INTEGRATION

As a measure of integration, participants completed a time-line ordering task in which participants chronologically ordered the 6 target events from earliest to most recent. To obtain an integration score, an event was counted as correct if it did not precede an event already placed before it by that participant. The percentage of correctly ordered items is shown in Table 3. An independent

<table>
<thead>
<tr>
<th>TABLE 3. Mean Percentage of Accurate Responses on the Content Recognition and the Time-Line Task (Standard Deviations in Parentheses).</th>
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<tbody>
<tr>
<td><strong>Experiment 1</strong></td>
</tr>
<tr>
<td>Macro-summary task</td>
</tr>
<tr>
<td>No break</td>
</tr>
</tbody>
</table>
t-test revealed a significant effect of Intervening Task, $t(26) = 2.14$, $p < 0.05$. The Macro-structure task led to better integration of material from the texts.

Overall, the results from Experiment 1 suggest that writing a summary of the first text improves participants’ ability to form an integrated representation. This finding provides initial support for the Restructuring Hypothesis. Participants writing a macro-summary formed a more integrated representation than those not writing such a summary. However, the improved integration may be a result of spending time focusing on the first text’s information is enough to aid integration without necessarily focusing on Macro-propositions. In Experiment 2, we manipulated the type of activity between readings (Macro-structure vs. Micro-structure questions) in order to test whether the enhanced integration was due to more time spent thinking about the text or due to the construction of a high-level macro-summary.

**Experiment 2**

Experiment 2 tested whether the level of text structure that readers focus on between readings influences integration. Rather than writing a summary, students were asked to answer questions about the macro-structure or micro-structure. In addition, the strategic nature of integration is addressed by instructing students either to read for comprehension or to read for integration. Prior research has shown that high-school students do not spontaneously integrate information from multiple texts without explicit instructions to do so (Britt, Goldman, & Perfetti, 1999). For a college student population, it is predicted that many will spontaneously integrate; however, like high-school students, some may need direct instruction to integrate. Explicit instruction may remind or prompt participants to strategically search for connections while reading. In this experiment we used a 2 (Intervening task) $\times$ 2 (Instructions) factorial design with an additional control group of students who were asked to read a text in which all of the events were presented in the correct chronological order in a single text. This Single-Integrated Text condition provides a measure of performance on each test when the integration of events was already completed by the author. It provides a bar against which we can assess the extent of integration induced by each of the other four
conditions. A prior Dunnett’s test will be used to compare each condition to the Single-Integrated Text baseline condition.

**Method**

**PARTICIPANTS**

One-hundred and forty-five undergraduates at Northern Illinois University participated in this experiment and received course credit for participating. The single session lasted approximately one hour.

**TEXTS**

Participants read two short narrative texts that were each approximately 800 words in length. These texts described a different historical event than the one used in Experiment 1: The United States obtaining the rights to build the Panama Canal in 1903. As in Experiment 1, both texts presented several well-established facts and events as well as several unique or controversial facts and events. These unique targeted events were temporally ordered and then numbered. The even numbered events were assigned to the first text and the odd numbered events were assigned to the second text. Table 4 shows the 16 targeted events across the two texts and the actual texts are presented in the Appendix. The date of each target event was mentioned with the event to ensure that participants could construct the correct temporal order across texts.

**DESIGN**

The design was a $2 \times 2$ factorial design with an additional control group. The first between-subjects factor, Reading Instructions (Comprehension vs. Integration), was manipulated prior to reading. Participants in the comprehension group were given standard comprehension instructions with the goal of later answering general questions about the texts. Participants in the integration group were told that they were going to read two conflicting perspectives of a story, so they should compare and contrast the information provided by the two authors when learning the complete story. The second between-subjects factor, Intervening Task (Macro-questions or Micro-questions), was manipulated immediately after reading the first text. The Macro-question participants were given 5 short-answer questions focusing on the Macro-structure.
TABLE 4. Key Events from the Experiment 2 Stories Combined to Form an Integrated Single Story by Date of Occurrence, Story Mentioning the Event, and the Story Segment.

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<td>1</td>
<td>1846</td>
<td>U.S.-Colombia treaty for passage</td>
<td>Text 1</td>
<td>Setting</td>
</tr>
<tr>
<td>2</td>
<td>1848</td>
<td>Gold discovered in California</td>
<td>Text 2</td>
<td>Setting</td>
</tr>
<tr>
<td>3</td>
<td>1855</td>
<td>Railroad across Panama completed</td>
<td>Text 1</td>
<td>Setting</td>
</tr>
<tr>
<td>4</td>
<td>1898</td>
<td>U.S. war with Spain</td>
<td>Text 2</td>
<td>Setting</td>
</tr>
<tr>
<td>5</td>
<td>May, 1900</td>
<td>French abandon their canal attempt</td>
<td>Text 1</td>
<td>Obstacle</td>
</tr>
<tr>
<td>6</td>
<td>1901</td>
<td>Spooner Act enables U.S. to pursue canal</td>
<td>Text 2</td>
<td>Obstacle</td>
</tr>
<tr>
<td>7</td>
<td>Early 1902</td>
<td>Nicaragua is initial recommendation</td>
<td>Text 1</td>
<td>Obstacle</td>
</tr>
<tr>
<td>8</td>
<td>Jan, 1903</td>
<td>U.S.-Col. negotiate for permission</td>
<td>Text 2</td>
<td>Obstacle</td>
</tr>
<tr>
<td>9</td>
<td>Aug, 1903</td>
<td>Pans act our of fear of losing canal</td>
<td>Text 1</td>
<td>Climax</td>
</tr>
<tr>
<td>10</td>
<td>Oct, 1903</td>
<td>BunauVarilla met President Roosevelt</td>
<td>Text 2</td>
<td>Climax</td>
</tr>
<tr>
<td>11</td>
<td>Early Nov 3</td>
<td>U.S.S. Nashville arrived in Panama</td>
<td>Text 1</td>
<td>Climax</td>
</tr>
<tr>
<td>12</td>
<td>Late Nov 3</td>
<td>U.S. shuts down the railroad in Panama</td>
<td>Text 2</td>
<td>Climax</td>
</tr>
<tr>
<td>13</td>
<td>Nov 6, 1903</td>
<td>U.S. recognized Pan independence</td>
<td>Text 1</td>
<td>Resolution</td>
</tr>
<tr>
<td>14</td>
<td>Nov 15, 1903</td>
<td>U.S.-Pan. negotiate for permission</td>
<td>Text 2</td>
<td>Resolution</td>
</tr>
<tr>
<td>15</td>
<td>1904</td>
<td>Spray water with insecticide</td>
<td>Text 1</td>
<td>Resolution</td>
</tr>
<tr>
<td>16</td>
<td>1906</td>
<td>Roosevelt visited the construction site</td>
<td>Text 2</td>
<td>Resolution</td>
</tr>
</tbody>
</table>

These were *why* and *what happened* questions such as “Why did President Roosevelt send the *U.S.S. Nashville* to Panama?” The Micro-question participants were given 5 questions about the same events but instead focused on Micro-structure details. These questions were where and how many questions such as “How many marines did President Roosevelt send to Panama aboard the *U.S.S. Nashville*?” In addition to the Intervening Task and Reading Instruction factors, a Single-Integrated Text condition was also
included in which participants read only a single text with the 16 events in the correct chronological order (See Table 3). This serves as a baseline for comparing the extent to which the other conditions create integrated representations.

PROCEDURE

The procedure was similar to the first experiment. First, participants were given their reading instructions and were asked to read the first text. After reading and returning the first text to the experimenter, participants received the intervening macro- or micro-structure questions to answer from memory. When they were done answering the questions, participants turned them in and were given the second text to read. After turning in the second text, participants were asked to recall the story in a chronologically correct order. Then they were given the content recognition test as in Experiment 1. Finally, participants were given a forced-choice test of integration which was comprised of a list of 20 events from the two texts, from which they were to select one of two stated events that occurred next in the sequence in actual time. There were two types of items: within-text and between-text items. Within-text items could be correctly answered by referring to a single text. The questioned event was an event immediately preceding the answer item in the same text. These items did not require integration, just a representation of each text. In contrast, the answer to the between-text items was always an event from the other text. For each between-text item, one of each pair of responses occurred immediately after the questioned event but was mentioned in the other text (i.e., correct choice). The other option of each pair of responses occurred after the correct event but was the next item in the same text (i.e., incorrect choice). Because the events were constructed to alternate in time between the two texts, an integrated representation of the two texts involved interweaving new (i.e., text 2) and old (i.e., text 1) events. All items and possible response items were mentioned in one of the texts and each was date-stamped in the texts but that date information was excluded from the test item.

Results and Discussion

Participants who failed to complete at least 50% the intervening task correctly were excluded from the data analysis. This resulted
in 5 participants being dropped from the Macro-questions Integration and the Micro-questions Comprehension conditions and 4 participants from the Micro-questions Integration and the Macro-questions Comprehension conditions, respectively.

**CONTENT**

Memory for content was measured in two different ways in order to assess both recognition and recall of content. The recognition results for content are shown in Table 5. The mean percentage of correctly recognized content events were analyzed with a 2 factor between-subjects ANOVA with Reading Instruction (Comprehension vs. Integration) and Intervening Task (Macro-questions vs. Micro-questions) as the factors. There was a significant effect of Reading Instruction, \( F(1, 98) = 4.047, p < 0.05, \) with Comprehension instructions leading to more accurate recognition (\( M = 83.97\% \)) than Integration instructions (\( M = 80.96\% \)). There was also a marginally significant effect of Intervening Task, \( F(1, 98) = 3.405, \ p = 0.068, \) with participants who were asked Macro-questions (\( M = 83.85\% \)) recognizing content slightly better than those asked Micro-questions (\( M = 81.09\% \)). The interaction between Reading Instruction and Type of Intervening Task was not significant, \( F(1, 98) = 0.621, \ p = 0.433. \)

Separate a priori analyses comparing each group to the participants that read the Single-Integrated Text using Dunnett’s test found no significant differences. In terms of recognizing the content, there was no serious cost to reading the material across texts or reading with different goals. Each treatment group recognized

<table>
<thead>
<tr>
<th>Condition</th>
<th>Content recognition</th>
<th>Targets in recall</th>
<th>Integration task</th>
<th>Switches in recall</th>
</tr>
</thead>
<tbody>
<tr>
<td>Comprehension instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macro-questions</td>
<td>85.94 (6.6)</td>
<td>5.38 (2.5)</td>
<td>2.58 (2.0)</td>
<td>2.42 (1.7)</td>
</tr>
<tr>
<td>Micro-questions</td>
<td>82.00 (7.8)</td>
<td>4.16 (1.4)</td>
<td>2.00 (1.9)</td>
<td>1.36 (1.2)</td>
</tr>
<tr>
<td>Integration instruction</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Macro-questions</td>
<td>81.75 (8.3)</td>
<td>5.52 (2.8)</td>
<td>1.40 (2.1)</td>
<td>2.28 (2.0)</td>
</tr>
<tr>
<td>Micro-questions</td>
<td>80.17 (7.4)</td>
<td>4.31 (2.3)</td>
<td>1.77 (2.1)</td>
<td>1.96 (1.7)</td>
</tr>
<tr>
<td>Single-integrated text</td>
<td>81.12 (10.8)</td>
<td>6.24 (2.7)</td>
<td>0.60 (2.5)</td>
<td>3.40 (2.2)</td>
</tr>
</tbody>
</table>
the same amount as the group reading the text as a single coherent story \( (M = 81.12\%) \). However, using this Single-Integrated Text group as a baseline shows that the significant main effect of Instruction was actually due to a slight improvement in the Comprehension Instructions along with a slight decrease in the Integration Instructions. The marginally significant effect of Intervening Task was due to only a slight improvement in the Macro-questions task.

The second measure of content memory was the number of target items in the participants’ free recalls. The number of target items (of 16 possible) mentioned in each group’s essays is presented in Table 5. A Reading Instruction × Intervening Task between-subjects ANOVA revealed only a significant effect of Intervening Task, \( F(1, 98) = 6.954, p < 0.05 \). The Macro-questions led to better content recall \( (M = 5.45) \) than the Micro-questions \( (M = 4.24) \). A priori analyses comparing each group to the Single-Integrated Text condition using Dunnett’s test found that the Single-Integrated Text group \( (M = 6.24) \) differed only from the two Micro-questions groups. Thus, the Macro-questions lead to recall equivalent to the Single-Integrated text but the Micro-questions impaired recall. The Intervening Task’s main effect was due to poorer recall by the Micro-question condition compared to baseline performance.

These results indicate that both reading instructions and the type of intervening activity influenced content memory. Reading Instructions affected the recognition of content—Comprehension Instructions led to a higher percentage of content correctly recognized than Integration Instructions. The type of intervening task had an effect on both measures of content. Macro-questions lead to marginally better content recognition and the recall of significantly more target events.

INTEGRATION

As with content, there were two complementary methods of integration: A measure that relied on recognition (forced-choice Time-Line task) and a measure that relied on free recall (source switches in recall).

The forced-choice Time-Line task involved selecting the event that occurred immediately after the target event in real time. For the within-text items, the chronologically correct answer was from the same text; for the between-text items, the chronologically
correct answer was from the other text. Table 5 shows the difference in the number correct for the between-text and within-text items. Lower scores mean that participants were performing as accurately on the between-text integration items as the within-text items. Higher scores indicate a bias towards the next item within the same text. A Reading Instruction × Intervening Task between-subjects ANOVA found a marginal effect of Reading Instruction, $F(1, 98) = 3.026, p = 0.085$. There was a trend toward the integration instruction group ($M = 1.59$) integrating more than the comprehension instruction group ($M = 2.29$). The more interesting analyses are the set of a priori tests comparing each group to the Single-Integrated Text condition as a baseline using Dunnett’s test. The Single-Integrated Text group ($M = 0.60$) differed only from the Macro-questions with Comprehension Instructions group ($M = 2.58$) and marginally from the Micro-questions with Comprehension Instructions group ($M = 2.00, p = 0.075$). Thus, the Integration Instructions resulted in a better integrated representation than the Comprehension Instructions. This pattern of instruction effects is consistent with the content results. In both cases, instructions led to improvement on the recognition measure except that while Comprehension Instructions were helpful for content, Integration Instructions were helpful for integration.

A second measure of integration was the extent to which the target events switched between the two texts in the free recalls. Source switches were counted each time a subsequent event mentioned in a recall came from a different text than its preceding event. So if the first event mentioned was from text 1, the second event was from text 2, and the third event was from text 1, that would count as 2 switches. By examining the number of switches between text 1 and text 2 in students’ recalls, we can look for evidence of integration. For instance, if the participant recalled several events from the first text and then several events from the second text, this would count as only one switch and indicate poor integration. At the other extreme, if a participant recalled all of the target events in the same order as presented in the Single-Integrated text, then there would be 15 switches, indicating maximal integration. Table 5 shows the average number of switches for each condition. A Reading Instruction × Intervening Task between-subjects ANOVA found a significant effect of Intervening Task, $F(1, 98) = 4.255, p < 0.05$. Macro-questions lead to more
integrated recalls ($M = 2.35$) than Micro-questions ($M = 1.66$). Dunnett’s a priori comparisons of each group to the Single-Integrated Text condition found that both Micro-questions groups differed from the Single-Integrated Text group ($M = 3.40$). Thus, the type of Intervening Task influenced the extent of integration in the recalls with Macro-questions resulting in a better integrated representation than Micro-questions. The Macro-question task produced integration levels similar to that of the Single text but the Micro-question task did not. Again, the recall results were influenced by the type of intervening task.

These results suggest that the extent to which participants form an integrated representation is influenced by both Reading Instruction and Intervening Task. As was the case from measures of content, Reading Instructions influenced recognition and Intervening Task influenced recall. The groups instructed to integrate did, in fact, have better integrated representations as measured by the Time-line task. The groups given the macro-question task between readings produced recalls with more switches between texts than those who received the micro-question task. The Macro-question group made a similar number of switches to the single text group whereas the Micro-question group made slightly fewer. This pattern of results is consistent with those of Rawson and Kintsch (2002) who found that providing a background text led to better recall of a subsequent text but not better recognition. By increasing the organization of the text representation, the Macro-question task enables better access to the information at the time of recall.

**General Discussion**

The results from both experiments support the Restructuring Hypothesis. A task that supports the construction of a well-structured initial representation of a text prior to reading a subsequent text will aid in the between-text integration process. In Experiment 1, the Macro-structure summary resulted in better integration of events than the No break condition. Experiment 2 showed that the type of intervening task influenced the degree of integration not just the presence of an intervening task. The recalls from Experiment 2 were more integrated when participants answered macro-questions compared to micro-questions. Furthermore, only the micro-question recalls were significantly less integrated than the
Single-Integrated baseline text. In accordance with the Restructuring Hypothesis, material from the first text needs to be restructured prior to reading subsequent material for enhanced integration. This aid to integration did not come at a cost to learning content. In fact, in both recognition and recall, the Macro-questions led to slightly better content memory than the Micro-questions.

Further support for the Restructuring Hypothesis comes from the effect of the instructional manipulation on the time-line integration task. Participants reading two texts under general comprehension instructions were more within-text focused as shown by the poorer performance than the Single-Integrated text participants on this time-line integration task. Furthermore, the participants instructed to integrate the two texts were marginally better than those reading for general comprehension on this integration task. These results support the presence of a strategic component to integration. Actively engaging in processes to search for relations between texts improves the extent of integration in the final representation. This influence of instruction is also consistent with prior findings with high-school students that not all readers spontaneously engage these processes to integrate related information.

One caveat to instructing students to integrate, however, is that there appears to be a cost associated with general content memory. At least for the recognition task, the comprehension instructions resulted in better memory for content than was found with the integration instructions. This suggests that perhaps there may be a cost to strategic integration processes when learning from texts. Poorer content recognition may result from readers focusing on constructing a Documents Model (Perfetti et al., 1999)—a secondary representation of the between-text links. Links that are not facilitated by the author of the individual texts required additional resources that may divert critical resources from the construction of representations of the individual texts. Perhaps the poorer content recognition with integration instructions can be avoided by having students comprehend each text first, individually and only later have them integrate the information across texts. Further research will need to be done to examine this relationship and its implication more thoroughly. However, it should be noted that there was no cost in terms of recall.

These results suggest that readers who form a well-structure representation of a text will be better able to recall the content of
Facilitating Textual Integration

the text and search this representation later when constructing a general understanding of the combined situation described across texts. A robust higher-level structure enables efficient searching through organized chunks. In the case of reading history texts, between-text mapping may be highly temporal. To the extent that temporal information is available with the macro-structure, then integration is a matter of temporally organizing these higher-level chunks. The alternative is a serial search through the text at each point of integration or a passive resonance which would not be possible for events that do not overlap in time or space with events from the prior texts.

There are several educational implications of these experiments. First, students should not merely read several related texts without taking a break to solidify each text’s overall representation. Not taking a break leads to poorer integration scores. Therefore, students working on research papers or learning from multiple sources could benefit from writing short summaries of each article on note cards thereby enhancing the extent to which they can properly organize and structure the information into a coherent “situation.” Similarly, other forms of discourse such as teacher directed questions in class discussion may also aid in readers in forming a more integrated representation (Lenski, 2001).

Second, these results are consistent with research suggesting that not all college students spontaneously solidify a macrostructure representation of a text. This is supported by the effect of the improved integration due to the macro tasks in both experiments. If all participants formed strong macrostructures, then performance should not be improved by such activity. Thus, activities that help students create a strong macrostructure may enhance their content learning and their integration of this content with subsequent material such as lectures and future textbook chapters.

Finally, there is a strategic component to integration, and it appears that, like the high-school students, not all college students spontaneously engage in an active search for integration. However, there is also a cost to content memory when strategically integrating.

There are several points of interest that can be examined in future research. First, the texts from both experiments were locally and globally coherent. It may be the case that points of low coherence lead to increased spontaneous integration to provide
coherence. According to the constructivist view, readers are driven
to construct a coherent representation of the discourse and when
resonance fails, the reader will search for meaning (Graesser et al.,
1994). Perhaps readers would engage in a higher degree of inte-
gration with texts that have coherence breaks that would require
background knowledge to fill in. Second, strong effects of text
structure on integration may be found when the second text is
read after a short delay, which is often the case in real-life situa-
tions. The positive effect of structure on efficient search may be
more pronounced. In this case, the reader may be less able to rely
on passive resonance and therefore the strategic integration pro-
cesses may play a greater role. Given the importance of learning
from multiple texts and across situations, it is important that we
learn more about what factors influence this process.

Note
1. Participants were also asked to determine the source of each event mentioned,
   first author or second author. This data is not presented here.

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Appendix

The Two Texts from Experiment 3

Note. The target items are underlined here to highlight the manipulation but were presented to participants in regular font.


The United States decided it needed to build a canal because the travel routes between the Atlantic Ocean and Pacific Ocean were much too time consuming. In order to do so, the United States had to negotiate with Colombia because, at the time, Panama was a Colombian colony. In 1846, the United States negotiated and signed the Bidlack Treaty with Colombia to obtain the right to cross Panama by any means. It also gave the U.S. the right to protect the land and anything they built there. In exchange, the United States agreed to guarantee Colombia’s sovereignty over Panama and to guarantee the neutrality of the isthmus. This was an
important first step to getting permission to use the land for a canal and to prevent other countries from trying to block the United States out.

Since it was not possible to build a canal immediately, the United States decided to build a railroad across Panama to connect the two oceans. In 1855, after 5 long years of toil, workers completed the railroad across Panama. It cost $8 million dollars, and its construction took the lives of more than 800 workers. During the next 14 years, as a result of all the railroad traffic, the Isthmus of Panama became the crossroads of the Western world. For a short time, this quelled American desires for a canal.

It was not long before international interest in a canal increased. In fact, in the years following, a French group attempted to build a canal after successfully building the Suez canal. Their work, however, was continually set back by landslides and disease. More importantly, it was discovered that the actual design of the canal itself was not appropriate for the land in Panama. In May 1900, the French gave up their canal attempt leaving their earth-moving equipment to rust and disappear in the jungle. They had completed two-fifths of their planned excavations, but even this effort proved of little assistance to those who later completed the canal project.

While the United States was relieved at this outcome, they knew it was only a matter of time before another foreign power would succeed. This increased the desire for an American-controlled canal as soon as possible. As a result, the United States government set up a commission to look for a place to build a canal. Central America was perfect because the land between the two oceans was so narrow. In early 1902, the Walker commission made an initial recommendation of Nicaragua for the canal location primarily because Nicaragua would be less expensive than Panama. A volcano had erupted in Nicaragua several years earlier, so they decided it was not safe to build there. This led the commission to change its recommendation to Panama. The commission also decided that the United States should offer $40 million for the rights to build a canal there. However, Colombia owned Panama and was asking for $100 million dollars for the rights to the land for building a canal.

The United States knew that the Panamanian people were not happy being ruled by Colombia. They felt that the Colombians ignored the Panamanians’ needs and because the wealthy Panamanians were tired of sharing their wealth with the Colombians. So in August of 1903 when the United States became frustrated with Colombia, the Panamanians’ fear of losing the canal grew to the point of action. When U.S. President Theodore Roosevelt learned that the Panamanians were going to revolt, he ordered the military to send a ship to the region to keep the peace in Panama. The U.S. wanted to make sure that the situation did not get out of hand in Panama. Early on the morning of 3rd of November 1903, the U.S.S. Nashville arrived in Panama with a small military force of 42 Marines. By noon on November 3, 1903, the Panamanians revolted. Quickly and without any bloodshed, the Panamanians gained their independence. Then, only days
later on November 6, 1903, the United States recognized Panama as an independent country. This action made sure that Colombia could not recover its lost territory. Colombia’s president visited Washington to protest, but instead Roosevelt convinced Colombia to officially recognize the new Panamanian government.

The United States immediately began building its canal. The next battle was against disease. America was determined that its workers would not meet with the same mortality rates the French had encountered during its attempts at construction. Recent research by Dr. Walter Reed identified that mosquitoes were the bearers of the main tropical diseases killing workers: yellow fever and malaria. So, in 1904, the first act was to set the troops to work covering all standing bodies of water with insecticide. The method worked in making the zone pest-free. Then, construction was only hampered by digging through swamps and avoiding deadly landslides. Finally, the canal opened during a ceremony when the first ship passed through the 40-mile long canal.


The United States had long wanted to build a canal for quicker travel from the east to the west coast. One event in particular increased their desire. In the 1800s most Americans lived on the East Coast, but in 1848 gold was discovered in California. Many Americans wanted to travel to the West quickly to make their fortune. However, with no railroad across the United States, ships had to travel all the way around the southern tip of South America. The United States decided it needed to shorten the journey to California.

No action was taken, however, until the military need for a canal became extremely apparent several years later. In 1898, the United States was involved in a war with Spain because they believed that Spain had sunk a U.S. battleship stationed in a Cuban Harbor. During this war, a U.S. warship took two months to travel all the way around South America to arrive at the battle. When the United States won this war with Spain, it gained new territories that it would have to protect. So now it was abundantly clear that the United States needed a canal for defensive purposes.

As a result of this increasing desire for a canal, in 1901, Congress passed the Spooner Act, authorizing the President to acquire the right to build a canal. The Spooner Act further provided the President $40 million dollars to purchase the land for the canal. This enabled the United States to now obtain permission from Colombia to build in Panama. So in January of 1903, the United States began negotiations on the Hay-Herran Treaty with Colombia to obtain permission to build a canal in Panama. The treaty would give the United States the right to build a canal in Panama and allow the United States to rent the land for 99 years. The
treaty said that both Colombia and the United States would control the land around the canal. The Colombian Congress, however, rejected this treaty. They felt that it gave the United States too much control over their land. They also felt that they deserved more money from the United States.

This rejection made the United States upset. Theodore Roosevelt, the U.S. President at the time, felt the U.S. government had been more than fair. He told the Colombians that if they did not sign the treaty, the United States would build a canal somewhere else. At the same time, a Panamanian revolutionary named Philippe Bunau-Varilla was in Washington, DC. October of 1903 Bunau-Varilla met with President Roosevelt and told him that a revolt in Panama was about to occur. He asked Roosevelt if the United States would help the Panamanians. Roosevelt did not say yes, but he implied that it would support the revolutionaries.

On November 3, 1903, the Panamanians rebelled against the Colombians. Early on the afternoon of November 3rd, the U.S. shut down the railroad in Panama. They did this so that neither the Panamanians nor the Colombians would use it to transport troops thereby protecting the railroad property. Not surprisingly, the revolution was successful. It only took three days for the Panamanians to gain their independence and no shots were even fired.

Without delay on November 15th, the United States began negotiations on the Hay-Bunáu-Varilla treaty with Panama to obtain the rights to build a canal. Secretary of State John Hay, the chief U.S. negotiator, met with Philippe Bunau-Varilla to work out an agreement. Bunau-Varilla was the chief negotiator for the Panamanians. Two other Panamanian negotiators arrived in Washington to help negotiations, but the treaty was already signed before they arrived. The Hay-Bunau-Varilla treaty gave the United States the right to build a canal in Panama and have complete control over this canal zone.

This deal was better than the United States could have hoped for. They immediately began construction on the canal in 1904. There were many obstacles that had to be overcome, and the challenge was great. President Roosevelt was so pleased with his accomplishment that in 1906 he visited the construction site. It was the first time in American history that a President had traveled outside the United States while in office. Roosevelt was not disappointed. The work was proceeding well, and in 1914, the canal opened during a large ceremony of flags and ships. The canal was a vital part of travel for the next seventy years.