2002

EFFECTS OF SEDUCTIVE AND BORING DETAILS ON READERS' COMPREHENSION OF EXPLANATORY TEXTS

Gregory Scott Johnston
University of Kentucky, scottjohnston@mail.com

ABSTRACT OF DISSERTATION

Gregory Scott Johnston

The Graduate School

University of Kentucky

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A dissertation submitted in partial fulfillment of the
requirements for the degree of Doctor of Philosophy in the
College of Arts and Sciences
at the University of Kentucky

By
Gregory Scott Johnston
Lexington, Kentucky
Director: Dr. Robert Lorch, Professor of Psychology
Lexington, Kentucky
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EFFECTS OF SEDUCTIVE AND BORING DETAILS ON READERS' COMPREHENSION OF EXPLANATORY TEXTS

Two experiments were conducted that examined the effects of tangential information on readers' comprehension of explanatory texts. Participants were recruited from Introduction to Psychology courses. They were assigned to read one of three versions of a text (i.e., a base-text version, a base-text plus seductive details version or a base-text plus boring details version) about the process of lightning or the lifecycle of a white dwarf star. In Experiment 1, participants were told they had to write down everything they could remember from their passage when they finished reading. The base-text group recalled more of the core content than either of the other two groups. Lengthening a text by adding tangential information interfered with readers' ability to recall the information. More interestingly, the boring details group recalled more core content than the seductive details group. The degree of interestingness of the tangential information had an independent effect on readers' memory. Reading times were also recorded and analyzed. The seductive details group spent less time reading the core content of the passage than either the base-text and boring details groups, which did not differ. The presence of seductive details reduced the amount of attention readers allocated to processing the core content of the passage.

In Experiment 2, readers were told that they had to verify whether or not certain sentences were presented in the passage they just finished reading. Reading times did not differ among the three groups. A post-hoc analysis of reading times across experiments revealed that participants in Experiment 1 spent more time processing the passages than those in Experiment 2. This suggests that changing the memory task from free-recall to a recognition-based task may have altered readers' online processing. In the sentence verification task, there was a tendency for participants who read a passage that included detail sentences to respond faster but less accurately. The presence of detail sentences lead readers to perform more poorly on identifying whether or not sentences were actually in the passage they read as compared to readers of the same passage without details.

KEYWORDS: Seductive Details Effect, Boring Details, Interestingness, Attention, Memory

Gregory Scott Johnston

June 28, 2002

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By

Gregory Scott Johnston

Robert Lorch, Ph. D.
Director of Dissertation

Michael Bardo, Ph. D.
Director of Graduate Studies

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Dedicated to my loving wife Amy Lynn Johnston

ACKNOWLEDGEMENTS

This dissertation would not have been possible without the guidance provided by my academic advisor and dissertation director, Dr. Robert Lorch. His insightful comments and requests for multiple reviews were helpful in writing this dissertation. I sincerely thank him for his belief in me and his patience with me. Additional thanks are extended to Dr. Melody Carswell, Dr. Jonathan Golding, Dr. Betty Lorch, and Dr. Joan Mazur for serving on my dissertation committee. They provided me with lots of advice and stimulating questions that substantially improved the quality of this dissertation. I also owe a debt of gratitude to Dr. Mary Shake for serving as the outside reader on the dissertation committee and to Lorna McDougall for serving as my undergraduate assistant. I am also grateful to the rest of the faculty and the graduate students in the Cognitive and Developmental area who contributed through suggestions in our brownbag discussions.

Personal thanks go to my parents, Nancy and Clay Johnston, whose love, support and belief have helped make this dream a reality. I also appreciate the thoughts and prayers from my brothers, Todd, Phillip, and Chip, and my sister, Rachael. A special acknowledgment goes to my wife, Amy, who has been an inspiration through this entire process. Her immeasurable love and support gave me strength when I had none. She filled me with the confidence and self-assurance I needed to bring this project to completion. My daughters, Emily Anne and Lauren Elizabeth, also helped keep me focused on my goals as well as served as needed distractions and sources of joy when I needed it most. Finally, there have also been numerous other friends who have provided me with support and reassurance.

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CHAPTER ONE

Introduction

Advertisers, educators and others with a message to convey often try to capture their audience's attention by intentionally placing highly interesting information in their message. One purpose for including highly interesting information is to grab people's attention. For instance, advertisers place scantily dressed models in their advertisements so that advertisements will have high attention getting value. As would be expected, research shows that magazine readers immediately take notice of such advertisements (see Schultz & Schultz, 1998). The main purpose for including highly interesting information is to draw people's attention to other more important information, namely the product being advertised. However, research examining the information people attend to in provocative advertisements reveals that, when there are sexy pictures of women, male readers look at the pictures while females read the product information; when there are sexy pictures of men, males read the product information and women look at the pictures. Further, advertisements with and without sexy illustrations show no difference in recall after a 24-hour delay, but after a one-week delay, non-sexy ads are more memorable (Jones, Stanaland, & Gelb, 1998; Severn, Belch & Belch, 1990; also see Schultz & Schultz, 1998). Results such as these suggest that including high-interest information may not increase attention to the more important information (at least not by the intended audience) and may result in worse memory than if the high-interest information was not included.

Similar to advertisers, educators have a problem with getting students interested in their messages. The problem stems from the fact that expositions in textbooks are often viewed as boring by students (Harp & Mayer, 1997; Hidi, Baird, & Hildyard, 1982). Some teachers recommend adding entertaining anecdotes and other highly interesting tidbits of information that tend to be only tangentially related to the main topics in order to enliven students and help them learn the material (Rathus, 1999). Garner and her colleagues (Garner, Brown, Sanders & Menke, 1992; Garner, Gillingham & White, 1989) coined the termed <u>seductive details</u> to refer to this type of information. Research examining the effects of seductive details in written passages has shown that the presence of seductive details either did not alter memory task performance (Garner & Gillingham, 1991; Garner, Alexander Gillingham, Kulikowich, & Brown, 1991; Schraw, 1998) or reduced the number of main ideas readers recalled (Garner, et al., 1989; Harp & Mayer, 1997, 1998; Schraw, Lehman, & Hartley, 2001) as compared to the recall of the same text without seductive details present. The inability to recall as many main ideas from a passage when seductive details are present as compared to when no seductive details are present has been termed the seductive details effect (Garner, et al., 1989; Garner, et al., 1991). However, due to methodological limitations of the research mentioned above and other studies that are typically cited in support of the seductive details effect (SDE), there is uncertainty as to whether the SDE has been established empirically (Goetz & Sadoski, 1995a, 1995b).

The research presented in this report was designed to overcome limitations of previous studies and address four questions regarding the seductive details effect. First, does the addition of seductive details have a detrimental effect on readers' memory of an expository passage? Second, does the information added to a passage have to be "seductive" in nature to have an effect on memory performance? Third, does the presence of seductive (or boring) details alter readers' online processing? And, fourth, does the presence of seductive (or boring) details alter readers' ability to make connections among main ideas?

Initially, a review of the research typically cited in support of the seductive details effect will be presented. Several limitations in this body of research will be pointed out and means for overcoming them will be offered. Next, theoretical bases for the seductive details effect will be discussed. Two experiments will be presented that address the questions mentioned above and the hypotheses generated from the theoretical positions. Finally, several conclusions will be drawn based on the results of the two experiments.

Effects of Interestingness

Speculation about the effects of adding highly interesting information to texts dates back as early as 1913. Back then, Dewey cautioned against adding such information just to make a boring topic more interesting. "When things have to be made interesting, it is because interest itself is wanting. Moreover, the phrase is a misnomer. The thing, the object, is no more interesting than it was before" (Dewey, 1913, p. 11-12). Nearly seventy years later, a line of empirical research was initiated to examine this position.

When presented with texts that contain both interesting and important information, readers tend to remember more interesting information than important information (Garner et al., 1991; Hidi et al., 1982; Hidi & Baird, 1986a, 1986b, 1988; Wade & Adams, 1990; Wade, Schraw, Buxton, & Hayes, 1993). For instance, Hidi and her colleagues (1982) were particularly interested in the question: What information do grade school children remember from textbooks? Seventh graders read texts and provided immediate and delayed recall. After a four-day delay, more interesting ideas were recalled than important ideas from texts that were partly exposition and partly narrative. In a subsequent set of studies (Hidi & Baird, 1986a, 1986b), participants recalled equal proportions of interesting material and important material (40%). However, examination of the most highly recalled sentences revealed that they all contained novel, active, and concrete information. These same attributes have been reported to be characteristic of highly interesting information (Anderson, Shirey, Wilson, & Fielding, 1984).

In a related set of studies, Wade and her colleagues (Wade, 1992; Wade & Adams, 1990; Wade et al., 1993) sought to examine the relation between text-based interest and structural importance. In these studies, participants read a biographical text about Horatio Nelson. Initially, ratings of high- and low-importance and high- and low-interest were gathered using a forced choice procedure described by Brown and Smiley (1978, 1979). Combining the ratings, the sentences were placed into four categories and a content analysis was conducted. High-important/high-interest sentences contained the macropropositions of the passage. High-important/low-interest sentences tended to elaborate on the macropropositions. Low-important/high-interest sentences contained information that was inherently interesting (i.e., death, destruction, money, and sex, also see Anderson et al., 1984; Schank, 1979), but was not relevant to the macropropositions. Low-important/low-interest sentences contained trivial tidbits of nonrelevant information. When asked to recall the passage, participants recalled more low-important/high-interest sentences (i.e., seductive details) than high-important/high-interest sentences (i.e., the main ideas). There was no difference between the poorly recalled high-important/low-interest and low-important/low-interest sentences (Wade & Adams, 1990, Wade, et al., 1993). These results suggest that when interestingness and importance diverge, interestingness is a better predictor of recall than importance.

The research by Hidi, Wade and their colleagues suggests that interestingness interferes with learning from texts. However, as pointed out by Goetz and Sadoski (1995a, 1995b), none of that research has the proper control group to test for a seductive details effect. To provide evidence of a SDE, there must be a demonstration that the presence of seductive details lured readers away from the main ideas that would have been learned otherwise. Without separate texts that present the same information with and without seductive details present, there is no evidence that readers would have recalled the main ideas. Main ideas may be difficult to remember for various other reasons; such as they are too abstract or general (Goetz & Sadoski, 1995a). Thus, a between-participant manipulation of seductive details is needed to draw the conclusion that seductive details reduce readers' memory for main ideas.

Effects of Seductive Details

When researchers have implemented a between-participants manipulation of seductive details, people who were presented texts with seductive details recalled fewer main ideas, did not perform as well on transfer problem tasks, and spent less time processing the non-seductive segments of the text as people who were presented the same texts without seductive details (Garner et al., 1989; Harp & Mayer, 1997, 1998; Schraw et al., 2001). Garner et al provided the first direct evidence of the SDE. They designed two experiments to address the question of how adults' and children's macroprocessing and microprocessing are affected by the presence of seductive details.

In their first experiment, Garner et al. (1989) constructed a short three paragraph (162 words) base-text about insects. It was written to follow the initial mention convention - the main idea of each paragraph was mentioned in the first sentence (Kieras, 1980). A seductive details version was also constructed by adding an extra sentence that was irrelevant to the main idea in each of the paragraphs. For example, in a paragraph about insects either living alone or in families, a sentence was added describing how click beetles make a clicking noise as they flip themselves right side up. Schoolteachers listed all three seductive details as being highly interesting information and the three main ideas as information students would remember. In contrast to the teachers' intuitions, when asked to recall the really important information from the passage, graduate students who read the seductive details version recalled fewer main ideas than students who read the base-text without details. Garner et al. interpreted this as demonstrating that readers' macroprocessing of the passage was disrupted by the presence of the seductive details, causing them to miss the point of the passage.

A picture-matching task was used as a measure of readers' microprocessing. In this task, the experimenter would show a participant a picture of an insect mentioned in the text. The participant would then have to pick out an image of another insect that differed in some way that was described in the text. The task was intended to assess differences in readers' recall of relevant details about the insects from the base and seductive texts. However, the graduate students' performance did not differ by type of text read.

In their second experiment, Garner et al. (1989) failed to replicate the SDE from Experiment 1. Seventh grade students were presented the base-text, the seductive details text, or a base-plus-signals text in which the main ideas were signaled with the phrase "It is an important fact that..." and written in italics. Students who read the base-plus-signals passage recalled more main ideas than those reading either of the other two texts, which did not differ. However, an effect of seductive details was found using the microprocessing task. Garner et al. suggest that processing seductive details may displace main ideas from working memory due to its limited storage capacity. Only when the main ideas were given "a boost" were seventh graders able to recall them.

More recently, Harp and Mayer (1997, 1998) replicated the SDE consistently while using an explanative text about the formation of lightning. Harp and Mayer (1997) constructed four versions of the text: (1) a base-text with explanative illustrations and captions, (2) a base-text with seductive details and explanative illustrations and captions, (3) a base-text with seductive illustrations and captions, and (4) a base-text with seductive details and seductive illustrations and captions. After reading one of these texts, participants were asked to recall as much of the text as possible. Participants who read the base-text with explanative illustrations recalled more of the causal chain idea units (i.e., main ideas) than participants who read the other three texts. Participants were also given four transfer problems to answer. Students who read the base-text provided more creative solutions than those who read a text with seductive details regardless of the type of illustrations included. Subsequently, Harp and Mayer (1998) replicated their 1997 findings in four separate experiments.

Seductive details not only have been shown to affect readers' memory for explanatory passages, but also their attention during reading. Schraw, Lehman and Hartley (2001) extended Harp and Mayer's (1997, 1998) research by examining the effect seductive details have on reading times. In this study, sentence reading times were recorded while participants read modified versions of the passage used by Harp and Mayer (1998). Participants in the seductive details groups spent less time reading the non-seductive text segments of their passage than participants in the no-details group. This result supported their <u>decreased attention hypothesis</u>, that readers' attention is drawn away from other parts of a text when seductive details are present. Schraw et al. also replicated Harp and Mayer's finding of a seductive detail effect with respect to memory performance; the seductive details group recalled less of the non-seductive segments of their text than the no-details group.

<u>Limitations of Previous Research</u>

Despite the numerous replications, it is premature to conclude that the effects reported by Schraw et al. (2001), Harp and Mayer (1997, 1998) and Garner et al. (1987) are due entirely to the presence of seductive details. By adding seductive details to a base-text these experimenters not only added highly interesting information that was tangentially related to the main ideas, they also increased the length of their texts. For instance, Garner et al.'s base-text was 162 words long. By adding three seductive detail sentences, the text was lengthened by more than 30%. Although Harp and Mayer's base-text was longer (550 words) than Garner et al.'s, the same basic confound exists. The seductive details sentences increased the length of their text by 150 words. Thus, the effect being reported may be caused by increasing the texts' length (i.e., a text length effect) rather than an effect of seductive details.

There are two ways to address the text length confound. First, information could be removed from the seductive details version of the passage so that it becomes approximately the same length as the base-text. However, this procedure introduces two problems. First, a confound is introduced because information is both added to and taken away from the base-text to create the seductive details version. Any effect observed might be due to the seductive details that were added or due to the information that was removed. Second, removing information is likely to alter the overall coherence of the passage. Hidi and Baird (1988) report that they found it impossible to construct such a control text because removing other statements produced a text that was little more than a generalized summary.

A second, more reasonable, way to overcome the text length confound is to create a third text that is equal in length to the seductive details passage, except have the details that are added to the passage not be "seductive" in nature (i.e., add boring details). That is, another version of the base-text should be created that includes information that is neither highly interesting nor relevant to the main ideas of the passage. That was the procedure followed in this study. If the memory deficit is due to lengthening the text, then texts that have additional information (i.e., seductive details and boring details texts) will produce worse memory for the main ideas than the base-text. However, if the deficit is a result of the seductive nature of the additional information, then the seductive details text will produce worse recall of the main ideas than the base-text and the boring details text.

<u>Theoretical Bases for Recalling Main Ideas</u>

Constructing seductive and boring details texts that are as similar as possible except for the degree of interestingness in the details sentences affords a means of testing whether the addition of the detail sentences produced the effects observed in previous studies (Garner et al., 1987; Harp & Mayer, 1997, 1998; Schraw et al., 2001). Regardless of whether the effect is due to the presence of seductive information or lengthening the text, previous research suggests that readers' memory for main ideas is being hindered. Thus, an important consideration is: How does adding information that is tangentially related to a text handicap memory for main ideas? What are the cognitive mechanisms involved in producing the effect? The following paragraphs examine a set of theoretical bases that can account for the effect.

Harp and Mayer (1998) offered three theoretical explanations for the seductive details effect. Although these hypotheses were framed around the influence of seductive details, they also can be applied to the addition of boring details, as will be described below. The first hypothesis is the <u>distraction hypothesis</u>. According to this hypothesis, "seductive details do their damage by 'seducing' readers' selective attention away from the important information" (p. 415). The second is the <u>disruption hypothesis</u>. According to this hypothesis, readers are not able to build a coherently organized mental representation of the text because seductive details interfere with readers' ability to make connections between main ideas. Finally, the third hypothesis is the <u>diversion hypothesis</u>. According to this hypothesis, seductive details activate inappropriate prior knowledge resulting in the construction of a mental representation based around the seductive details rather than the main ideas.

Harp and Mayer (1998) conducted four experiments that pitted these hypotheses against each other as though they were mutually exclusive possibilities. However, there is reason to believe that any combination of the three hypotheses may be operating to produce a memory deficit when seductive or boring details are added to a text as compared to when they are left out. This can be seen by considering the role of working memory in the processing of a text.

The concept of working memory has taken different forms in the cognitive psychology literature. The classic understanding of working memory is that it is closely associated with short-term memory in that it has a limited capacity (Miller, 1956) and duration (Brown, 1958; Peterson & Peterson, 1959). A more recent conceptualization of working memory posits that there are short-term (ST-WM) and long-term (LT-WM) components of working memory (Ericsson & Kintsch, 1995) that use a resonance mechanism to permit a relatively large amount of information to be readily available should it be needed (Kintsch, 1988, 1998; McKoon & Ratcliff, 1992, O'Brien, 1994; O'Brien & Albrecht, 1995). Although the specific mechanisms underlying each model differ, they both agree that only a limited amount of information can be active during comprehension. This restriction of active (and readily available) information can account for how adding details, whether they are seductive or boring, can potentially affect a reader's attention to main ideas, ability to make connections and the construction of an appropriate representation.

As people read, they attempt to integrate the new information being read with the old information that came before it (Haviland & Clark, 1974). When they encounter information that is only tangentially related to the main ideas of the passage, they are unsure how this new information fits with their current representation of the text. Therefore, readers are likely to hold this information in working memory in anticipation of the author explaining how this new information relates to the old information. To do this, some of the propositions currently being stored in working memory have to be removed so there will be resources available to maintain the detail information. Given the limited capacity of ST-WM, some of the deactivated propositions would likely relate to the preceding main ideas. By electing to retain the details, readers' attention is effectively seduced away from the main ideas and drawn to the details.

Replacing main idea propositions in working memory with propositions relating to details also has consequences for making connections among propositions. Details are often added to texts between presentations of main ideas. If details displace main ideas from working memory, then readers will be less likely to connect the next main idea they encounter with the main ideas that preceded it. This would be especially damaging to the comprehension of explanative texts such as the ones used in the present experiments because readers would fail to make connections between the causal steps in the processes being discussed. As a result, readers would be less likely to recall the main ideas when details are present than if the details were not present.

Furthermore, if readers hold propositions relating to the details in their working memory, then the details could become the basis for organizing their text representation. The propositions held in working memory spread activation to (or resonate with) other prior world knowledge readers have in long-term memory. Thus, the introduction of details into a text causes readers to activate knowledge that is related to the details. Over time, the tangentially relevant information may become the basis of readers' representation as more and more such information becomes activated. For instance, a reader who encounters several tidbits of information about the devastating effects of lightning could be mislead into believing the text is about "what lightning causes" rather than "what causes lightning" (Harp & Mayer, 1998).

Given this account of the processing of information, two experiments were conducted that were intended to examine readers' on-line processing of main ideas and whether connections were made among main ideas in the text. In the first experiment, participants' on-line processing and ability to recall information from the text was examined. Recall performance was expected to replicate previous findings in which recall suffered when seductive details were present compared to when they were absent. If the memory deficit is due to the seductiveness of the details, then a group that receives boring details should perform similar to the group that receives no details. However, if the deficit is due to lengthening the text, then a group that receives boring details should perform similar to the group that receives seductive details.

Reading times were collected in both Experiment 1 and Experiment 2 as a measure of readers' on-line processing during comprehension. If readers have difficulty making connections between main ideas and the information that precedes them because details are present, then reading times from texts with details present should be slower than when there are no details (Kintsch, 1978). Alternatively, the presence of details may decrease readers' attention to the core content of the passage as compared to the amount they would have allocated if the details were not present (Harp & Mayer, 1998; Schraw et al., 2001). Reading time has been shown to decrease when the propositions in STM have few causal connections to the clause being processed as compared to when they have many causal connections (Bloom, Fletcher, van den Broek, Reitz, & Shapiro, 1990). As mentioned above, when details are present, they can displace from readers' STM the propositions that have more causal links to the core content. Thus, when details are present, readers may spend less time attempting to construct a coherent representation of the causal structure of the text. If so, then reading times from texts with details present should be faster than when there are no details.

In Experiment 2, a priming procedure was used in a true-false sentence verification task to assess whether readers were making connections among main ideas. If the presence of details interferes with readers' ability to make connections, then response times for the target-probes that were preceded by a causally connected event should be slower when the text contains details than when the text contains no details (Kintsch, 1998). Alternatively, the presence of details sentences may lead readers to respond more quickly to the verification probes for one of two reasons, which can be differentiated by readers' accuracy in responding to the probes.

The presence of detail sentences will activate more nodes of information from readers' prior world knowledge than if the detail information was not presented. The additional active nodes may provide readers with more paths to and connections among individual nodes in their mental representation of the text. This hypothesis predicts that readers who receive detail sentences should be able to verify whether or not a sentence was presented in the text quicker and more accurately than readers who do not receive details (Kintsch, 1988, 1998). In contrast, the presence of detail sentences may result in readers processing the text more superficially. If this were the case, then they would be expected to generate a less accurate representation of the text with fewer connections among nodes in their representation of the text than readers who do not receive detail sentences. Because of this, readers who receive detail sentences may adopt a plausibility strategy for answering the verification probes (Reder, 1987; Reder & Wible, 1983; Singer, 1991). That is, if a verification statement seems like it should have been in the text, then the person responds in the affirmative, otherwise respond in the negative. This hypothesis predicts that readers who receive detail sentences will respond faster than readers who do not receive details because they are not investing time to directly verify the statement against their mental representation of the text. However, using this strategy also would be expected to lead to poorer performance (lower accuracy). Before discussing the experiments in more detail, the following section will describe how the texts were constructed and how the manipulations were validated.

CHAPTER TWO

Construction of Texts and Validation of Manipulations

Two explanative scientific texts were constructed. Explanative texts were chosen because they describe a scientific process that follows a cause-and-effect chain of events that leads to a specific outcome. The causal chains of events were used to identify the main ideas within the texts.

One of the texts was constructed from Harp and Mayer's (1997, 1998) text that described the process of lightning. Their base-text was analyzed into event units following the procedure described by Lorch, Bellack, and Augsbach (1987), with each event unit being any single action or event. Next, causal relations among event units were identified by applying four criteria for identifying whether a causal relation exists between two events (van den Broek, 1990). The criteria include (a) temporality, a cause always occurs before a consequence, (b) operativity, when a consequence occurs the cause is active, (c) necessity in the circumstance, a consequence would not have occurred if the cause did not occur, and (d) sufficiency in the circumstance, a circumstance is likely to occur if the cause occurs. This resulted in the construction of a causal chain of events that started with an initiating event (i.e., moist air is heated) and ended with the outcome of the process (i.e., a bright flash of light is produced).

In this study, the main ideas of a passage are operationally defined as all of the event units residing on the causal chain. These events were then used as an outline for constructing the base-text used in the present study (see Appendix A). The first paragraph of the base-text defined the phenomena to be described in the passage (i.e., lightning). Each subsequent paragraph described the various steps in the process of lightning that made up the causal chain of events. Additional sentences were included to give the passage more substance. These additional sentences contained elaborations of the main ideas or other supportive or descriptive information relating to the main ideas.

After constructing the base-text, it was analyzed into individual event units like Harp and Mayer's (1997, 1998) base-text. There were 37 event units identified in the base-text (see Appendix B). Causal relations among these events were then assessed using the criteria described above, resulting in the construction of a causal chain of events.

Next, two additional versions were created, a seductive details version and a boring details version (see Appendix C and Appendix D, respectively). The seductive details text was constructed by adding eight pairs of sentences that (a) were tangentially related to the main ideas, (b) were not on the causal chain of events (i.e., dead-ends), (c) maintained local coherence with the sentence that preceded them and (d) were expected to be rated as being interesting. Local level coherence was maintained by using argument overlap between the first detail sentence and information in the sentence that immediately preceded it. The pairs of detail sentences were placed in the text such that they immediately followed a sentence that introduced a main idea and the first sentence that followed the pair of detail sentences introduced another main idea. The boring details text was constructed using the same guidelines, except that readers were expected to rate those pairs of detail sentences as being uninteresting.

Particular care was taken to control the amount of information being added to the seductive and boring versions. A total of sixteen pairs of detail sentences were written, eight seductive pairs and eight matching boring pairs. Each pair of detail sentences was written to be between 30 and 40 words in length. Furthermore, each pair of seductive detail sentences and its matching pair of boring detail sentences were written so that they both contained the same number of words.

The second base-text was written about the life cycle of white dwarf stars (see Appendix E). The information for this text was drawn primarily from a college level Introduction to Astronomy textbook (Kaufmann, 1990). Some additional information was culled from two other sources (Hoskin, 1997; Richardson, 1967). As with the lightning text, the main ideas were identified by creating a causal chain of events starting with the initiating event (i.e., life cycle begins as a nebula) and ending with the outcome of the process (i.e., life cycle of white dwarf star ends). Forty-three main ideas were identified in the white dwarf base-text (see Appendix F). The seductive and boring details versions were constructed in the same manner described above (see Appendix G and Appendix H, respectively).

A three-step process was used to validate the manipulation of interestingness among the detail sentences. The first step involved conducting a norming study to determine whether the detail sentences would be perceived as seductive (interesting) and boring (uninteresting). In the second step, several detail sentences were revised or replaced and a second norming study was conducted. In the third step, a content analysis was performed, the results of which were used to revise a few of the detail sentences. The specifics of each of the steps are discussed in the following sections.

Norming Study One

Methods

Participants. Fifty-nine students who were enrolled in Introduction to Psychology participated in this study. Participation in experiments is a requirement for students in this course. The only exclusionary criterion for participation was that English be the person's first language.

Materials. Four packets of reading materials were created, each containing one of two versions of each of the two explanative scientific texts. The two versions were created by dividing the seductive and boring details into two equal groups and then creating two mixed details versions of each text. That is, two lightning and two white dwarf texts were created. One version contained half of the seductive details and half of the boring details while the other version contained the remaining seductive and boring details. Two of the reading packets had the lightning text first, whereas the other two had the white dwarf text first. The pairs of detail sentences were underlined and the statement "STOP HERE AND RATE THE PRECEDING PAIR OF SENTENCES" was printed in bold following them to ensure that participants would rate just the detail sentences.

To gather a measure of interestingness, the reading packets also included a ratings sheet for each text (see Appendix I). The top portion of the ratings sheet provided instructions of how participants were to use the ratings sheet. The lower portion of the ratings sheet had eight lines on which participants were to respond to the question: In general, how interesting is the information in this pair of sentences? A 7-point Likert-type scale followed the question. The range on the scale was numbered from one to seven, with low numbers associated with being very uninteresting and high numbers associated with being very interesting (Graesser & Riha, 1984).

Procedure. Participants were recruited in groups of 7 to 14 people. First, they were asked to read and sign an informed consent sheet. Next, they were told that they were going to be reading two scientific texts and providing ratings of how interesting they find some of the information contained within each passage. They were instructed to make their responses on the ratings sheets by circling a number on the 7-point Likert-type scale. The reading packets were then distributed. Participants were permitted to read at their own pace. After rating the first text, they were asked to wait until the other participants in the group also finished rating the first text before beginning the second text. This was done to encourage participants to give an honest effort and evaluation of the sentences rather than racing through the texts quickly so they could leave early. After everyone finished evaluating the second text, the purpose of the norming study was explained. Finally, they were given a written debriefing sheet, a copy of the informed consent sheet and a credit slip for their participation and dismissed.

Results

Descriptive statistics were gathered from each text. For the lightning text, the interestingness ratings of the seductive details ranged from a low of 3.76 to a high of 6.35. The ratings for the boring details ranged from 3.07 to 4.62. Although the ranges overlapped, a paired t-test showed that the seductive details (M = 4.94) were rated significantly more interesting than the boring details (M = 3.95), t (58) = 9.35, p < .001, SE = .4225. Because the ranges overlapped, t-tests were performed comparing each pair of seductive details sentences to its matching pair of boring details. As a result of these tests, five pairs of sentences were revised. Four pairs failed to have ratings that significantly differed from one another. In three instances, the boring pair of detail sentences was rewritten to be less interesting because their ratings were relatively high (i.e., above the 3.5-midpoint on the 7-point scale). In the other instance, both the seductive and boring details pairs were replaced. These pairs not only failed to differ from one another, but also they were not placed between two events on the causal chain. They were interjected between the definition of lightning in the opening paragraph and the initiating event of the causal chain. Because the purpose of this study was to observe the effect details have on memory for main ideas, the new pairs were placed between two events on the causal chain. The fifth revision entailed making another pair of boring details less interesting because it received a relatively high rating (4.10) even though it differed from its matching pair of seductive details (6.35).

Examination of the white dwarf text revealed that interestingness ratings of the seductive details ranged from 4.30 to 5.59. Ratings of the boring details ranged from 3.00 to 4.10. Again, a paired t-test showed that seductive details ($\underline{M}$ = 4.78) were rated significantly more interesting than the boring details ($\underline{M}$ = 3.59), $\underline{t}$ (58) = 9.78, $\underline{p}$ < .001, $\underline{SE}$ = .4867. T-tests comparing each seductive detail to its matching boring detail revealed differences in all but one of the eight pairs. The boring details sentences in this instance were rewritten to be less interesting. Three other pairs of boring sentences were rewritten to be less interesting because their mean ratings were relatively high (i.e., exceeded the 3.5-midpoint of the ratings scale).

Overall, seven of the sixteen details sentences were rewritten in the lighting text and four of sixteen were rewritten in the white dwarf text. Due to the high number of sentences that were revised, a second norming study was conducted to assess whether the changes made to the detail sentences would be perceived as seductive and boring.

Norming Study Two

Methods

Participants. Fifty-two students who were enrolled in Introduction of Psychology participated in this study. Participation in experiments is a requirement for students in this course. The only exclusionary criterion for participation was that English be the person's first language.

Materials. The same mixed details texts described in Norming Study One were used in the second norming study except that seven of the details sentences from the lightning text and four of the details sentences from the white dwarf text were rewritten to be either more or less interesting.

Procedure. The same procedure described for Norming Study One was used in the second norming study.

Results

Interestingness ratings for the seductive version of lightning text ranged from a low of 3.92 to a high of 5.50. The ratings for the boring details ranged from 3.08 to 4.19. Although the ranges overlapped, a paired t-test showed that the seductive details ($\underline{M}$ = 4.74) were rated significantly more interesting than the boring details ($\underline{M}$ = 3.63), $\underline{t}$ (51) = 7.57, $\underline{p}$ < .001, $\underline{SE}$ = .5893. Because the ranges overlapped, t-tests were performed comparing each pair of seductive details sentences to its matching pair of boring details. As a result, two pairs of sentences were revised. In one instance, the seductive pair was rewritten to be more interesting. In the other instance, both the seductive and boring pairs were revised to further enhance their respective degrees of interestingness.

The range of rating for the seductive version of the white dwarf text was 4.00 to 5.31. Ratings of the boring details ranged from 2.85 to 4.31. As before, a paired t-test revealed that seductive details ($\underline{M}$ = 4.70) were rated significantly more interesting than the boring details ($\underline{M}$ = 3.61), $\underline{t}$ (51) = 6.84, $\underline{p}$ < .001, $\underline{SE}$ = .6351. The t-tests comparing each seductive detail to its matching boring detail sentence revealed that the pair of sentences modified in Norming Study 1 showed no difference. The boring pair of sentences was rated relatively high ($\underline{M}$ = 4.31). This pair of sentences was discarded and replaced by a new pair of sentences.

Based on the results of the second norming study, four pairs of detail sentences needed to be revised. Rather than continuing to iteratively perform norming studies and make further revisions, a content analysis of the detail sentences was performed on the pairs of sentences that did show significant differences. The findings from the content analysis were then used to guide the revision of the four pairs.

Content Analysis

A content analysis was performed in an attempt to identify any systematic differences that were discernible between the two levels of interestingness being investigated. There has been no research reported that directly investigated uninterestingness; however, research has identified some common themes found in texts that were considered to be interesting (Anderson et al., 1984; Schank, 1979).

These researchers were unable to generate an operational definition of interestingness. Anderson et al. reported that interestingness has typically been defined as whatever is rated as interesting. Furthermore, there are no absolutes when interestingness is involved. What one person finds highly interesting may not be interesting at all to the next person. Schank wisely recognized that “interestingness is in general a very dynamic property, heavily dependent on context” (p. 279). Thus, even the same person may not rate the same piece of information as interesting if its context is changed.

Rather than attempting to construct an operational definition of interestingness, the content analysis identified common themes that were present in the seductive and boring detail sentences. The seductive sentences primarily contained unusual or unexpected events such as launching metal rockets into storm clouds or deep-sea divers breathing helium. Other themes that were highly prevalent were death or potentially deadly events, danger, destruction, explosions, loud or strange sounds, large amounts or money and mythological characters.

The analysis of the boring sentences revealed that they tended to convey common or mundane information. For instance, readers were informed that skyscrapers are the tallest objects in urban cities and that helium filled balloons float. Other themes that appeared in the boring details included highly technical information, specific details, verbose scientific definitions, and uneventful activities.

Once the prevalent themes within the seductive and boring details were identified, they were used to generate four pairs of sentences. Based on the results of the second norming study, two pairs needed to be seductive and the other two boring. The seductive sentences included the elements of danger, possible death, destruction, and chaos. The boring sentences included mundane information and uneventful activities.

CHAPTER THREE

Experiment One: Free Recall and Reading Times

The purpose of the first experiment was to address three questions. First, does the addition of highly interesting but irrelevant information (i.e., seductive details) have a detrimental effect on readers' ability to recall main ideas from an explanative text as compared to readers' who read the same text without seductive details? Second, does the information added to a text necessarily have to be seductive to have an effect on memory performance, or will the addition of boring details also have an effect? And third, does the presence of seductive and boring details differentially affect readers' on-line processing.

This experiment also tested the replicability and generalizability of the results presented by Harp and Mayer (1997, 1998). Replicability was tested by using a revised version of their explanative passage about the process of lightning. Generalizability was tested in two ways. First, a text about the life cycle of white dwarf stars was used to see if the seductive details effect would be observed in other explanative texts. Second, the texts were presented to participants using a computerized sentence-by-sentence presentation rather than presenting the texts in a printed booklet. This methodology has been a common procedure in studies of on-line text comprehension and inference generation (Keenan, Baillet, & Brown, 1984; Long, Golding, & Graesser, 1992; McKoon & Ratcliff, 1992; Myers, Shinjo, & Duffy, 1987). This procedure has even been used in the study of the seductive details effect (Schraw, 1998; Schraw et al. 2001; Wade et al. 1993), but none of the studies included a between participants manipulation of the presence of detail sentences.

Methods

Participants. One hundred thirty three students enrolled in Introduction to Psychology participated in this study. Participation in experiments is a requirement for students in this course. The only exclusionary criterion for participation was that English be the person’s first language. Data from two participants were not included in the analyses because they did not meet this criterion (see Results section below for more details).

Materials. Six sets of materials were constructed. Each set contained identical instructions to the participants and the same practice text. The practice text was entitled “The Body’s Immune System” and contained 219 words in 26 sentences (see Appendix J). The practice text was included to help familiarize participants with the procedure. The practice text was also included to gather a measure of each person’s general ability to read and recall a text, which was subsequently used as a covariate in the analysis of the data. The six sets differed only with respect to the experimental text. A given set contained one of the three versions (i.e., base-text, seductive details or boring details) of either the Process of Lightning or Life-cycle of a White Dwarf text.

As discussed earlier, particular care was taken in the construction of the explanative passages so they would be as similar as possible across conditions and texts. This was especially true for the generation of the seductive and boring versions of the texts. The base-text version of the lightning passage contained 641 words in 51 sentences (see Appendix A). Eight pairs of details sentences were added to construct the seductive details (see Appendix C) and boring details passages (see Appendix D), each of which contained at total of 911 words. The base-text version of the white dwarf passage contained 635 words in 51 sentences (see Appendix E). The addition of the eight pairs of details sentences resulted in the seductive and boring details passages both containing 914 words (see Appendix G and Appendix H, respectively).

Sheets of 8.5 x 11 inch paper were used to collect recall protocol from participants. Similar to Harp and Mayer (1998), each sheet included the following instruction across the top of the page: "Please write down everything that you can remember from the passage. You can use your own words to paraphrase the passage."

Procedure. Participants were recruited in groups of one to four participants per session. Upon their arrival at the testing laboratory, participants were asked to read and sign an informed consent sheet. Next, they were given a verbal overview of the experiment and a computer program was activated. The first part of the computer program presented a set of instructions to participants. They were informed that they would be reading two scientific texts that would be presented one sentence at a time on the computer screen. They were instructed that they could advance from one sentence to the next by pressing the spacebar on the keyboard, but they could not go backwards to a previously presented sentence. They were informed that they should read the passages very carefully because their memory for the information would be tested at the end of each passage. Participants were then given an opportunity to ask questions about the procedure. Any questions raised by participants were answered before they were allowed to begin the experiment.

Participants were presented with a practice text to read to help them become familiarized with the task and the computer. The title of the practice text was presented in the center of the computer screen. Participants pressed the spacebar to advance to the first sentence in the text. The first sentence was presented after a 250 ms pause. Each sentence in the passage was presented in the center of the screen. When participants finished reading a sentence, they pressed the spacebar to proceed to the next sentence. The sentence on the screen was erased immediately and the next sentence presented in its place after a 250 ms pause. The pause was included to reduce the risk of a participant skipping over a sentence by pressing the spacebar twice. The computer recorded participants' reading times for each sentence in the text. Reading times from the practice text were gather so they could be used as a covariate in the analysis of the reading times from the experimental text. Reading times were recorded from the onset of a sentence until the spacebar was pressed to proceed to the next sentence. Participants continued to read in this sentence-by-sentence manner until the entire text was read.

When the participants finished reading the practice text, an instruction screen was presented. The instructions informed participants that they were expected to write down everything they could remember from the practice text. Several recall sheets of paper were placed beside the computers for the participants to use. Participants' ability to recall the practice text was assessed (see Scoring section below) so they could be used as a covariate in the analysis of recall from the experimental text. At the end of the recall session, the recall sheets were placed to the side of the computer and were collected after the experiment session was finished. The participants were given another opportunity to ask questions before starting to read the experimental passage.

Any questions about the task were answered before the participants were permitted to continue. The procedure for reading and recalling the experimental text was the same as that described for the practice text.

After participants finished writing down their recall of the experimental passage, the recall sheets were collected. Next, the participants were given a verbal debriefing of the purpose of the study. They also were given a written debriefing sheet, a copy of the informed consent sheet and a credit slip for their participation. Finally, they were thanked for their participation and dismissed.

<u>Scoring.</u> All of the texts were converted into lists of propositions for the purpose of scoring participants' recall. The practice text contained 36 propositions (see Appendix K). The propositions for the experimental passages were divided into four categories: (1) propositions in the base-text that were on the causal chain of events, (2) propositions in the base-text that were not on the causal chain, (3) propositions from the seductive details sentences, and (4) propositions from the boring details sentences. In the lightning passage there were 40 causal chain propositions, 33 non-causal chain propositions, 39 seductive details propositions, and 36 boring details propositions (see Appendix L). In the white dwarf passage there were 53 causal chain propositions, 31 non-causal chain propositions, 34 seductive details propositions, and 41 boring details propositions (see Appendix M).

Participants' recall protocols were compared to the lists and given one point for each event they included in their recall that matched a proposition in the list. Because participants were allowed to paraphrase, credit was given as long as the participants' recall was very similar to or a semantic equivalent of a proposition in the list. Due to the subjectivity of making this type of judgment, two people scored the data. A single rater scored the entire set of data, and the second rater scored 25% of the protocols. The judgments of the two raters were compared to assess interrater reliability (Cohen, 1960). Kappa for all three passages was very high. Specifically, kappa for the practice text was .96, for the lightning text it was .93 and for the white dwarf text it was .88.

Finally, because the numbers of propositional units differed across the four categories of propositions and between the two explanative texts, recall scores were computed as proportions of the maximum number of propositions that could be recalled for a given category and text. For example, a person who recalled 15 of 40 causal propositions would receive a recall score of .375.

Results

Data from 122 of the 133 participants were analyzed. As mentioned earlier, data from two participants were not analyzed because English was not their first language. Data from another person was not included because her recall sheet was lost before it was coded. Data from an additional eight participants were not analyzed because they did not perform the recall task as instructed. Specifically, five participants wrote down only a few keywords from the passages rather than full sentences. Three other participants' recall protocols included nothing that resembled the texts that were presented.

The data were tested against both participant variability (F_S and t_S) and item variability (F_I and t_I). As discussed above, participants' reading times and their recall of the practice text were included as covariates in all of the tests against participant variability. However, no covariate was included in the tests against item variance because none existed. All reported effects are significant at the .05 level unless noted otherwise.

Free Recall. The analysis of the recall data addressed two main questions. First, does the addition of seductive details have a detrimental effect on readers' memory for the main ideas of a text? If so, then recall from the seductive detail passages should be worse than from the base-text passages. Second, does the information added to a text have to be seductive to affect memory? If the SDE is due to the seductiveness of the details, then recall from the seductive details passages should be worse than from both the base-text and the boring details passages. However, if the SDE is due to extending the length of the text by adding details (i.e., a text-length effect), then recall from both the seductive and boring details passages should be worse than from the base-text passages.

In the test against participant variability, a 2 (Proposition) x 2 (Text) X 3 (Version) ANCOVA was performed, with Proposition (i.e., Causal and Non-Causal) entered as a within-participant factor and Text and Version entered as between-participant factors.

The covariate, practice text recall, had a significant main effect $\underline{F}_S$ (1, 115) = 69.168, $\underline{MSE}$ = .604, but did not interact with any of the factors. A 2 (Proposition) X 2 (Text) X 3 (Version) ANOVA was performed against item variability. Proposition and Text were entered as between-item factors and Version was entered as a within-item factor. Table 1 presents the mean free recall scores, both adjusted and unadjusted for the covariate, as a function of Proposition and Version.

As expected, Version did affect recall performance, $\underline{F}_S$ (2, 115) = 5.340, $\underline{MSE}$ = .046, $\underline{F}_I$ (2, 286) = 30.101, $\underline{MSE}$ = .206. Planned contrasts were performed to examine the nature of the effect. The contrasts supported previously reported findings by revealing that fewer propositions were recalled from passages with seductive details than from base-text passages; $\underline{t}_S$ (115) = 3.215, $\underline{SE}$ = .021, $\underline{t}_I$ (143) = 7.258, $\underline{SE}$ = .011. Fewer propositions also were recalled from seductive details passages than from boring details passages; $\underline{t}_S$ (115) = 1.941, $\underline{p}$ = .051, $\underline{SE}$ = .021, $\underline{t}_I$ (143) = 4.534, $\underline{SE}$ = .009. In the test against participant variability, recall from the passages with boring details ($\underline{M}$ = .242) did not differ from base-text passages; $\underline{t}_S$ (115) = 1.275, $\underline{p}$ = .202, $\underline{SE}$ = .021. However, the test against item variability indicated that fewer propositions were recalled from passages with boring details than from base-text passages, $\underline{t}_I$ (143) = 3.686, $\underline{SE}$ = .011. The pattern of results from these contrasts suggests that the seductive details effect is, in part, due to lengthening the text because adding boring details tended to reduce participants' recall relative to the base text. However, there is still evidence of a seductive details effect because fewer propositions were recalled when seductive details were present than when boring details were present.

Table 1

Mean Free Recall Scores in Experiment 1 as a Function of Proposition and Version

	Causal		Non- Causal		Mean	
Condition	Adjusted M	Unadjusted M	Adjusted M	Unadjusted M	Adjusted M	Unadjusted M
Base	.2866	.2972	.2618	.2713	.2742	.2842
	(.1238)	(.1573)	(.1069)	(.1395)	(.0938)	(.1218)
Boring	.2417	.2364	.2532	.2477	.2474	.2420
	(.1236)	(.1366)	(.1067)	(.1186)	(.0935)	(.1123)
Seductive	.2136	.2088	.1997	.1966	.2067	.2027
	(.1234)	(.1610)	(.1066)	(.1229)	(.0936)	(.1238)

Note. Values enclosed in parenthesis are standard deviations.

Recall of propositions from the seductive and boring detail sentences was also examined. A 2 (Text) x 2 (Version) ANCOVA was performed against the participants' data, with Text and Version entered as between-participant factors. The covariate, practice text recall, neither had a main effect nor interacted with the independent variables. A 2 (Text) x 2 (Version) ANOVA was performed against item variability, with Text and Version entered as between-item factors. There was no difference in the amount of detail propositions recalled from seductive details passages (adjusted $\underline{M}$ = .2469, unadjusted $\underline{M}$ = .2471) and boring details passages (adjusted $\underline{M}$ = .2121, unadjusted $\underline{M}$ = .2122); $\underline{F}_S$ (1, 81) = 1.383, $\underline{p}$ = .243, $\underline{MSE}$ = .025, $\underline{F}_I$ (1, 149) = 1.930, $\underline{p}$ = .167, $\underline{MSE}$ = .048. Thus participants appear to be including similar ratios of extraneous information in their recall regardless of whether the additional details are seductive or boring.

Although both groups recalled similar amounts of detail propositions, how those propositions were recalled may have affected recall of the core content. Seductive details could create proactive interference; such that the retrieval paths to the core content may weaken due to time elapsing while the person is writing down the seductive details information. If this is the case, then participants who read a seductive details passage would be expected to recall detail propositions earlier and have more detail propositions in the early part of their recall protocol than participants who read a boring details passages. To test these predictions, participants' data from those who read the seductive details and boring details versions of the passages were evaluated on two measures. First, the first serial position where a detail proposition was included in recall was examined. There was no significant difference between participants who read a seductive details passage ($\underline{M}$ = 7.82) and those who read a boring details passage ($\underline{M}$ = 6.48), $\underline{t}_S$ (77) = 1.262, $\underline{p}$ = .211, $\underline{SE}$ = 1.067. Second, the percentage of detail propositions that were included within participants' first five propositions recalled was computed. The percentage of seductive details (19.51%) did not differ from the percentage of boring details propositions (15.12%) that were recalled, $\underline{t}_S$ (80) < 1, $\underline{p}$ = .439, $\underline{SE}$ = 5.802. An examination of the percentage of detail propositions within the first ten propositions recalled yielded the same result; no significant difference between the percentage of seductive detail (28.05%) and boring detail propositions (26.34%) that were recalled, $\underline{t}_S$ (80) < 1, $\underline{p}$ = .728, $\underline{SE}$ = 4.922. Thus, seductive details do not appear to be producing proactive interference for recalling the core content of the passages.

The results from the analysis of the free recall protocols replicated previous findings by Harp and Mayer (1997, 1998) and Schraw et al. (2001). Recall was handicapped by the presence of seductive details as compared to when there were no details present. Boring details also tended to handicap recall performance as compared to when no details were present. This pattern suggests that adding any tangential information is damaging to the memorability of the more important information. Although this finding supports a text-length effect, the seductiveness of the tangential information had its own effect, as demonstrated by the poorer recall performance from texts with seductive details than from texts with boring details. Examining the recall of the detail propositions revealed that participants included similar amounts of the details in their recall.

Reading Times. The analysis of the reading time data addressed the question of how readers' online processing is affected by the presence of seductive and boring details. Three predictions can be made. The first two predictions stem from the assertion that the presence of detail sentences makes online processing more difficult as compared to processing the same information when no details are present. One prediction is that adding details, regardless of whether they are boring or seductive, disrupts processing equally. If this is the case, then reading times from passages with details should be slower than reading times from the base-text passages.

An alternative prediction is that adding one type of detail disrupts processing more than adding the other type of detail. So, for instance, adding seductive details may hinder processing more than adding boring details to the base-text. If this is the case, then reading times should be slower in passages with seductive details than from passages with boring details or the base-texts.

A third prediction can be made based on the notion that seductive details seduce readers' attention away from processing main ideas. According to this position, having seductive details in a passage leads readers to spend less time processing the more important information relative to the processing than readers would have performed if the details were not present. If this is the case, then reading times should be faster in passages with seductive details than from passages with boring details or the base-texts.

These predictions were evaluated by analyzing participants' reading times across three sentences. The primary sentence of interest was the sentence that immediately followed the detail sentences. This target sentence is where the impact of the details should be most observable. However, readers' processing may not show evidence of being disturbed until after they read the next sentence in the passage. Therefore, the post-target sentence was included to check for carry-over effects. Additionally, detail sentences may affect readers' overall processing of the passages, leading to either faster or slower processing of the passage as a whole. To check for an overall effect of details on processing, the pre-target sentence (i.e., the sentence that appeared just before the detail sentences were interjected) was also included. Thus, to get a complete picture of the effect details have on readers' online processing, reading times were analyzed from the three sentences that surrounded the eight places where detail sentences were interjected. Because the lengths of these sentences were not controlled during the construction of the material, reading times were analyzed as reading time per syllable.

A 2 (Text) X 3 (Version) X 3 (Sentence) mixed factors ANCOVA with planned contrasts was conducted against participant variability. Text and Version were entered as between-participant factors, while Sentence was entered as a within-participant factor. The covariate, mean practice text reading time, had a significant main effect, F_S (1, 113) = 91.249, MSE = 1.220, but interacted with Version F_S (2, 113) = 37.961, MSE = .508. Participants who read a seductive details text tended to have longer practice text reading times (M = 462 ms) than those who read either a base-text (M = 422 ms) or a boring details text (M = 404 ms). Because there was an interaction with the covariate, the analysis against participant variability was performed again without including the covariate. A 2 (Text) X 3 (Version) X 3 (Sentence) mixed factors ANOVA with planned contrasts was conducted against item variability. Text and Sentence were entered as between-item factors, while Version was entered as a within-item factor.

As displayed in Figure 1, the version of the passages that participants read had an impact on reading times; F_S (2, 116) = 2.792, $p < .07$, MSE = .069, F_I (2, 84) =

12.353, MSE = .081. The planned contrasts revealed a tendency for reading times from the seductive details passages (M = 301 ms) to be faster than from either the base-text passages (M = 362 ms); t_S (116) = 1.76, p = .08, SE = .035, t_I (84)= 4.10, SE = .015, or the boring details passages (M = 379 ms); t_S (116) = 2.24, SE = .035, t_I (84)= 4.12, SE = .019. There was no difference between RTs from the base-text passages and boring details passages, t_S (116) < 1, p = .64, SE = .035, t_I (84)= 1.06, p = .294, SE = .015. This pattern supports the hypothesis that seductive details seduced readers' attention way from the passages.

To further test the idea that the seductiveness of the detail sentences is the cause of the difference, an analysis of the RTs of the detail sentences was performed. The same mixed factor ANCOVA and ANOVA were performed as those reported above except that only two levels of Version (i.e., seductive and boring) and two levels of Sentence (i.e., Detail Sentence 1 and Detail Sentence 2) were included. There was a significant effect of the covariate, practice text reading time, in the analysis of participant variability, F_S (1, 75) = 19.569, MSE = .156. The covariate also interacted with Version, F_S (1, 75) = 10.824, MSE = .001, and with Sentence, F_S (1, 75) = 12.108, MSE = .037. Because there were interactions with the covariate, the analysis against participant variability was performed again without including the covariate. There was no effect of Version on the reading time of detail sentences; F_S (1, 78) = 0.151, p = .70, MSE = .001, F_I (1, 28) = 0.300, p = .59, MSE = .001.

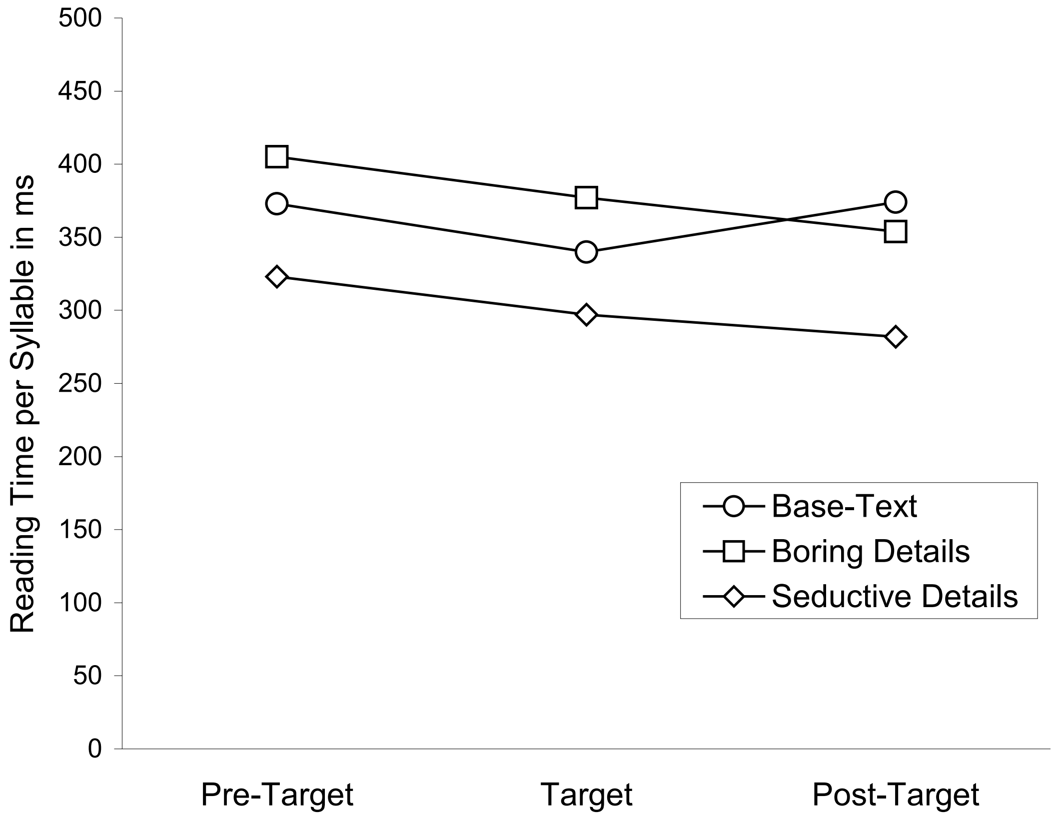


Figure 1. Mean reading times of causal sentences in Experiment 1 as a function of Sentence and Version.

time reading the first detail sentence (M = 294 ms) than the second detail sentence (M = 260 ms).

The reading time analyses reveal that readers' tended to spend less time reading the core content from the passages with highly interesting tidbits of tangential information added than when either no details or boring details were added. This finding cannot be explained as a text length effect because a difference was found between the seductive and boring passages which both had the same amount of detail information added to each of them. Even though readers allocated different amounts of attention to the sentences surrounding the details, readers of the passages with details spent equal amounts of time processing the seductive and boring detail sentences that were added to those passages.

Discussion

The results from Experiment 1 replicated previous findings by demonstrating the presence of a seductive details effect on recall performance (Garner et al., 1989; Harp & Mayer, 1997, 1998; Schraw et al., 2001). Participants who read passages with seductive details recalled fewer causal propositions from the base-text portion of the text than those who read base-text passages without any details. Participants who read passages with boring details also recalled fewer causal propositions than those who read the base-text without details. This pattern of results demonstrates the presence of a text-length effect because adding boring details to the base-text lead to poorer recall performance than if the details were not added. In addition to the text-length effect, there was evidence of a seductive details effect. In particular, participants who read passages with boring details recalled more propositions from the base-text than those who read passages with seductive details added. Although their recall of the base-text propositions differed, participants recalled similar amounts of the tangential information, regardless of whether it was seductive or boring. Thus, the lengthening of a passage by adding tangential information cannot fully account for the memory deficit observed. The seductiveness of the information being added has its own effect on participants' ability to recall the main content from a passage.

Participants' online processing also was affected by the presence of seductive details. Participants spent less time reading the core content from a passage when seductive details were present than when either boring details or no details were present. Thus, readers’ attention was diverted away from the core content of the passage when seductive information was present. Analysis of the reading times for the seductive and boring detail sentences revealed no difference in the amounts of time spent processing those sentences. Therefore, the seductive information itself does not appear to capture readers’ attention; rather it simply reduces the amount of attention readers allot for processing the more important information.

Experiment 1 revealed that seductive details affected readers’ ability to process and recall explanatory passages. Readers of passages with seductive details spent considerably less time processing the core content of their passage than other readers. They also recalled less information from the passage than the other readers. A possible explanation is that the reduction in online processing time resulted in fewer connections being made among the main idea units of the passages. Therefore, subsequent recall performance for these participants suffered as compared to the other participants. Experiment 2 was designed to test whether the presence of detail sentences interferes with readers' ability to make connections among the main ideas in their mental representations of explanatory texts.

CHAPTER FOUR

Experiment Two: Reading Times and Sentence Verification Task

Although Experiment 1 demonstrated that readers were spending less time processing sentences from the passages when seductive details were present than when they were not present, that experiment cannot reveal how well readers were making connections among the main ideas. The purpose of the second experiment was to test whether the presence of detail sentences alters readers' ability to make connections among main ideas. A possibility is that when details are present they displace propositions relating to main ideas from ST-WM, thereby making connections among main ideas becomes more difficult. A priming procedure, introduced by McKoon and Ratcliff (1980), was used to evaluate this possibility. After reading a passage, participants were asked to respond whether a statement was presented in the passage. A prime statement trial that was causally connected to the target always preceded the target statement trials. Previous research has shown that target events are responded to faster when preceded by causally related events than when the prime and target are not directly related (van den Broek & Lorch, 1993). This suggests that readers make connections among causally related events in their mental representation of a passage. If seductive details reduce the likelihood of making these connections, then responses to targets in a sentence verification task should take longer and be less accurate when seductive details are interjected between causally connected events in the text as compared to when either no details or boring details are interjected between pairs of events.

Methods

Participants. One hundred twenty two students enrolled in Introduction to Psychology participated in this study. There were two exclusionary criteria for participation in Experiment 2. The first was that the person was not a participant in Experiment 1. The second was that English be the person's first language. Data from three participants were not included in the analyses because they did not meet this criterion. All volunteers received credit for experimental participation as part of the requirements of their introductory course.

Materials. The six computer programs used in Experiment 1 were modified for use in this experiment. The free recall task was replaced with a sentence verification task. There were two sentence verification tasks in each program, one practice and one experimental. The practice task consisted of six trials, three “YES” trials and three “NO” trials (see Appendix N). The YES trials were constructed by paraphrasing sentences that appeared in the practice passage. The NO trials contained information that was not presented in the passage but was thematically related to the information in the practice passage (i.e., the human immune system). The practice session was included to help familiarize the participants with the computer and the sentence verification task procedure.

A 48 trial sentence verification task was created for The Process of Lightning (see Appendix O) and The Life Cycle of White Dwarf Stars (see Appendix P) experimental passages. Half of the trials were YES trials and half were NO trials. All of the YES trials were constructed by paraphrasing sentences that were presented in the passages. Sixteen of the YES trials were constructed as prime and target trial pairs. That is, each prime trial was paired with a specific target trial and was always presented immediately before the target trial during the sentence verification task. Recall that in the construction of the seductive details and boring details passages, the detail sentences were always interjected between two causally related events. Thus, the eight YES trials that served as prime trials contained information from the sentence that immediately preceded the point where the detail sentences were inserted. The eight YES trials that served as target trials contained information from the sentence that immediately followed the point where the detail sentences were inserted. The remaining eight YES trials were constructed by paraphrasing any of the other sentences in the passage except for the seductive or boring detail sentences. These last eight YES trials were included to mask the true nature of the task. The 24 NO probe trials contained information that was not presented in the passages, but was from the same thematic topic as the experimental passage (i.e., weather related or astronomy related).

In summary, the design of this experiment was 2 (Text) x 3 (Version). Text refers to whether a participant received the lightning or the white dwarf experimental passage. Version refers to whether the participant read a base-text, seductive details, or boring details version of the passage. Both Text and Version were between-participant manipulations.

Procedure. The procedure closely mirrored that described for Experiment 1. Participants were recruited in groups of one to four people per session. They were given a verbal overview of the study and asked to sign an informed consent sheet. Then they were given instructions on using the computer to advance through the passages in a sentence-by-sentence fashion using the spacebar. The computer collected reading times for each sentence in the passage from the onset of a sentence until participants pressed the spacebar to continue.

The main difference in the procedure was that participants completed a sentence verification task after reading each passage rather than providing recall. Before starting the sentence verification task, the computer presented participants with a set of instructions about the task. In this task, participants were presented a single statement in the center of the computer screen. The participants' task was to decide whether or not the information was presented in the text they just read. Participants were instructed to press the YES button (the "K" key) if the information was presented in the text; otherwise they should press the NO key (the "D" key). They were informed that they should make their responses as quickly as possible without sacrificing accuracy. The presentation of the statements was done in a random order for each participant with two constraints. First, a prime event trial always immediately preceded its paired target event trial. Second, at least one NO trial always preceded the presentation of a prime-target pairing. This was done to reduce the possibility of priming from a previously presented trial. It also helps to minimize speeded responding due to pressing the YES key repetitively.

After reading the instructions for completing the sentence verification task, participants had to signal that they were ready to begin the sentence verification task by pressing one of the response keys (i.e., K or D). The computer screen was cleared immediately and the first verification statement was presented after a 100 ms delay.

Participants' response time to a probe was recorded from the onset of the verification statement until a response key was pressed. After a keypress was made the screen was cleared. If the correct response was made, then the next statement was presented after a 100 ms delay. If an incorrect response was made, the statement "WRONG: THAT STATEMENT (WAS / WAS NOT) IN THE TEXT" was displayed in the center of the screen for 1900 ms. The screen was then cleared and the next verification statement was presented after a 100 ms delay.

After responding to the 48 verification statements, participants were given a verbal debriefing of the purpose of the study. Finally, they were given a written debriefing sheet, a copy of the informed consent sheet and a credit slip for their participation and then dismissed.

Results

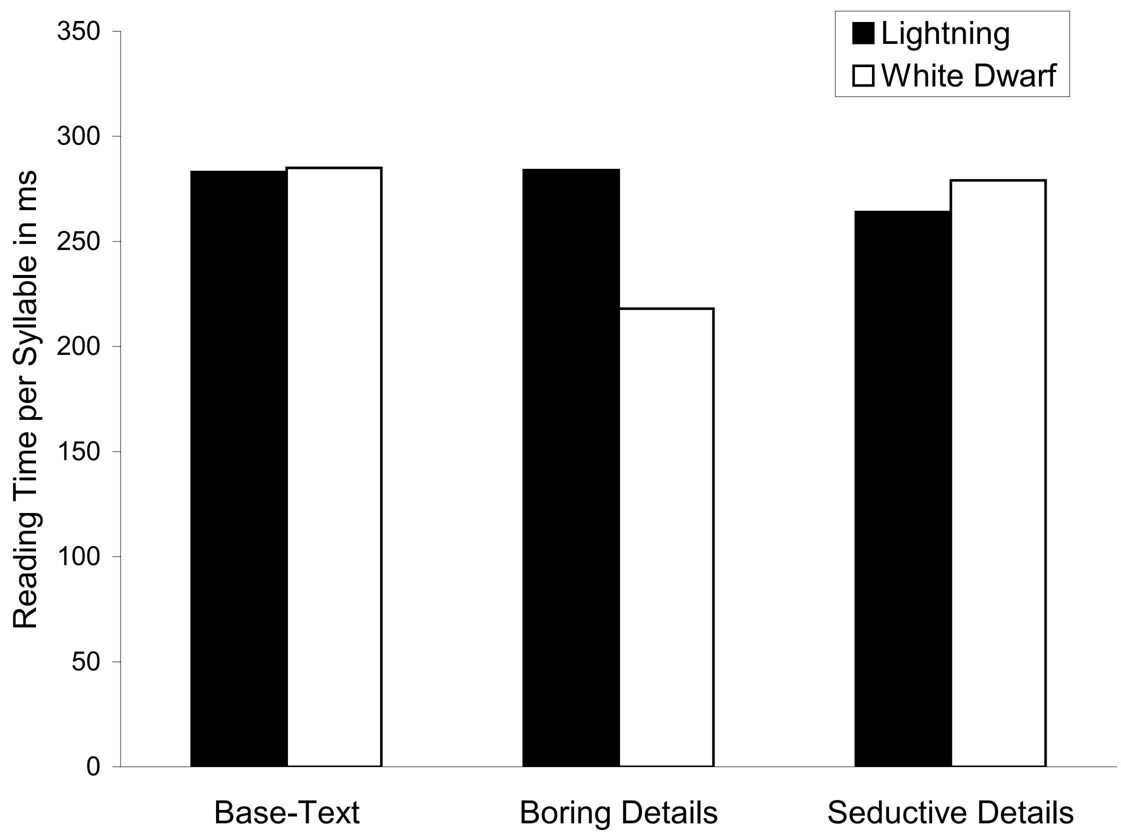
Data from 118 of the 122 participants were analyzed. As mentioned earlier, data from three participants were not analyzed because English was not their first language. Data from another person was not included because he fell asleep while reading the experimental passage.

Reading Times. The reading time data were predicted to replicate the pattern of results found in Experiment 1; the pre-target, target, and post-target sentences should be read faster in passages with seductive details than in passages with boring details or no details present. As in Experiment 1, the initial analysis of participant variability consisted of 2 (Text) X 3 (Version) X 3 (Sentence) mixed factors ANCOVA with planned contrasts. Text and Version were entered as between-participant factors, while Sentence was entered as a within-participant factor. The covariate, mean practice text reading time, had a significant main effect, F_S (1, 109) = 106.369, MSE = .592, and it interacted with Version F_S (2, 109) = 6.189, MSE = .023. This time, participants who read a boring details text tended to have faster practice text reading times (M = 273 ms) than those who read either a base-text (M = 298 ms) or a seductive details text (M = 311 ms). Because there was an interaction with the covariate, the analysis against participant variability was performed again without including the covariate. A 2 (Text) X 3 (Version) X 3 (Sentence) mixed factors ANOVA was conducted against item variability. Text and Sentence were entered as between-item factors, while Version was entered as a within-item factor.

The patterns of results from the tests against participant and item variability differed. In the test against participant variability, there were no significant differences across conditions. However, in the test against item variability, there was a significant interaction between Text and Version, F_I (2, 84) = 22.023, MSE = .022. As illustrated in Figure 2, the interaction stemmed from a fast reading time in the boring details version of the white dwarf passage. Specifically, reading time in the boring details version (M = 218 ms) was faster than in either the base-text version (M = 285 ms), t_I (84) = 7.87, SE = .008, or the seductive details version (M = 279 ms), t_I (84) = 6.91, SE = .009. This pattern does not replicate the findings from Experiment 1.

An analysis of the reading times for the detail sentences also was performed. The same mixed factor ANCOVA and ANOVA were performed as those reported above except that only two levels of Version (i.e., seductive and boring) and two levels of Sentence (i.e., Detail Sentence 1 and Detail Sentence 2) were included. There was a significant effect of the covariate, practice text reading time, F_S (1, 72) = 105.736, MSE = .211. The covariate also interacted with Version, F_S (1, 72) = 6.450, MSE = .013. Because there was an interaction with the covariate, the analysis against participant variability was performed again without including the covariate. There was a main effect of Version in both participant and item analyses; F_S (1, 73) = 6.425, MSE = .014, F_I (1, 28) = 17.321, MSE = .034. In the analysis of participant variability, Version also interacted with Sentence, F_S (1, 74) = 6.021, MSE = .005. The pattern of means revealed that, although participants spent more time reading the first detail sentence (M = 240 ms) than the second (M = 211 ms), participants who read seductive details spent more time processing their pair of sentences (M = 250 ms) than those who read boring details (M = 204 ms).

The reading time results did not replicate those from Experiment 1. In Experiment 1, reading times from the seductive details passages were faster than from the base-text or boring details passages. In contrast, in Experiment 2, reading times showed little variation except for fast times by participants who read the boring details version of the white dwarf passage. In Experiment 1, reading times for seductive and boring detail sentences did not differ. However, in Experiment 2, readers spent more time reading the seductive details than boring details.



<u>Figure 2.</u> Mean reading times of causal sentences in Experiment 2 as a function of Text and Version.

The differences in readers' online processing across the two experiments may be a result of changing the memory task from a free recall task in Experiment 1 to a recognition task (i.e., sentence verification task) in Experiment 2. Readers who expect a recall test would be expected to spend a relatively long time processing the text in an attempt to construct a mental representation of the text that closely mirrors the actual text. By comparison, readers who expect a recognition based task would be expected to spend less time processing the text because they believe that cues will be presented later that will help them retrieve the information. To test this hypothesis, post-hoc analyses were performed on the reading times of the three sentences surrounding the detail sentences (i.e., pre-target, target and post-target sentences) and the reading times of the detail sentences with Experiment included as a factor.

The reading times for the sentences surrounding the detail sentences were submitted to univariate ANOVAs that included two levels of Experiment (i.e., Experiment 1 and Experiment 2). Note that an ANCOVA was not performed in the analysis of participant variability because the covariate, practice text reading time, interacted with the other independent variables in the analyses of the reading times from Experiment 1 and Experiment 2 reported earlier. In the analysis of participant variability, Experiment was entered as a between-participant factor. In the analysis of item variability, Experiment was entered as a within-item factor. Reading times were slower in Experiment 1 ($\underline{M}$ = 347 ms) than in Experiment 2 ($\underline{M}$ = 269 ms); $\underline{F}_S$ (1, 240) = 20.926, $\underline{MSE}$ = .364, $\underline{F}_I$ (1, 47) = 33.629, $\underline{MSE}$ = .149. Reading times for the detail sentences were submitted to univariate ANOVAs. Reading times for the detail sentences were slower in Experiment 1 ($\underline{M}$ = 277 ms) than in Experiment 2 ($\underline{M}$ = 227 ms); $\underline{F}_S$ (1, 160) = 12.922, $\underline{MSE}$ = .097, $\underline{F}_I$ (1, 31) = 26.158, $\underline{MSE}$ = .040. Thus, readers who expected a free recall task spent significantly more time processing the text than did participants who expected the recognition-based sentence verification task.

<u>Target Probe Trials.</u> If the presence of seductive details displaces important information from ST-WM, then participants should be less likely to make connections among main ideas from passages containing seductive details than from passages with no details or with boring details. This should be evidenced by slower probe response times and poorer accuracy to target trials when seductive details were present than

when no details or boring details were in the passage. However, the construction of a mental representation of the text with few connections could also be evidenced by fast target probe response times. If participants adopt a feeling of knowing strategy for responding, then they would be expected to have quick response times but have relatively poor accuracy. Another alternative is that participants who receive details in their passage may respond faster and more accurately to the probes if the detail information leads to activating more prior world knowledge and create more connections among the nodes in their mental representations of the text than participants who read the base-text (Kintsch, 1988, 1998).

The analyses of the probe response times included only the times from target trials in which a participant answered both the prime and target trials correctly, which excluded 26.06% of the trials. The mean correct target item response times are presented in Table 2. The analysis of participant variability consisted of a 2 (Text) X 3 (Version) ANCOVA, in which both factors were entered as between-participant manipulations. The covariate, correct practice probe response times, had a significant effect; $\underline{F}_S$ (1, 111) = 30.961, $\underline{MSE}$ = 29.929. In the analysis of item variability, Text was entered as a between-item factor while Version was entered as a within-item factor. The analyses revealed a significant effect of Version; $\underline{F}_S$ (2, 111) = 4.393, $\underline{MSE}$ = 4.246, $\underline{F}_I$ (2, 28) = 6.288, $\underline{MSE}$ = 1.725. Planned comparisons revealed that target probes were responded to faster after reading a seductive details version of a passage than a base-text version; $\underline{t}_S$ (111) = 2.93, $\underline{SE}$ = .221, $\underline{t}_I$ (28) = 3.72, $\underline{SE}$ = .170. Target events were even responded to marginally faster after reading a boring details version than a base-text version; $\underline{t}_S$ (111) = 1.81, $\underline{p}$ = .072, $\underline{SE}$ = .222, $\underline{t}_I$ (28) = 1.98, $\underline{p}$ = .068, $\underline{SE}$ = .237. Response times from the seductive and boring details versions did not differ; $\underline{t}_S$ (111) = 1.10, $\underline{p}$ > .25, $\underline{SE}$ = .223, $\underline{t}_I$ (28) = 1.24, $\underline{p}$ > .20, $\underline{SE}$ = .133. Participants who read a passage with seductive or boring details tended to respond to target probes faster than participants who read a base-text passage. Analyses were performed on participants' response accuracy to determine whether the detail sentences lead readers to create many connections to the target information or whether these readers adopted a strategy for answering the verification probes.

Table 2

Mean Probe Response Times in seconds from Experiment 2 for Correct Target Trials when the Prime Trial also was Correct as a Function of Text and Version

	Lightning		White Dwarf		Mean	
Condition	Adjusted M	Unadjusted M	Adjusted M	Unadjusted M	Adjusted M	Unadjusted M
Base	3.297	3.290	3.880	3.964	3.589	3.610
	(0.983)	(1.191)	(0.985)	(1.419)	(0.985)	(1.332)
Boring	2.967	3.020	3.403	3.215	3.185	3.115
	(0.984)	(0.934)	(0.985)	(1.090)	(0.984)	(1.005)
Seductive	2.852	2.852	3.026	3.083	2.939	2.964
	(0.983)	(0.623)	(0.985)	(1.230)	(0.986)	(0.961)

Note. Values enclosed in parenthesis are standard deviations.

If participants who received detail sentences were activating more prior knowledge and constructing more connections to the target information than readers of the base-text, then their accuracy in responding to the target trials should be better than readers of the base-text. In contrast, if participants who received detail sentences failed to construct connections to the target information, particularly between the prime and target information, then they could be expected to use a strategy for responding to the verification probes. Using a strategy such as the feeling of knowing strategy would result in poorer accuracy in responding to targets as compared to base-text reader who would be comparing the verification statement to their representation of the text.

The analyses of probe response accuracy included only the target trials in which the prime trial was answered correctly, which excluded 16.89% of the trials. The mean percentages of target probes answered correctly are displayed in Table 3. The analysis of participant variability consisted of a 2 (Text) X 3 (Version) ANCOVA, in which both factors were entered as between-participant manipulations. The covariate, accuracy responding to practice probe trials, did not have a significant effect, $\underline{F}_{S}$ (1, 111) = 2.447, $\underline{p} > .10$, $\underline{MSE} = .091$. In the analysis of item variability, Text was entered as a between-item factor while Version was entered as a within-item factor. Although the pattern of means displayed in Table 3 shows the highest degree of accuracy for the base-text condition, only the analysis of item variability produced a significant effect for Version; $\underline{F}_{S}$ (2, 111) = 1.558, $\underline{p} > .20$, $\underline{MSE} = .058$, $\underline{F}_{I}$ (2, 28) = 4.466, $\underline{MSE} = .026$. Planned comparisons revealed a tendency for probes to be responded to more accurately in the base-text condition than in the boring details condition; $\underline{t}_{S}$ (111) = 1.74, $\underline{p} = .084$, $\underline{SE} = .044$, $\underline{t}_{I}$ (28) = 3.46, $\underline{SE} = .023$. Although not significant in the participant analysis, there was also a marginal difference by items between the base-text and seductive details conditions; $\underline{t}_{S}$ (111) = 1.10, $p > .25$, $\underline{SE} = .044$, $\underline{t}_{I}$ (28) = 1.98, $\underline{p} = .068$, $\underline{SE} = .023$. There was no difference in response accuracy between the seductive and boring details conditions; $\underline{t}_{S}$ (111) < 1, $\underline{p} > .30$ $\underline{SE} = .044$, $\underline{t}_{I}$ (28) = 1.38, $\underline{p} > .30$, $\underline{SE} = .024$. The results reveal a tendency for target probes to be responded to more accurately if a participant read a base-text version of a passage rather than reading either a seductive details or boring details version.

Table 3

Mean Probe Response Accuracy from Experiment 2 for Target Trials when the Prime Trial was Answered Correctly as a Function of Text and Version

	Lightning		White Dwarf		Mean	
Condition	Adjusted M	Unadjusted M	Adjusted M	Unadjusted M	Adjusted M	Unadjusted M
Base	78.85	79.76	77.10	79.32	77.97	78.13
	(19.51)	(19.95)	(19.40)	(19.94)	(19.35)	(19.77)
Boring	74.34	74.38	66.41	65.79	70.38	70.19
	(19.32)	(21.26)	(19.40)	(18.09)	(19.34)	(19.99)
Seductive	74.52	75.00	71.86	71.71	73.19	73.40
	(19.37)	(16.72)	(19.33)	(20.35)	(19.34)	(18.40)

Note. Values enclosed in parenthesis are standard deviations.

When detail sentences were added to passages, participants tended to respond faster but less accurately to the verification statements than when no detail sentences added to the passages. However, caution should be taken when interpreting these results because relatively high percentages of trials were excluded from the response time (26.06%) and response accuracy (16.89%) analyses. To test whether participants in the details conditions were making more errors simply because they were responding to the probe trials faster, mean response times to incorrectly answered prime and target trials were computed (see Table 4). Response times to practice trials was entered as the covariate along with Text and Version entered as between-participant factors in the analysis of participant variability. In the item analysis, Text was entered as a between item factor while Version was entered as a repeated measure. Incorrectly answered probes were responded to about equally fast regardless of the version of a passage that was read, F_S (2, 94) < 1, p > .50, MSE = 3.975, F_I (2, 46) < 1, p > .85, MSE = .558. This result suggests that participants may not have traded speed for accuracy when responding to the verification probes.

Table 4

Mean Probe Response Times in seconds from Experiment 2 for Incorrect Prime and Target Trials Combined as a Function of Text and Version

	Lightning		White Dwarf		Mean	
Condition	Adjusted M	Unadjusted M	Adjusted M	Unadjusted M	Adjusted M	Unadjusted M
Base	4.851	4.922	5.145	5.241	4.998	5.076
	(2.410)	(3.205)	(2.411)	(2.032)	(2.414)	(2.661)
Boring	3.806	4.129	5.161	4.873	4.484	4.545
	(2.616)	(1.842)	(2.436)	(3.007)	(2.426)	(2.552)
Seductive	3.176	3.095	5.403	5.370	4.289	4.196
	(2.334)	(1.135)	(2.409)	(3.240)	(2.412)	(2.623)

Note. Values enclosed in parenthesis are standard deviations.

NO Probe Trials. Responses to the NO probe trials demonstrate how well participants were able to identify information that was not included in the text. If participants who received seductive details were relying on a feeling of knowing to answer the verification questions, then the same fast response times and low accuracy should be evident when responding to these trials. Responses times of correctly answered NO probe trials were analyzed to test this prediction, which excluded 14.16% of trials. In the participant analysis, Text and Version were entered into an ANCOVA as between-participant factors. The covariate, response times to correctly answered probes about the practice text, had a significant effect; F_S (1, 111) = 29.599, MSE = 20.590. An ANOVA was used in the analysis of item variability with Text entered as a between-item factor and Version entered as a within-item factor. There was a significant effect of Text, F_S (1, 111) = 14.152, MSE = 9.844, F_I (1, 46) = 4.403, MSE = 3.196. Probes about the lightning text (adjusted M = 2.992 s, unadjusted M = 3.004 s) were responded to faster than those about the white dwarf text (adjusted M = 3.570 s, unadjusted M = 3.557 s). The item analysis also revealed an interaction between Text and Version; F_S (2, 111) = 1.786, p = .159, MSE = 1.300, F_I (2, 92) = 3.086, MSE = .685. As Table 5 shows, response times to NO probes were not affected by the version of the lightning text that was read. However, response times to NO probes about the white dwarf text were faster after reading a seductive details version of the passage than after reading either the base-text, t_S (111) = 1.720, p = .088, SE = .027, t_I (92) = 4.166, SE = .126, or boring details text, t_S (111) = 2.128, SE = .273, t_I (92) = 2.343, SE = .139. Response time did not differ between the base-text and boring details versions, t_S (111) < 1, p = .674, SE = .273, t_I (92) = 1.406, p = 167, SE = .142. Seductive details in the white dwarf text lead readers to discriminate statements that were not present faster than if boring or no details were present.

Participants who read a base-text version of a passage were predicted to respond to the NO probe trials more accurately than participants who received details sentences. Mean percent accuracy for the NO probe trials are presented in Table 6. In the participant analysis, Text and Version were entered in an ANCOVA as between-participant factors. The covariate, accuracy responding to the practice text probes, had a significant effect, F_S (1, 111) = 4.076, MSE = .052. An ANOVA was used

Table 5

Mean Response Times in seconds from Experiment 2 for Correct No-Probe Trials as a Function of Text and Version

	Lightning		White Dwarf		Mean	
	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted
Condition	M	M	M	M	M	M
Base	3.034	3.028	3.687	3.757	3.360	3.374
	(0.834)	(0.905)	(0.836)	(1.016)	(0.836)	(1.016)
Boring	3.018	3.062	3.802	3.647	3.410	3.347
	(0.835)	(0.766)	(0.843)	(1.297)	(0.837)	(1.085)
Seductive	2.923	2.922	3.221	3.268	3.072	3.091
	(0.834)	(0.564)	(0.834)	(0.924)	(0.835)	(0.771)

Note. Values enclosed in parenthesis are standard deviations.

Table 6

Mean Probe Response Accuracy from Experiment 2 for No Probe Trials as a Function of Text and Version

	Lightning		White Dwarf		Mean	
	Adjusted	Unadjusted	Adjusted	Unadjusted	Adjusted	Unadjusted
Condition	M	M	M	M	M	M
Base	93.16	93.85	88.75	88.16	90.95	91.15
	(11.42)	(5.98)	(11.39)	(9.94)	(11.33)	(8.50)
Boring	88.31	88.33	78.54	78.07	83.42	83.33
	(11.31)	(10.17)	(11.36)	(13.09)	(11.34)	(12.65)
Seductive	83.38	83.75	82.13	82.02	82.76	82.91
	(11.34)	(12.38)	(11.32)	(15.41)	(11.34)	(13.78)

Note. Values enclosed in parenthesis are standard deviations.

in the analysis of item variability with Text entered as a between-item factor and Version entered as a within-item factor. Although marginally significant in the item analysis, the analyses suggest that participants' responses were more accurate if they read the lightning passage ($\underline{M}$ = 88.28%) than if they read the white dwarf passage ($\underline{M}$ = 83.14%), $\underline{F}_S$ (1, 111) = 5.903, $\underline{MSE}$ = .076, $\underline{F}_I$ (1, 46) = 3.022, $\underline{p}$ = .09, $\underline{MSE}$ = .042. More importantly, Version had a significant effect on response accuracy, $\underline{F}_S$ (1, 111) = 6.405, $\underline{MSE}$ = .082, $\underline{F}_I$ (1, 92) = 13.765, $\underline{MSE}$ = .102. Participants who read a base-text passage were able to identify statements that were not presented in their passage more accurately than participants who read either a boring details passage, $\underline{t}_S$ (111) = 2.951, $\underline{SE}$ = .026, $\underline{t}_I$ (92) = 4.869, $\underline{SE}$ = .016, or a seductive details passage, $\underline{t}_S$ (111) = 3.216, $\underline{SE}$ = .025, $\underline{t}_I$ (92) = 4.353, $\underline{SE}$ = .019. There was no difference in accuracy between participants who received boring or seductive details, $\underline{t}_S$ (111) < 1, $\underline{p}$ = .796, $\underline{SE}$ = .026, $\underline{t}_I$ (92) < 1, $\underline{p}$ = .859, $\underline{SE}$ = .018. Thus, when irrelevant information was present, readers were less accurate at identifying statements that did not appear in the passage than readers who read the same passage without detailed added. The analysis of the NO probes supports the findings from the target probe analysis, that the presence of details sentences leads readers to perform more poorly on the sentence verification task than readers of the base-text.

Discussion

The reading time results did not replicate the findings from Experiment 1. In Experiment 1, participants tended to read passages with seductive details faster than participants who read the base-text or boring details versions. However, in Experiment 2, there was little variability in reading times of the core content from the passages. Another difference was that in Experiment 1, participants spent similar amounts of time reading the seductive and boring details sentences. In Experiment 2, though, readers spent more time reading the seductive details than the boring details.

Differences in the memory tasks used in the two experiments can account for the differences in online processing. A post-hoc analysis showed that reading times in Experiment 1 were significantly slower than in Experiment 2. In the first experiment, participants were told that they would have to write down everything they could recall from the passage. This type of memory task places a heavy burden on participants to remember the information they read. In this situation, readers would be expected to invest considerable time constructing a mental representation of the text that closely resembled the actual text.

In contrast, participants in Experiment 2 were told that they would have to verify whether or not a statement was presented in the passage they read. This type of memory task does not place a heavy burden on participants to remember the information because the verification statements serve as a memory cues. Participants only needed to recognize whether or not the information was presented in the text they read. Without the burden of trying to remember everything about the passage, participants read the various versions of the passages at the same rate. However, analysis of the reading times of the seductive and boring detail sentences revealed that readers' spent more time processing the seductive information than the boring information. Thus, in this case, the seductive details appear to have captured readers' attention more than the boring details.

Despite the difference in reading times for the detail sentences, the mere fact that a text contained detail sentences had negative consequences on participants' sentence verification task performance. Analysis of response times to target probes revealed that participants who read a passage containing detail sentences responded faster than participants who read a base-text passage. However, they also tended to answer fewer of the target probes correctly as compared to participants who read a base-text passage. Not only did readers of the passages with details have difficulty accurately identifying statements that were in the passage they read, they also has difficulty identifying statements that were not present in the passage. Analysis of the NO probe trails revealed lower accuracy when the passage that was read contained detail sentences than when no details were added.

CHAPTER FIVE

General Discussion

The findings from this study provide insights into the effects seductive and boring details have on readers and the cognitive mechanisms involved in producing the observed effects. There were four questions that this research was designed to address. The main issue addressed in this study was whether seductive details have a detrimental effect on readers' memory of explanative texts. The results of both experiments demonstrated that they do. In Experiment 1, participants who read a passage with seductive details recalled fewer of the propositions from the base text portion of the passage than those who read the same passage without details. This result replicates the findings reported in previous literature (Garner et al., 1989; Harp & Mayer, 1997, 1998; Schraw et al., 2001). In Experiment 2, participants who read a passage with seductive details responded less accurately to the sentence verification probes than those who read the same passage without details.

A second issue addressed in this study was whether the information added to a passage has to be seductive to have an effect on memory task performance. Both experiments showed that including boring details hindered readers' performance on subsequent memory tasks. In Experiment 1, boring details affected readers' ability to recall information from the passage. In this experiment, participants who read a passage that contained boring details tended to recall fewer propositions from their passage as those who read the same passage without details. More importantly, though, they recalled more propositions than participants who read the same passage with seductive details. This pattern of results demonstrates that adding tangential information to a passage handicaps readers' ability to recall the more important information.

The results of Experiment 2 also demonstrated that including either seductive or boring details affects participants' memory of the text. Although the participants in this experiment who read a passage with seductive details responded just as accurately to the sentence verification trials as those who read the same passage with boring details, both details groups tended to respond less accurately than participants who read the same passage without details. Thus, including tangential information, regardless of whether it was seductive or boring, interfered with readers' ability to discern whether or not a sentence was included in a text.

A third issue addressed in this study was whether the presence of detail sentences affects readers' online processing of main ideas. Similar to the effects on readers' memory, online processing was affected differently in the two experiments. In Experiment 1, readers' online processing was seduced away from the main ideas. When seductive details were present, readers tended to spend less time processing the sentences surrounding the details than when either no detail present or boring details were present. However, in Experiment 2, readers' online processing did not appear to be affected by the presence of either seductive or boring details. Both details groups spent a similar amount of time reading the core content of their passage as participants who read the same passage without details. The possibility that the difference in online processing relates to the differences observed in readers' memory task performance will be discussed further below.

The fourth issue was whether the presence of detail sentences alters readers' ability to make connections among main ideas in an explanatory text. The results from Experiment 2 are consistent with the position that including detail sentences reduces the likelihood that readers will make connections among the main ideas as compared to when there are no details. The results of the sentence verification task revealed that when seductive or boring details were in a passage, participants tended to respond faster but less accurately than those who read the same passage without detail sentences. This pattern suggests that groups that received a text with detail sentences may have adopted a strategy for responding to the probes. Although the findings do not reveal why readers adopted a strategy, one possibility is that the detail sentences consumed their working memory resources for constructing a coherent representation of the text. Without a coherent well-connected representation, they may have resorted to making their responses based on how plausible they believed it was that the verification statement was included in the passage they read. The discussion below will examine this possibility further.

Recall versus Recognition

Readers respond differently when faced with a free recall task than they do when faced with a recognition task (Lorch, Klusewitz, & Lorch, 1995; van den Broek, Risden, & Husebye-Hartman, 1995; Yang, Verheul, Verhelst, & Van Essen, 1985). Likewise, the cognitive processing a person has to perform in a free recall task differs from what has to be performed in a recognition task (Kintsch, 1971, 1998). Considering the methodological differences between the two experiments in the current study can help reconcile the differences in the effects seductive and boring details had on readers in each experiment.

When given the choice, most students prefer to take a multiple choice (i.e., recognition) exam rather than an essay (i.e., free-recall) exam. Why? Because, with an essay exam, students have to invest a relatively long amount of time intensely studying to fully comprehend the material for the test. At test time, they have relatively few cues available for retrieving the critical information, and if they are unable to retrieve the information there is not much else they can do to provide a credible response. In contrast, with a multiple choice exam, students do not have to spend as much time studying, the studying they do does not have to be as intense, at test time they only need to recognize correct answers, and when recognition fails they can use strategies to help then make a response (D'Ydewalle, Swerts, & de Corte, 1983; O'Neill, & Johnston, 1976; Yang, et al., 1985). This example illustrates some of the key differences between free-recall and recognition. These same differences can be seen in the results of Experiments 1 and 2.

Participants' online processing was affected by knowing the type of memory task they were going to perform when they finished reading. Before they started reading, participants in Experiment 1 were told that they would perform a free-recall task, whereas participants in Experiment 2 were told they would perform a sentence verification task (i.e., a recognition task). A comparison of reading times across experiments revealed that participants in Experiment 1 spent more time processing their passage than participants in Experiment 2. This finding suggests that participants in Experiment 1 invested more resources constructing a mental representation of the passage than those in Experiment 2. This may have had an impact on the way in which seductive and boring details affected readers' memory for the passages in each of the experiments.

When participants were expecting a free-recall task, they responded differently when seductive details were added to the text than when either no detail sentences were added or boring details were added. Readers who encountered seductive details in their passage spent considerably less time processing the information from the base-text portion of passage than the other participants. This indicates that these readers were not investing the same amount of resources integrating that information into their representation of the passage. Because of this, they were less likely to include propositions from the base-text portion of the passage in their recall protocol as participants who did invest additional time and resources constructing their mental representation of the passage.

Participants who expected a sentence verification task spent even less time processing their passage than those who expected a free-recall test. This suggests that these readers had a lower threshold for comprehension. That is, they knew that they only needed to understand the passage well enough to recognize the information that was presented. They did not have to connect each sentence with the information that came before it or develop a deep understanding of the material. Because of this, the presence of seductive and boring details did not produce any detectable effects on readers' online processing of the core content sentences in the passage. This position also can account for why the detail sentences interfered with readers' construction of an accurate mental representation of the passage.

After people read a sentence, they try to relate that new information with the information that came before it (Haviland & Clark, 1974). The participants in Experiment 2 who were in a base-text group would have been able to construct a coherent representation of their passage because each new sentence could be related to the information that came before it. However, participants who were in either of the details groups would not have been able to easily relate the new information to the information that immediately came before it (i.e., the pair of detail sentences). Because the sentence itself was comprehensible and readers only needed to recognize the information later, local level processing was not disrupted.

The results from the sentence verification task revealed that adding detail sentences to the passages affected readers' comprehension. Participants who read a passage that contained either seductive or boring details tended to respond faster to the target trials but less accurately to both target trials and NO probe trials than participants who read the base-text without detail sentences. This pattern suggests that these participants were using a strategy to respond to the trials. They may have used a feeling of knowing strategy; basing their responses on a judgment of how plausible it was that the to-be-verified statement was in the passage they read. If a statement seemed as though it belonged in the passage, the details groups could quickly respond in the affirmative. As a result, though, some target probes would incorrectly be judged as having not been presented in the passage because they did not match their understanding of the passage. Conversely, statements that seemed not to fit their understanding of the passage could quickly be responded to in the negative. Nevertheless, some of the NO probes would have been judged as being in the passage because they were thematically related to the information in the passage (Sulin & Dooling, 1974). When neither the threshold for responding affirmatively nor negatively was reached, participants would have to invest time and resources to make the determination of which way to respond. Participants who read a passage with details statements made the wrong decision more frequently than those who read the same passage without details. Readers in the base-text group were able to construct a coherent representation of the passage. Therefore, during the sentence verification task, they compared the to-be-verified statement with the information stored in their mental representation. Although this process took more time, the benefit was higher accuracy in detecting whether or not the statement was actually in the passage they read.

<u>Assessment of Harp and Mayer’s (1998) Hypotheses</u>

Harp and Mayer (1998) pitted three possible explanations of the seductive details effect against one another as though they were mutually exclusive possibilities. They concluded that seductive details prime inappropriate prior knowledge, which readers then use as an organizational schema for understanding the material. The findings from the present study support this position, but they also provide support for the two other hypotheses that were discounted as explanations of how seductive details do their damage.

Seductive details were named such because they are thought to seduce readers' attention away from the main ideas. This is the basis of Harp and Mayer's (1998) distraction hypothesis. It also posits that "seductive details do their damage by grabbing and holding readers' selective attention" (p. 430). They reasoned that if this hypothesis was correct, then introducing manipulations that draw attention to the main ideas should reduce or eliminate the presence of the seductive details effect. They highlighted the main ideas, provided learning objectives, and included preview sentences and number signals. None of these manipulations improved the ability of readers of a seductive details text to recall the structurally important information or their ability to answer transfer problems as compared to readers of the same passage without details. This failure to affect the seductive detail effect was taken as evidence that was inconsistent with the distraction hypothesis. However, because they did not include a dependent variable that measures readers' attention, they cannot eliminate the distraction hypothesis as a viable explanation of the seductive details effect.

Reading times were collected as a measure of readers' attention in the present study. Reading times from Experiment 1 demonstrated that readers' attention was seduced away from the main ideas in the passages. When told that they would have to recall the text, participants who read a passage containing seductive details spent less time processing the causally connected statements that surrounded the detail sentences than participants who read the same passage with no detail or boring details. Reading times from Experiment 2 demonstrated that seductive details grabbed and held readers' attention. When told they would have to verify whether or not a statement came from the passage, participants whose passage contained seductive details spent more time processing the details than participants whose passage contained boring detail sentences. Thus, readers' selective attention does appear to be affected by the presence of seductive details. Future research could take advantage of eye-tracking methodologies to identify more definitively where people's attention is (and is not) being focused in texts containing seductive and boring details.

The disruption hypothesis states that seductive details are harmful because they interfere with readers' ability to construct a coherent representation of the passage. Because seductive details often are interjected between main ideas, they break the causal chain of events. A consequence of which may be that readers do not interpret the main ideas as parts of a sequence of related events, but rather as separate events. Harp and Mayer (1998) postulated that if this were the case, then introducing manipulations that helped participants organize the important events would reduce the seductive details effect. They provided instructions for how to organize the material, included numerical signals, and separated the seductive details from between the main ideas by placing them at the beginning of the passage. Again, though, none of these manipulations affected the seductive details effect. This was taken as evidence inconsistent with the disruption hypothesis.

In contrast, the results from the present study can be interpreted as being consistent with the disruption hypothesis. Readers in Experiment 1 who had seductive details in their passage may have spent less time processing the events than the other two groups because they were only constructing a representation of the individual events being presented; whereas, the other readers were integrating the events into a coherent mental representation. As a result, the readers of the seductive details passages were unable to recall as much of the passage as the other two groups. In Experiment 2, readers did not have to construct a fully integrated mental representation of the passage because they only needed to recognize the material later. As a consequence, reading times were similar for all three groups. Nevertheless, readers of the base-text passages likely formed a coherent representation because each sentence could be integrated with the information the immediately preceded it. In contrast, the presence of detail sentences could have prevented the other two groups from constructing a coherent representation, resulting in their poorer accuracy in the verification task as compared to the base-text group.

Harp and Mayer's (1998) other hypothesis was the diversion hypothesis. This hypothesis posits that although readers of a passage with seductive details construct a coherent mental representation, they do so based on inappropriate prior knowledge that was activated by the seductive details. Harp and Mayer reasoned that placing all of the seductive details at the beginning of a passage should exacerbate the seductive detail effect, whereas placing them all at the end should diminish the effect. They found that putting the details at the beginning did result in a seductive details effect, but the magnitude of the effect did not differ from having the details interspersed throughout the passage. When the details were placed at the end of the passage, the effect of the seductive details disappeared as they predicted.

The results from the present study can also be interpreted in support of the diversion hypothesis. If information that is tangentially related to the main ideas primes inappropriate prior knowledge, then both seductive and boring details should have similar effects on readers' memory. In Experiment 1, both seductive and boring details groups recalled fewer propositions from the base-text portion of their passages than participants in a base-text group. Furthermore, in Experiment 2, both seductive and boring details groups responded less accurately to the verification probes than participants in base-text group.

The results from this study have implications for a variety of "real world" applications. One likely area is that of classroom teaching. Professors who want to enliven their lectures should avoid adding tangential information in a haphazard fashion to their lessons. Instead, they could add stories, act out skits, or provide hands-on examples that reiterate and reinforce the main points of the lesson. For example, conducting an experiment in which static electricity is produced (i.e., creating miniature bolts of lightning) may be a good means of teaching students about what causes lightning. Also, considering the results from Harp and Mayer's (1998) third and fourth experiments, these types of lesson reinforcers would be least distracting if introduced only after the main points have been taught to the students. This same process could equally be applied to the construction of textbook material. Rather than placing comics in a textbook just for entertainment purposes, considerations should made to assure that the comics reinforce main ideas of the chapter or section in which they are added.

Another area where this research could be applied is website construction and software design (or more generally product development). In website construction, the main themes of the website should be prominently displayed near the top of webpages and supporting information following. Distracters, such as banner advertisements, flashing text, or seductive images should be avoided as much as possible. In situations where they must be used, they should be placed in out of the way places, such as grouped together at the bottom of the webpage. In software design, good design is characterized by keeping the interface as simple as possible (Nielsen, 1993, Shneiderman, 1992). That is, just because a programming language or device permits the programmer to create certain widgets does not necessarily mean that those widgets should be included in the product. Widgets should be included only when they facilitate the completion the of the users' primary goal or simplify the users' task.

In conclusion, people who want to convey a message to an audience should be wary of including seductive details as a means of making the rest of their message more interesting. Their true message may become obscured by the seductive information, and thereby become less memorable than if the seductive information was not included. If seductive details are included, then the audience should be made explicitly aware of how the seductive information relates to the more important information. That way, they can incorporate the seductive information into their representation as a means of reinforcing the main ideas, as well as building strong causal connections among the main ideas.

Appendix A
Base-Text Version of The Process of Lightning Text

The Process of Lightning

What causes lightning? Lightning can be defined as the discharge of electricity resulting from a difference in electrical charges between a cloud and an object on the ground.

The process of lightning begins when moist air near the Earth's surface becomes heated and rises rapidly, producing an updraft. As the water vapor rises, it cools off because the surrounding air pressure and temperature decrease at higher altitudes. The cooled water vapor begins to merge into tiny droplets of water and form clouds. Clouds are little more than large pockets of water droplets that drift around overhead.

The tops of clouds often extend so high into the atmosphere that they are above the freezing level. When water droplets rise to these high altitudes they turn into tiny ice crystals. The ice crystals get larger when they bump into each other and freeze together. Over time, some of the water droplets and ice crystals inside a cloud become too heavy to remain suspended by updrafts. Gravity takes over and the heavier particles begin to fall back down towards Earth. This falling precipitation is commonly known as rain, sleet, snow and hail. The precipitation drags air along with it as it falls, which creates a downdraft.

The larger falling raindrops and pieces of ice collide with the smaller upward moving water droplets and ice crystals. These collisions are believed to create small electrical charges that build up within clouds. However, the exact manner by which the charges develop is not fully understood. The electrical charges that are created may have either a negative or positive voltage associated with them. The charges separate under the influence of the updrafts, downdrafts and gravity. Negatively charged particles tend to sink to the bottom of clouds, and positively charged particles tend to rise to the top of clouds.

Scientists believe that a very strong electrical potential is created between the opposing charges within the cloud. The first stroke of lightning takes the form of a step leader. A spark is created when the air's threshold for electrical resistance breaks down, triggering a step leader to form.

In a cloud-to-ground lightning strike, a negatively charged leader moves downward from the bottom of the cloud in short stairstep increments towards the Earth. Each step is about 50 yards long, and lasts for a mere one millionth of a second. The forward motion pauses for about 50 millionths of a second between steps. As a step leader approaches the ground, positively charged streamers spring forth from earthbound objects. These grounded streamers can come from most any object on Earth, such as flagpoles, cars, houses and even people.

Because opposing electrical charges attract each other, the positively charged streamers race towards the negatively charged step leader from the cloud. The step leader will connect with only one of the streamers, usually the one that is connected to the tallest object. The two leaders typically meet about 165 feet above the surface of the Earth, creating a direct current between the cloud and the Earth. At this point, the negative energy stored in the cloud is released and flows down the electrical pathway until it strikes the ground. A return stroke of positively charged particles rushes skyward, back up to the cloud. It reaches the cloud in about 70 microseconds. Because it moves so quickly, its upwards motion cannot be detected by the human eye. This return stroke produces the bright light people notice as lightning.

After a thunderstorm, the ground is saturated with rain. When the Sun peeks out from behind the storm clouds, the whole process begins again.

Appendix B

Event Units in the Base-Text Version of Process of Lightning Text

1. moist air becomes heated
2. moist air rises rapidly
3. updraft is created
4. water vapor cools off
5. cooled water vapor merges into droplets
6. water droplets form clouds (clouds are pockets of water droplets)
7. clouds extend above the freezing level
8. water droplets turn into ice crystals
9. ice crystals bump into each other
10. ice crystals freeze together
11. ice crystals get larger
12. water droplets become too heavy to remain suspended
13. ice crystals become too heavy to remain suspended
14. gravity attracts heavier particles
15. heavier particles fall towards Earth
16. air gets dragged downward with precipitation
17. downdraft is created
18. falling raindrops and ice collide with rising droplets and ice crystals
19. small electrical charges are created
20. electrical charge build up within clouds
21. electrical charges separate
22. negatively charged particles tend to sink
23. positively charged particles tend to rise
24. an electrical potential is created between opposing charges
25. air's threshold for electrical resistance breaks down
26. a spark is created
27. a step leader forms
28. a negatively charged leader moves downward

29. positively charged streamers spring forth from earthbound objects
30. positively charged leaders race towards the negatively charged step leader
31. The step leader connects with one streamer (two leaders meet)
32. a direct current between the cloud and the Earth is created
33. negative energy is released
34. negative energy flows down electrical pathway
35. negative energy strikes the ground
36. return stroke of positively charged particles rushes skyward
37. bright light is produced

Appendix C

Seductive Details Version of Process of Lightning Text

The pairs of seductive detail sentences have been underlined in the following text to make them more obvious. They were not underlined in any of texts presented to participants during the experiments.

The Process of Lightning

What causes lightning? Lightning can be defined as the discharge of electricity resulting from a difference in electrical charges between a cloud and an object on the ground.

The process of lightning begins when moist air near the Earth's surface becomes heated and rises rapidly, producing an updraft. <u>Large birds often seek out updrafts so they can spend a long time soaring around in the sky. This helps them scour the ground below so they can swoop down and catch unsuspecting prey.</u> As the water vapor rises, it cools off because the surrounding air pressure and temperature decrease at higher altitudes. The cooled water vapor begins to merge into tiny droplets of water and form clouds. Clouds are little more than large pockets of water droplets that drift around overhead. <u>Some meteorologists earn hundreds of thousands of dollars by studying cloud formations. Top dollar is paid to those who specialize in research on the most deadly types of clouds, such as tornadoes and hurricanes.</u>

The tops of clouds often extend so high into the atmosphere that they are above the freezing level. When water droplets rise to these high altitudes they turn into tiny ice crystals. The ice crystals get larger when they bump into each other and freeze together. Over time, some of the water droplets and ice crystals inside a cloud become too heavy to remain suspended by updrafts. Gravity takes over and the heavier particles begin to fall back down towards Earth. This falling precipitation is commonly known as rain, sleet, snow and hail. The precipitation drags air along with it as it falls, which creates a downdraft. <u>Occasionally, downdrafts create a particularly dangerous phenomena known as vertical wind shear. These downward gusts of wind are so strong that they can slam large planes straight into the ground</u>.

The larger falling raindrops and pieces of ice collide with the smaller upward moving water droplets and ice crystals. These collisions are believed to create small electrical charges that build up within clouds. However, the exact manner by which the charges develop is not fully understood. <u>In trying to understand these processes, sometimes scientists create lightning by launching small metal rockets into storm clouds. After blasting off, the rockets are guided into the heart of the storm by using remote controllers.</u> The electrical charges that are created may have either a negative or positive voltage associated with them. The charges separate under the influence of the updrafts, downdrafts and gravity. Negatively charged particles tend to sink to the bottom of clouds, and positively charged particles tend to rise to the top of clouds.

Scientists believe that a very strong electrical potential is created between the opposing charges within the cloud. The first stroke of lightning takes the form of a step leader. A spark is created when the air's threshold for electrical resistance breaks down, triggering a step leader to form. <u>Metal airplanes have a very low electrical resistance. They sustain very little or no damage when they are struck by a lightning bolt because it passes right through the plane and out the other side.</u>

In a cloud-to-ground lightning strike, a negatively charged leader moves downward from the bottom of the cloud in short stairstep increments towards the Earth. Each step is about 50 yards long, and lasts for a mere one millionth of a second. The forward motion pauses for about 50 millionths of a second between steps. As a step leader approaches the ground, positively charged streamers spring forth from earthbound objects. These grounded streamers can come from most any object on Earth, such as flagpoles, cars, houses and even people. <u>People watched as a bolt of lightning struck a high school football player. The bolt tore a hole in his helmet, burned his jersey, and blew off his shoes, but he lived through the experience.</u>

Because opposing electrical charges attract each other, the positively charged streamers race towards the negatively charged step leader from the cloud. The step leader will connect with only one of the streamers, usually the one that is connected to the tallest object. <u>The tallest objects in dense forest areas are trees. If they are struck, the chances are high that a wildfire will be started that will ravage thousands of acres each day.</u> The two leaders typically meet about 165 feet above the surface of the Earth, creating a direct current between the cloud and the Earth. At this point, the negative energy stored in the cloud is released and flows down the electrical pathway until it strikes the ground. If the ground where the lightning strikes is composed of sand, a fulgurite may be formed. The extreme heat of the lightning fuses sand together into a rock that has the shape of the electricity's path. A return stroke of positively charged particles rushes skyward, back up to the cloud. It reaches the cloud in about 70 microseconds. Because it moves so quickly, its upwards motion cannot be detected by the human eye. This return stroke produces the bright light people notice as lightning.

After a thunderstorm, the ground is saturated with rain. When the Sun peeks out from behind the storm clouds, the whole process begins again.

Appendix D
Boring Details Version of Process of Lightning Text

The pairs of boring detail sentences have been underlined in the following text to make them more obvious. They were not underlined in any of texts presented to participants during the experiments.

The Process of Lightning

What causes lightning? Lightning can be defined as the discharge of electricity resulting from a difference in electrical charges between a cloud and an object on the ground.

The process of lightning begins when moist air near the Earth's surface becomes heated and rises rapidly, producing an updraft. <u>People who fly kites often seek out updrafts so they can get their kites up in the sky. After a kite reaches a couple hundred feet, the prevailing winds will keep the kite airborne.</u> As the water vapor rises, it cools off because the surrounding air pressure and temperature decrease at higher altitudes. The cooled water vapor begins to merge into tiny droplets of water and form clouds. Clouds are little more than large pockets of water droplets that drift around overhead. <u>Some meteorologists specialize in the nephology, which is the study of cloud formations. There are dozens of types of clouds floating around in the skies up above, such as stratus, cirrus, and cumulous clouds.</u>

The tops of clouds often extend so high into the atmosphere that they are above the freezing level. When water droplets rise to these high altitudes they turn into tiny ice crystals. The ice crystals get larger when they bump into each other and freeze together. Over time, some of the water droplets and ice crystals inside a cloud become too heavy to remain suspended by updrafts. Gravity takes over and the heavier particles begin to fall back down towards Earth. This falling precipitation is commonly known as rain, sleet, snow and hail. The precipitation drags air along with it as it falls, which creates a downdraft. <u>When downdrafts strike the ground, they tend to spread out in all directions. This makes gauging the wind's speed and direction a difficult task to accomplish, even for trained meteorologists.</u>

The larger falling raindrops and pieces of ice collide with the smaller upward moving water droplets and ice crystals. These collisions are believed to create small electrical charges that build up within clouds. However, the exact manner by which the charges develop is not fully understood. <u>In trying to understand these processes, scientists have invested many long hours studying satellite images of storm clouds. Originally, the images were black and white, but technological advances now permit color images to be taken.</u> The electrical charges that are created may have either a negative or positive voltage associated with them. The charges separate under the influence of the updrafts, downdrafts and gravity. Negatively charged particles tend to sink to the bottom of clouds, and positively charged particles tend to rise to the top of clouds.

Scientists believe that a very strong electrical potential is created between the opposing charges within the cloud. The first stroke of lightning takes the form of a step leader. A spark is created when the air's threshold for electrical resistance breaks down, triggering a step leader to form. <u>The ohm is a unit of electrical resistance. It represents the physical property of a conductor that offers resistance to the flow of electricity, permitting just one ampere to flow at one volt of pressure.</u>

In a cloud-to-ground lightning strike, a negatively charged leader moves downward from the bottom of the cloud in short stairstep increments towards the Earth. Each step is about 50 yards long, and lasts for a mere one millionth of a second. The forward motion pauses for about 50 millionths of a second between steps. As a step leader approaches the ground, positively charged streamers spring forth from earthbound objects. These grounded streamers can come from most any object on Earth, such as flagpoles, cars, houses and even people. <u>People can avoid being struck by lightning by staying indoors during thunderstorms. They should avoid talking on the telephone, watching television, or running any other electrical appliances until the storm is no longer a threat.</u>

Because opposing electrical charges attract each other, the positively charged streamers race towards the negatively charged step leader from the cloud. The step leader will connect with only one of the streamers, usually the one that is connected to the tallest object. <u>The tallest objects in large urban cities are buildings. Building codes</u>

have been imposed that now require most buildings over four stories high to have lightning rods installed on the roof. The two leaders typically meet about 165 feet above the surface of the Earth, creating a direct current between the cloud and the Earth. At this point, the negative energy stored in the cloud is released and flows down the electrical pathway until it strikes the ground. If the ground where the lightning strikes is covered with plant life, carbonization may turn the area black. Carbonization occurs when a plant's material combusts causing it to be reduced back to its primary element, carbon. A return stroke of positively charged particles rushes skyward, back up to the cloud. It reaches the cloud in about 70 microseconds. Because it moves so quickly, its upwards motion cannot be detected by the human eye. This return stroke produces the bright light people notice as lightning.

After a thunderstorm, the ground is saturated with rain. When the Sun peeks out from behind the storm clouds, the whole process begins again.

Appendix E

Base-Text Version of The Life Cycle of a White Dwarf Text

The Life Cycle of a White Dwarf

What exactly is a white dwarf? A white dwarf is a low-mass star that has exhausted all of its thermonuclear fuel and contracted to the size of Earth. Before a star becomes a white dwarf it progresses through several stages.

The life cycle of all stars begins as a mass of interstellar gas and dust referred to as a nebula. Nebulae are composed mainly of hydrogen, helium and stellar debris. Gravitational attraction draws denser portions of a nebula together and forms clumps of material known as protostars. As a protostar's material contracts, gravitational energy is converted into thermal energy, producing light and heat. At this point, protostars are still rather expansive but they produce substantial luminosity.

After contracting for thousands of years, the star's temperature reaches a few million degrees Kelvin, setting off a thermonuclear reaction. Such extreme temperatures cause hydrogen atoms at the star's core to travel so fast that they slam into one another and stick together. When this happens hydrogen is converted into helium, a process known as core-hydrogen burning.

Core-hydrogen burning also creates outward radiating energy. When the outward force matches the inward gravitational pressure from a star's many layers, equilibrium is achieved. At this point, a protostar stabilizes and can be classified as a main sequence star; the longest stage of most stars' lives.

Gradually, all of the hydrogen at a star's core is converted into helium. Without core-hydrogen burning, the outer layers begin to compress and heat the core. The increasing heat ignites a thin shell of hydrogen surrounding the core, a process called shell-hydrogen burning. Stars manage to remain on the main sequence for several million more years by converting this hydrogen source into helium. Shell-hydrogen burning also causes the outer layers to expand and cool. The expansion produces a hundredfold increase in the star's diameter. When a star's surface temperature falls to 3500 degrees Kelvin, the gases take on a reddish hue and it becomes known as a red giant star.

Gravitational pressure continues to compress a star's core until its temperature reaches 100 million degrees Kelvin, activating core-helium burning. At this point, helium atoms are converted into carbon and oxygen. As long as the core is burning helium, equilibrium between the inward and outward forces is maintained. However, core-helium burning stops when the core becomes filled with carbon and oxygen. Pressure from the outer layers begins to compress and heat the core again. When the shell of helium surrounding the core becomes hot enough, a thermal pulse is created as it begins to burn. The thermal pulse causes the red giant's outer layers to expand to the size of Earth's or Mars' orbital path. In some cases, the thermal pulse can separate some of the outer layers from the star, creating a nebula.

Low-mass stars do not have enough material to generate the gravitational pressure needed to initiate core-carbon burning. The core's temperature must reach 600 million degrees Kelvin to start the reaction. Due to the lack of thermonuclear reactions, the core compresses itself until reaching the size of Earth. The core becomes so densely packed that a single tablespoon of the material would weigh approximately one ton. Eventually, the remaining layers surrounding the core of the star separate themselves from the compressed core, exposing a white dwarf star.

Over billions of years, a white dwarf slowly dims as its temperature cools to absolute zero. At this point, the star is sometimes referred to as a black dwarf or dead star. So ends the life cycle of the white dwarf star.

Appendix F

Event Units in the Base-Text Version of

The Life Cycle of a White Dwarf Text

1. life cycle begins as a nebula (of gas and dust)
2. gravity draws dense portions of a nebula together
3. dense portions of a nebula form clumps (known as protostars)
4. gravitational energy is converted into thermal energy
5. light is produced (protostars produce substantial luminosity)
6. heat is produced
7. a thermonuclear reaction is set off
8. hydrogen atoms to travel fast
9. hydrogen atoms slam into one another
10. hydrogen atoms stick together
11. hydrogen is converted into helium (known as core-hydrogen burning)
12. outward radiating energy is created
13. outward force matches the inward gravitational pressure (equilibrium is achieved)
14. protostar stabilizes
15. all of the hydrogen at a star's core is converted into helium
16. core-hydrogen burning ceases
17. the outer layers begin to compress
18. compression heats the core (core becomes heated)
19. thin shell of hydrogen surrounding the core ignites (known as shell-hydrogen burning)
20. shell-hydrogen burning also causes the outer layers to expand
21. shell-hydrogen burning also causes the outer layers to cool
22. gases take on a reddish hue
23. temperature activates core-helium burning
24. helium atoms are converted into carbon
25. helium atoms are converted into oxygen
26. equilibrium between inward and outward forces is maintained

27. core becomes filled with carbon
28. core becomes filled with oxygen
29. core-helium burning stops
30. outer layers compress the core
31. compression heats the core
32. shell of helium surrounding the core begins to burn
33. a thermal pulse is created
34. outer layers to expand
35. thermal pulse can separate the outer layers of the star
36. separated layers become nebula
37. Low-mass stars cannot initiate core-carbon burning
38. the core compresses itself to the size of Earth
39. the remaining layers separate from the core
40. white dwarf star is exposed
41. white dwarf slowly dims
42. white dwarf's temperature cools
43. the life cycle of the white dwarf star ends

Appendix G

Seductive Details Version of The Life Cycle of a White Dwarf Text

The pairs of seductive detail sentences have been underlined in the following text to make them more obvious. They were not underlined in any of texts presented to participants during the experiment.

The Life Cycle of a White Dwarf

What exactly is a white dwarf? A white dwarf is a low-mass star that has exhausted all of its thermonuclear fuel and contracted to the size of Earth. Before a star becomes a white dwarf it progresses through several stages.

The life cycle of all stars begins as a mass of interstellar gas and dust referred to as a nebula. Nebulae are composed mainly of hydrogen, helium and stellar debris. <u>Dark nebulae are referred to as Barnard objects, after Edward Barnard, a filthy rich astronomer who documented their existence. When he died, there was a rumor that he requested a gold telescope be laid beside him in his coffin.</u> Gravitational attraction draws denser portions of a nebula together and forms clumps of material known as protostars. As a protostar's material contracts, gravitational energy is converted into thermal energy, producing light and heat. At this point, protostars are still rather expansive but they produce substantial luminosity.

After contracting for thousands of years, the star's temperature reaches a few million degrees Kelvin, setting off a thermonuclear reaction. Such extreme temperatures cause hydrogen atoms at the star's core to travel so fast that they slam into one another and stick together. When this happens hydrogen is converted into helium, a process known as core-hydrogen burning. <u>Helium was discovered by astronomers using a spectral analysis of light coming from the Sun during a solar eclipse in 1868. The name helium was given to this new element from the Greek god of the Sun, Helios.</u>

Core-hydrogen burning also creates outward radiating energy. When the outward force matches the inward gravitational pressure from a star's many layers, equilibrium is achieved. At this point, a protostar stabilizes and can be classified as a main sequence star; the longest stage of most stars' lives. <u>The shortest stage in the lives of very large</u>

stars is when the star goes supernova. Within minutes a high-mass star's outer layers collapse in upon the core, causing the whole star to violently explode.

Gradually, all of the hydrogen at a star's core is converted into helium. Without core-hydrogen burning, the outer layers begin to compress and heat the core. The increasing heat ignites a thin shell of hydrogen surrounding the core, a process called shell-hydrogen burning. Stars manage to remain on the main sequence for several million more years by converting this hydrogen source into helium. Helium is often used by deep sea divers in their breathing tanks to avoid getting decompression sickness. This prevents nitrogen bubbles from forming in their blood, which can cause death. Shell-hydrogen burning also causes the outer layers to expand and cool. The expansion produces a hundredfold increase in the star's diameter. When a star's surface temperature falls to 3500 degrees Kelvin, the gases take on a reddish hue and it becomes known as a red giant star. Betelgeuse is a well known red giant star in the constellation Orion. Betelgeuse is the armpit of the giant hunter Orion who was turned into a constellation by Artemis in Greek mythology.

Gravitational pressure continues to compress a star's core until its temperature reaches 100 million degrees Kelvin, activating core-helium burning. At this point, helium atoms are converted into carbon and oxygen. As long as the core is burning helium, equilibrium between the inward and outward forces is maintained. However, core-helium burning stops when the core becomes filled with carbon and oxygen. Although oxygen is a gas, it can be converted to a liquid when supercooled. Because liquid oxygen is highly combustible, NASA uses it in their fuel mixture for the space shuttles' rocket boosters. Pressure from the outer layers begins to compress and heat the core again. When the shell of helium surrounding the core becomes hot enough, a thermal pulse is created as it begins to burn. The thermal pulse causes the red giant's outer layers to expand to the size of Earth's or Mars' orbital path. In some cases, the thermal pulse can separate some of the outer layers from the star, creating a nebula. Inside the Crab Nebula, astronomers found an unusual pulsating radio signal. Although researchers originally thought it was a communication from an alien civilization, scientists discovered that it was a special kind of star known as a pulsar.

Low-mass stars do not have enough material to generate the gravitational pressure needed to initiate core-carbon burning. The core's temperature must reach 600 million degrees Kelvin to start the reaction. Due to the lack of thermonuclear reactions, the core compresses itself until reaching the size of Earth. The core becomes so densely packed that a single tablespoon of the material would weigh approximately one ton. <u>The most dense objects in the universe are believed to be singularities. Black holes in space are created by singularities because they are so dense that nothing can escape from their gravitational pull, not even light.</u> Eventually, the remaining layers surrounding the core of the star separate themselves from the compressed core, exposing a white dwarf star.

Over billions of years, a white dwarf slowly dims as its temperature cools to absolute zero. At this point, the star is sometimes referred to as a black dwarf or dead star. So ends the life cycle of the white dwarf star.

Appendix H

Boring Details Version of The Life Cycle of a White Dwarf Text

The pairs of boring detail sentences have been underlined in the following text to make them more obvious. They were not underlined in any of texts presented to participants during the experiments.

The Life Cycle of a White Dwarf

What exactly is a white dwarf? A white dwarf is a low-mass star that has exhausted all of its thermonuclear fuel and contracted to the size of Earth. Before a star becomes a white dwarf it progresses through several stages.

The life cycle of all stars begins as a mass of interstellar gas and dust referred to as a nebula. Nebulae are composed mainly of hydrogen, helium and stellar debris. <u>Dark nebulae are referred to as Barnard objects, after Edward Barnard, a poverty stricken astronomer who documented their existence. While growing up, his family was so poor that there were days when there was no food available to eat.</u> Gravitational attraction draws denser portions of a nebula together and forms clumps of material known as protostars. As a protostar's material contracts, gravitational energy is converted into thermal energy, producing light and heat. At this point, protostars are still rather expansive but they produce substantial luminosity.

After contracting for thousands of years, the star's temperature reaches a few million degrees Kelvin, setting off a thermonuclear reaction. Such extreme temperatures cause hydrogen atoms at the star's core to travel so fast that they slam into one another and stick together. When this happens hydrogen is converted into helium, a process known as core-hydrogen burning. <u>Helium is a colorless, odorless and tasteless gas that is listed as the second element in the periodic table of elements. The leading producer of helium in the United States is Kansas, but Nebraska also produces a lot.</u>

Core-hydrogen burning also creates outward radiating energy. When the outward force matches the inward gravitational pressure from a star's many layers, equilibrium is achieved. At this point, a protostar stabilizes and can be classified as a main sequence star; the longest stage of most stars' lives. <u>The longest stage in a few stars' lives occurs</u>

if the star goes into a dormant-like state. This occurs when a microstar slowly cools in the vastness of space without any other nebulous material nearby.

Gradually, all of the hydrogen at a star's core is converted into helium. Without core-hydrogen burning, the outer layers begin to compress and heat the core. The increasing heat ignites a thin shell of hydrogen surrounding the core, a process called shell-hydrogen burning. Stars manage to remain on the main sequence for several million more years by converting this hydrogen source into helium. Helium is often used by balloon venders so that their balloons will float in the air. Helium filled balloons rise upwards because the helium is lighter that the surrounding air. Shell-hydrogen burning also causes the outer layers to expand and cool. The expansion produces a hundredfold increase in the star's diameter. When a star's surface temperature falls to 3500 degrees Kelvin, the gases take on a reddish hue and it becomes known as a red giant star. There are no red giant stars located in our solar system. The only star in our solar system is the Sun which is at the center and it has nine orbiting planets.

Gravitational pressure continues to compress a star's core until its temperature reaches 100 million degrees Kelvin, activating core-helium burning. At this point, helium atoms are converted into carbon and oxygen. As long as the core is burning helium, equilibrium between the inward and outward forces is maintained. However, core-helium burning stops when the core becomes filled with carbon and oxygen. Similar to helium, oxygen is a colorless, odorless and tasteless gas that is readily abundant. Because pure oxygen has some health benefits, doctors give it to their patients who are having problems breathing. Pressure from the outer layers begins to compress and heat the core again. When the shell of helium surrounding the core becomes hot enough, a thermal pulse is created as it begins to burn. The thermal pulse causes the red giant's outer layers to expand to the size of Earth's or Mars' orbital path. In some cases, the thermal pulse can separate some of the outer layers from the star, creating a nebula. Over 103 nebulous objects were cataloged by Charles Messier during his career. Messier's catalog contains 33 galaxies, 55 star clusters, 11 nebulae, a double stars, an asterism, a patch of the Milky Way, and one duplicate observation.

Low-mass stars do not have enough material to generate the gravitational pressure needed to initiate core-carbon burning. The core's temperature must reach

600 million degrees Kelvin to start the reaction. Due to the lack of thermonuclear reactions, the core compresses itself until reaching the size of Earth. The core becomes so densely packed that a single tablespoon of the material would weigh approximately one ton. <u>The density of an object refers to the closeness of its atoms. The atoms inside a lead brick are closely packed, making it heavy; while atoms inside a styrofoam brick are loosely packed, making it light.</u> Eventually, the remaining layers surrounding the core of the star separate themselves from the compressed core, exposing a white dwarf star.

Over billions of years, a white dwarf slowly dims as its temperature cools to absolute zero. At this point, the star is sometimes referred to as a black dwarf or dead star. So ends the life cycle of the white dwarf star.

Appendix I

Norming Study Ratings Sheet

Instructions: Below are eight (8) measurement scales that you are to use to make your judgments about the passage you are about to read. Pairs of sentences in the passage have been underlined. DO NOT rate the sentences individually; rather rate the information in the two sentences together as a pair. When making your ratings of the sentence pairs, answer the question: In general, how interesting is the information presented in this pair of sentences. If the information is not interesting to you, then circle a low value. If the information is interesting to you, then circle a high value.

____

(Write the title of the passage above)

(1) In general, how interesting is the information in this pair of sentences?

Very Uninteresting 1 2 3 4 5 6 7 Very Interesting

(2) In general, how interesting is the information in this pair of sentences?

Very Uninteresting 1 2 3 4 5 6 7 Very Interesting

(3) In general, how interesting is the information in this pair of sentences?

Very Uninteresting 1 2 3 4 5 6 7 Very Interesting

(4) In general, how interesting is the information in this pair of sentences?

Very Uninteresting 1 2 3 4 5 6 7 Very Interesting

(5) In general, how interesting is the information in this pair of sentences?

Very Uninteresting 1 2 3 4 5 6 7 Very Interesting

(6) In general, how interesting is the information in this pair of sentences?

Very Uninteresting 1 2 3 4 5 6 7 Very Interesting

(7) In general, how interesting is the information in this pair of sentences?

Very Uninteresting 1 2 3 4 5 6 7 Very Interesting

(8) In general, how interesting is the information in this pair of sentences?

Very Uninteresting 1 2 3 4 5 6 7 Very Interesting

Appendix J

Practice Text – The Body's Defense System

The Body's Defense System

One of the first things our body learns is how to differentiate its own chemicals from those that are foreign. Any foreign substance that causes the formation of antibodies is called an antigen. For example, an antigen may be a protein in the membrane of a bacterium or a virus. Our immune system fights off antigens so that we can remain healthy.

The body's defense system is a two-stage process. First, the body must recognize that an antigen exists. Second, the body must get rid of the antigen. Leukocytes are a class of white blood cells. There are special types of leukocytes involved in each stage of the defense system.

Lymphocytes are white blood cells that are responsible for recognizing that an antigen entered the body. Most lymphocytes are produced in our bone marrow. From there, they go straight into our blood stream. These lymphocytes are called B-cells.

B-cells are important for recognizing antigens. They have protein molecules on them called receptors. The receptor molecules are believed to fit with particular antigen receptor sites. Once the receptor of a B-cell attaches itself to an antigen, the B-cell begins to grow. The enlarged B-cell begins to divide. The cluster of B-cells produces proteins called antibodies. Each B-cell cluster can produce as many as one-hundred thousand antibodies per minute.

There are several ways that antibodies assist in the removal of antigens. Typically, antibodies attach themselves to bacterium or virus cells. This makes the invading cells more likely to be attacked by large white blood cells called macrophages. Macrophages are a type of leukocyte involved in the removal of antigens from the body. A macrophage surrounds and then consumes the invading cell. The macrophage then travels to the lymph nodes, where it is destroyed.

Appendix K

Propositional Units in The Body's Defense System Text

1. our bodies learn to differentiate own chemical from foreign
2. antigens are substances that cause the formation of antibodies
3. antigen may be a protein in the membrane of a bacterium
4. antigen may be (a protein in the membrane of) a virus
5. immune system fights off antigens
6. we remain healthy
7. body's defense system is two-stage process
8. body must recognize an antigen exists
9. body must get rid of the antigen
10. leukocytes are a class of white blood cells
11. special leukocytes are involved in each stage
12. lymphocytes are white blood cells
13. lymphocytes are responsible for recognizing antigens
14. most lymphocytes are produces in our bone marrow
15. lymphocytes go straight into our blood stream
16. these lymphocytes are called B-cells
17. B-cells are important for recognizing antigens
18. B-cells have molecules on them
19. the molecules are called receptors
20. the receptors fit with antigen receptor sites
21. B-cell attaches to an antigen
22. B-cell begins to grow
23. B-cell begins to divide
24. B-cell cluster produces proteins
25. the proteins are called antibodies
26. a B-cell can produce one-hundred thousand antibodies per minute
27. antibodies help remove antigens in several ways
28. antibodies attach themselves to bacterium cells

29. antibodies attach themselves to virus cells
30. invading cell becomes more likely to be attacked
31. large white blood cells attach to the invading cell
32. large white blood cells are called macrophages
33. macrophages are a type of leukocyte
34. macrophages are involved in removing antigens from the body
35. macrophage surrounds the invading cell
36. macrophage consumes the invading cell
37. macrophage travels to lymph nodes
38. macrophage (or invading cell) is destroyed

Appendix L

Propositional Units in The Process of Lightning Text

This list has three sections. The first contains the base-text (i.e., core content) propositions. The second contains the seductive details propositions. The third contains the boring details propositions.

<u>Base-Text</u>

01. what causes lightning
02. lightning can be defined as a discharge of electricity
03. discharge results from a difference in electrical charges
04. the difference is between a cloud and an object on the ground
05. the process of lightning begins
06. moist air becomes heated
07. moist air rises rapidly
08. updraft is created
09. water vapor cools off
10. temperatures decreases at high altitudes
11. cooled water vapor merges into droplets
12. water droplets combine to form clouds
    (clouds are pockets of water droplets)
13. clouds drift around overhead
14. updrafts push tops of clouds into the atmosphere
15. clouds extend above the freezing level
16. water droplets turn into ice crystals (water freezes)
17. ice crystals get larger
18. ice crystals bump into each other
19. ice crystals freeze together
20. water droplets become too heavy to remain suspended
21. ice crystals become too heavy to remain suspended
22. gravity attracts heavier particles

23. heavier particles fall towards Earth
24. precipitation is known as rain
25. precipitation is known as sleet
26. precipitation is known as snow
27. precipitation is known as hail
28. precipitation drags air along with it
29. a downdraft is created
30. falling raindrops and ice collide with rising droplets and ice crystals (rising particles collide with falling particles)
31. small electrical charges are created (by collisions)
32. electrical charge build up within clouds
33. the exact manner (by which charge is created) is not understood
34. the charges may have a negative voltage
35. the charges may have a positive voltage
36. electrical charges separate
37. updrafts cause charges to separate
38. downdrafts cause charges to separate
39. gravity causes charges to separate
40. negatively charged particles tend to sink (go to bottom of cloud)
41. positively charged particles tend to rise (go to top of cloud)
42. an electrical potential is created between opposing charges
43. the first stroke takes the form of a step leader
44. air's threshold for electrical resistance breaks down
45. a spark is created
46. a step leader forms
47. a negatively charged leader moves downward
48. step leader comes from bottom of cloud
49. leader moves in short stairstep increments
50. each step is about 50 yards long
51. each step last for one millionth of a second
52. forward motion pauses (for 50 millionths of a second) between steps

53. step leader approaches the ground
54. positively charged streamers spring forth
55. streams can come from any object (flagpoles, cars, houses, people)
56. opposing electrical charges attract each other
57. positively charged leaders race towards negatively charged leader
58. the step leader connects with one streamer (two leaders meet)
59. streamer from the tallest object usually reaches step leader first
60. leaders typically meet about 165 feet above the Earth
61. a direct current between the cloud and the Earth is created
62. negative energy in cloud is released
63. negative energy races down electrical pathway
64. negative energy strikes the ground
65. return stroke of positively charged particles rushes skyward
66. return stroke reaches cloud in 70 microseconds
67. upwards movement cannot be detected by human eye
68. return stroke's positive charge neutralizes cloud's electrical imbalance
69. bright flash of light is produced
70. people call the flash lightning
71. ground is saturated after storm
72. Sun comes out from behind the clouds
73. whole process begins again

Seductive Details

1. violent updrafts combine to form a whirling vortex of air
2. vortex is called a funnel cloud
3. tornado is a funnel cloud the reconnects with ground
4. a tornado wreaks havoc everywhere it goes
5. a tornado wreaks destruction everywhere it goes
6. some meteorologists earn hundreds of thousands of dollars
7. meteorologists earn money by studying cloud formations
8. meteorologists who research deadly types of clouds are paid top dollar

9. tornadoes are deadly types of clouds
10. hurricanes are deadly types of clouds
11. downdrafts create a dangerous phenomena
12. the dangerous phenomena is known as vertical wind shear (VWS)
13. downward gusts are (VWS is) very strong
14. VWS can slam large planes into the ground
15. scientists try to understand the process (of electric charge creation)
16. scientists create lightning
17. scientist launch small metal rockets into storm clouds
18. the rockets are guided into storm by remote controls
19. metal planes have low electrical resistance
20. planes sustain very little damage
21. planes are struck by lightning
22. lightning bolt passes through the airplane
23. lightning bolt comes out the other side of plane
24. people watched a football player
25. a bolt of lightning struck the football player
26. the bolt tore a hole in his helmet
27. the bolt burned his jersey
28. the bolt blew off his shoes
29. the football player lived
30. trees are tallest objects in forest areas
31. trees get struck by lightning
32. (chances are high that) a wildfire will be ignited
33. the wildfire can ravage hundreds of acres each day
34. lightning strikes the ground
35. the ground is composed of sand
36. a fulgurite is formed
37. extreme heat of lightning fuses sand together
38. the sand turns into a rock
39. the rock has the shape of the lightning's path

Boring Details

1. people who fly kites seek out updrafts
2. kite flyers do so to get their kites up in the sky
3. there are prevailing winds at a couple hundred feet
4. a kite can reach a couple hundred feet
5. the prevailing wind will keep the kite airborne
6. some meteorologists specialize in nephology
7. nephology is the study of cloud formations
8. there are dozens of types of clouds in the skies
9. stratus clouds are a type of cloud
10. cirrus clouds are a type of cloud
11. cumulous clouds are a type of cloud
12. downdrafts strike the ground
13. downdrafts spread out in all directions
14. downdrafts make gauging wind speed difficult
15. downdrafts make gauging wind direction difficult
16. scientists try to understand the process (of electric charge creation)
17. scientists invest hours studying satellite images
18. the images used to be in black and white
19. technological advances permit color images to be taken
20. ohm is unit of electrical resistance
21. ohm represents physical property of a conductor
22. the conductor offers resistance to flow of electricity
23. the resistance permits one ampere to flow at one volt of pressure
24. people can avoid being struck by lightning
25. people should stay indoors during a thunderstorm
26. people should avoid talking on the phone
27. people should avoid watching television
28. people should avoid running electrical appliances
29. skyscrapers are tallest objects in urban areas

30. building codes make stipulations
31. tall building must be constructed to keep people safe
32. lightning strikes the ground
33. the ground is covered with vegetation
34. carbonization turns the ground turns black
35. carbonization occurs when a plant's material combusts
36. plant is reduced to its primary element (reduced to carbon)

Appendix M

Propositional Units in The Life Cycle of a White Dwarf Text

This list has three sections. The first contains the base-text (i.e., core content) propositions. The second contains the seductive details propositions. The third contains the boring details propositions.

Base-Text

01. what is a white dwarf star
02. a white dwarf star is a low-grade star
03. a white dwarf star has exhausted all of its energy
04. a white dwarf star has contracted to the size a Earth
05. a star progresses through several stages
06. life cycle begins as a mass of gas and dust
07. the mass is referred to as a nebula
08. a main element in a nebula is hydrogen
09. a main element in a nebula is helium
10. gravity draws dense portions of a nebula together
11. dense portions of a nebula form clouds
12. the clouds are known as protostars
13. a protostar contracts
14. gravitational energy is converted into thermal energy
15. thermal energy produces light
16. thermal energy produces heat
17. protostar produces substantial amount of light
18. protostars have relatively low temperatures
19. protostar contracts for thousands of years
20. protostar's internal temperature reaches a few million degrees
21. extreme temperature causes hydrogen atoms to travel very fast
22. hydrogen atoms slam into one another
23. hydrogen atoms stick together

24. hydrogen is converted into helium
25. the conversion is known as core-hydrogen burning
26. outward radiating energy is created
27. outward force eventually matches the inward gravitational pressure (equilibrium is achieved)
28. protostar becomes full-fledged star
29. full-fledged stars are called main sequence stars
30. main sequence is the longest stage in stars' lives
31. all of the hydrogen at a star's core is converted into helium
32. core-hydrogen burning ceases (no more core-hydrogen burning)
33. the outer layers begin to compress the core
34. compression heats the core (core becomes heated)
35. thin shell of hydrogen (surrounding the core) ignites
36. the process is known as shell-hydrogen burning
37. shell hydrogen burning allows star to remain on main sequence
38. shell-hydrogen burning also causes the outer layers to expand
39. expansion produces hundred-fold increase in star's size
40. shell-hydrogen burning also causes the outer layers to cool
41. star's surface temperature drops to 3500 degrees
42. star's gases take on a reddish color
43. star is referred to as a red giant star
44. gravity continues to compress the core
45. star's internal temperature exceeds 100 million degrees
46. high temperature activates core-helium burning
47. helium atoms bond together
48. helium atoms are converted into carbon
49. helium atoms are converted into oxygen
50. equilibrium between inward and outward forces is maintained
51. core becomes filled with carbon
52. core becomes filled with oxygen
53. core-helium burning stops

54. outer layers compress the core again
55. compression heats the core (temperature increases at the core)
56. shell of helium surrounding the core begins to burn
57. a pulse of outward energy is created
58. outer layers expand to size of Earth's (or Mars') orbital path
59. thermal pulse can separate the outer layers from the star
60. separated layers become/create a nebula
61. star may not have much material in its outer layers
62. the star cannot generate heat
63. star cannot initiate core-carbon burning
64. core temperature much exceed 600 million degrees to start carbon-burning
65. the core compresses itself
66. core shrinks to the size of Earth
67. core becomes very dense
68. atoms in the core cannot be forced any closer together
69. the remaining layers separate from the core
70. white dwarf star is exposed
71. white dwarf is the glowing core of larger star
72. white dwarf slowly dims over billions of years
73. white dwarf's temperature cools over billions of years
74. the life cycle of the white dwarf star ends

<u>Seductive Details</u>

1. dark nebula are referred to as Barnard objects
2. Barnard objects are named after Edward Barnard
3. Edward Barnard was a filthy rich astronomer
4. Edward Barnard documented existence of dark nebula
5. Edward Barnard died
6. there was a rumor
7. (rumor was that) Barnard requested a gold telescope be put in his coffin
8. helium was discovered by astronomers

9. astronomers used spectral analysis of light from sun during an eclipse
10. Helium was named after the Greek god of the Sun
11. the Greek god of the Sun is Helios
12. shortest stage in life of large star is when it goes supernova
13. outer layers of high-mass star collapse upon the core
14. the collapse occurs in minutes
15. whole star violently explodes
16. helium is used by deep sea divers
17. divers use helium to avoid getting decompression sickness
18. helium prevents nitrogen bubbles from forming in divers blood
19. nitrogen bubbles can cause death
20. Betelgeuse is a well known red giant star
21. Betelgeuse is in the constellation Orion
22. Betelgeuse is the armpit of the hunter Orion
23. Orion was turned into a constellation by Artemis
24. oxygen is a glass
25. oxygen can be converted into a liquid when supercooled
26. liquid oxygen is highly flammable
27. NASA used liquid oxygen in their rocket fuel for space shuttles
28. astronomers found unusual pulsating radio signals in Crab Nebula
29. researchers thought is was a communication from alien civilization
30. scientists discovered that signal was special kind of star (a pulsar)
31. singularities are believe to be most dense object in universe
32. black holes are created by singularities
33. nothing can escape the gravitational pull of a singularity
34. light cannot escape the gravitational pull of a singularity

<u>Boring Details</u>

1. dark nebula are referred to as Barnard objects
2. Barnard objects are named after Edward Barnard
3. Edward Barnard was a poverty stricken astronomer

4. Edward Barnard documented existence of dark nebula
5. Edward Barnard grew up
6. his family was very poor
7. some days there was no food available to eat
8. Helium is a colorless gas
9. Helium is an odorless gas
10. Helium is a tasteless gas
11. Helium is listed as the second item in periodic table
12. Kansas is leading producer of helium
13. Nebraska produces a lot of helium
14. longest stage in life of few stars is when it goes dormant-like state
15. microstar slowly cools in space without material nearby
16. helium is used by balloon venders
17. helium causes balloons to float in the air
18. balloons rise because they are lighter than the surrounding air
19. Salistrom is a red giant star
20. Salistrom was discovered in 1835
21. Salistrom does not shine brightly
22. anyone can see Salistrom on the eastern horizon during summer months
23. oxygen is a colorless gas
24. oxygen is an odorless gas
25. oxygen is a tasteless gas
26. oxygen is readily abundant
27. pure oxygen has health benefits
28. doctors give oxygen to patients with breathing problems
29. Charles Messier cataloged over 103 nebulous objects during his career
30. Messier's catalog contains 33 galaxies
31. Messier's catalog contains 55 star clusters
32. Messier's catalog contains 11 nebulae
33. Messier's catalog contains a double star
34. Messier's catalog contains an asteroid

35. Messier's catalog contains a patch of Milky Way

36. Messier's catalog contains a duplicate observation

37. density refers to closeness of an object's atoms

38. atoms inside lead brick are closely packed

39. closeness of atoms makes lead bricks heavy

40. atoms inside styrofoam brick are loosely packed

41 looseness of atoms makes styrofoam bricks light

Appendix N

Sentence Verification Task Probes for The Body's Defense System Text

These are the statements presented in the practice text sentence verification task for The Body’s Defense System text. The first set contains the "YES" response statements. The second set contains the "NO" response statements.

<u>YES Statements</u>

1. B-cells can make thousands of antibodies per minute
2. Lymphocytes are produced in our bone marrow
3. Macrophages are a type of leukocyte

<u>NO Statements</u>

1. Red blood cells attach themselves to invading cells
2. Antibodies are made from inactive antigen cells
3. The thyroid gland destroys harmful bacteria

Appendix O

Sentence Verification Task Probes for The Process of Lightning Text

These are the statements that were presented in the sentence verification task for The Process of Lightning text. The first set contains the prime (denoted by the "a") and target (denoted by "b") pairs. The second set contains additional "YES" response statements. The third set contains all of the "NO" response statements.

Prime and Target Pairs

1a. Rising air produces an updraft.

1b. Water vapor cools off.

2a. Clouds are large pockets of water droplets.

2b. Clouds extend above the freezing level.

3a. Falling precipitation creates a downdraft.

3b. Raindrops collide with rising water droplets.

4a. Small charges are created.

4b. Electricity builds up within clouds.

5a. The formation of a step leader is triggered.

5b. A negatively charged leader moves downward.

6a. Streamers come up from grounded objects.

6b. Positive charges head towards the step leader.

7a. A step leader only connects with one streamer.

7b. A cloud to ground current is created.

8a. Negative energy strikes the ground.

8b. A return stroke races to the cloud.

Additional YES Statements

1. High altitudes turn water vapor into ice.
2. Ice crystals freeze together.
3. Positively charged particles tend to rise.
4. The electrical resistance in the air breaks down.

5. Each step of the leader is about 50 yards long.
6. The human eye cannot detect lightning's upward motion.
7. The return stroke creates the bright flash.
8. The ground is saturated with rain.

<u>NO Statements</u>

1. Lightning injures thousands of people each year.
2. Tornadoes cause more damage than lightning bolts.
3. Heat from the lightning bolt creates thunder.
4. A lightning flash is comprised of multiple strikes.
5. A lightning bolt carries hundreds of volts of power.
6. The extreme fear of lightning is called astraphobia.
7. Lightning rods were invented by Benjamin Franklin.
8. Hail is a common occurrence before rain storms.
9. The ground becomes ionized when a step leader approaches.
10. Step leaders from clouds are positively charged.
11. Hurricanes generate lots of lightning.
12. Surge protectors neutralize energy pulses.
13. Most lighting strikes do not hit the ground.
14. Sever thunderstorms are tracked with radar.
15. Funnel clouds create electrical disturbances.
16. Some hail grows to be larger than a baseball.
17. Satellites have photographed lightning on Jupiter.
18. Copper wires are good conductors of electricity.
19. High pressure systems move from west to east.
20. Stratus clouds tend to produce the strongest currents.
21. Energy spreads in all directions as the bolt streaks across the sky.
22. Wearing rubber sole shoes can prevent serious injury.
23. Turbulent air causes the cloud to be pushed downward.
24. The flash is seen before the clap of thunder is heard.

Appendix P

Sentence Verification Task Probes for The Life Cycle of a White Dwarf Text

These are the statements presented in the sentence verification task for The Life Cycle of a White Dwarf text. The first set contains the prime (denoted by the "a") and target (denoted by "b") pairs. The second set contains additional "YES" response statements. The third set contains all of the "NO" response statements.

Prime and Target Pairs

1a. The life cycle begins as gas and dust.

1b. Gravity draws dense parts of the nebula together.

2a. Hydrogen is converted into helium.

2b. Core-hydrogen burning creates outward pressure.

3a. Equilibrium is a balance between inward and outward pressure.

3b. All of the hydrogen at the core is converted into helium.

4a. A shell of hydrogen around the core begins to burn.

4b. The outer layers of the star expand.

5a. The core becomes hotter as it gets compresses.

5b. Core-helium burning is activated.

6a. Core-helium burning stops.

6b. Pressure from the outer layers compresses the core again.

7a. An energy pulse separates the outer layers from a read giant star.

7b. The star cannot generate enough heat to activate core-carbon burning.

8a. The core compresses itself to the size of Earth.

8b. The outer layers of the star finally separate from the core.

Additional YES Statements

1. Nebula are composed mainly of hydrogen and helium.
2. Gravitational energy is converted to thermal energy.
3. Protostars produce substantial amounts of light.
4. A star's internal temperature reaches a few million degrees.

5. Gases at the outer layers take on a reddish color.
6. Helium atoms are converted into carbon.
7. A white dwarf slowly dims over a long period of time.
8. All activity ceases when the temperature reaches absolute zero.

NO Statements

1. Stars spend relatively little time as main sequence stars.
2. Red giant stars are one thousand times bigger than the Sun.
3. The surface temperature of a white dwarf is 600 degrees.
4. Astronomers classify stars according to their spectral class.
5. The core of a red giant star is filled with nitrogen.
6. Larger stars can strip away the outer layers of smaller stars.
7. A spectral shift occurs when stars change color.
8. A main sequence star is bigger than the Sun.
9. The Milky Way contains hundreds of solar systems.
10. Cold temperatures cause nebulous material to contract.
11. White dwarf stars were first discovered only 22 years ago.
12. Solar flares can stretch across dozens of miles.
13. Young stars do not shine as bright as older stars.
14. Red giant stars emit infra-red light into space.
15. The gases inside a nebula are easily agitated.
16. Helium burning creates large deposits of calcium.
17. The star remains a red giant for 10 million years.
18. Oxygen atoms combine to form carbon.
19. A nebula acts like a nursery for star formation.
20. The core ceases to produce magnesium.
21. Hydrogen atoms move relatively slow at the core.
22. The pressure forces nitrogen to be expelled.
23. The star’s brightness indicates its distance from the Earth.
24. The hydrogen shell gets thicker as more helium burns.

REFERENCES

Anderson, R. C., Shirey, L. L., Wilson, P. T., & Fielding, L. G. (1984). Interestingness of children's reading material (Technical Report No. 323), Urbana: University of Illinois, Center for the Study of Reading.

Bloom, C. P., Fletcher, C. R., van den Broek, P., Reitz, L., & Shapiro, B. P. (1990). An on-line assessment of causal reasoning during comprehension. Memory and Cognition, 18 (1), 65-71.

Brown, A. L., & Smiley, S. S. (1977). Rating the importance of structural units of prose passages: A problem of metacognitive development. Child Development, 48, 1-8.

Brown, A. L., & Smiley, S. S. (1978). The development of strategies for studying texts. Child Development, 49, 1076-1088.

Brown, J. (1958). Some tests of the decay theory of immediate memory. Quarterly Journal of Experimental Psychology, 10, 12-21.

Cohen, J. (1960). A coefficient of agreement for nominal scales. Educational and Psychological Measurement, 20, 37-46.

Dewey, J. (1913). Interest and effort in education. Cambridge, MA: Houghton Mifflin.

Duffy, T. M., Higgins, L., Mehlenbacher, B. Cochran, C., Wallace, D., Hill, C., Haugen, D., McCaffrey, M., Burnett, R., Sloane, S., & Smith, S. (1989). Models for the design of instructional text. Reading Research Quarterly, 24, 434-457.

D'Ydewalle, G., Swerts, A., & de Corte, E. (1983). Study time and test performance as a function of test expectations. Contemporary Educational Psychology, 8 (1), 55-67.

Ericsson, K. A., & Kintsch, W. (1995). Long-term working memory. Psychological Review, 102, 211-245.

Garner, R., & Gillingham, M. G. (1991). Topic knowledge, cognitive interest, and text recall: A microanalysis. Journal of Experimental Education, 59, 310-319.

Garner, R., Alexander, P. Gillingham, M., Kulikowich, J., & Brown, R. (1991). Interest and learning from text. American Educational Research Journal, 28, 643-659.

Garner, R., Brown, R., Sanders, S., & Menke, D. (1992). "Seductive details" and learning from text. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.), The role of interest in learning and development (pp. 239-254). Hillsdale, NJ: Erlbaum.

Garner, R., Gillingham, M. G., & White, C. S. (1989). Effects of "seductive details" on macroprocessing and microprocessing in adults and children. Cognition and Instruction, 6, 41-57.

Goetz, E. T., & Sadoski, M. (1995a). The perils of seduction: Distracting details or incomprehensible abstractions? Reading Research Quarterly, 30 (3), 500-511.

Goetz, T. E., & Sadoski, M. (1995b). The perils of seduction revisited: A reply to Wade, Alexander, Schraw, & Kulikowich. Reading Research Quarterly, 30 (3), 518-519.

Graesser, A. C., & Riha, J. R. (1984). An application of multiple regression techniques to sentence reading times. In D. E. Kieras and M. A. Just (Eds.), New methods in reading comprehension research (pp. 183-218). Hillsdale, NJ: Erlbaum.

Harp, S. F., & Mayer, R. E. (1997). The role of interest in learning from scientific text and illustrations: On the distinction between emotional and cognitive interest. Journal of Educational Psychology, 89, 92-102.

Harp, S. F., & Mayer, R. E. (1998). How seductive details do their damage: A theory of cognitive interest in science learning. Journal of Educational Psychology, 90, 414-434.

Haviland, S. E., & Clark, H. H. (1974). What's new? Acquiring new information as a process in comprehension. Journal of Verbal Learning and Verbal Behavior, 13, 512-521.

Hidi, S., & Baird, W. (1986a). Interestingness - A neglected variable in discourse processing. Cognitive Science, 10, 179-194

Hidi, S., & Baird, W. (1986b). What children remember: A study of school textbooks. Orbit, 17, 10-11.

Hidi, S., & Baird, W. (1988). Strategies for increasing text-based interest and students' recall of expository texts. Reading Research Quarterly, 23, 465-483.

Hidi, S., Baird, W., & Hildyard, A. (1982). That's important, but is it interesting? Two factors in text processing. In A. Flammer & W. Kintsch (Eds.), Discourse Processes (pp. 63-75). Amsterdam, North Holland.

Hoskin, M. (1997). The Cambridge illustrated history of astronomy. New York: Cambridge University Press.

Jones, M. Y., Stanaland, A. J., & Gelb, B. D. (1998). Beefcake and cheesecake: Insights for advertisers. Journal of Advertising, 27 (2), 33-51.

Kaufmann, W. J. (1990). Discovering the universe (2nd ed.). New York: W. H. Freeman and Company.

Keenan, J. M., Baillet, S. D., & Brown, P. (1984). The effects of causal cohesion on comprehension and memory. Journal of Verbal Learning and Verbal Behavior, 23, 115-128.

Kieras, D. E. (1980). Initial mention as a signal to thematic content in technical passages. Memory & Cognition, 8, 345-353.

Kintsch, W. (1971). Models for free recall and recognition. In D. A. Norman (Ed.), Models of human memory. New York: Academic Press.

Kintsch, W. (1988). The role of knowledge in discourse comprehension: A construction-integration model. Psychological Review, 95, 163-182.

Kintsch, W. (1998). Comprehension: A paradigm for cognition. New York: Cambridge University Press.

Long, D. L., Golding, J. M., & Graesser, A. C. (1992). A test of the on-line status of goal-related inferences. Journal of Memory and Language, 31, 634-647.

Lorch, E. P., Bellack, D. R., & Augsbach, L. H. (1987). Young children's memory for televised stories: Effects of importance. Child Development, 58, 453-463.

Lorch, R. F., Klusewitz, M. A., & Lorch, E. P., (1995). Distinctions among reading situations. In R. F. Lorch & E. J. O'Brien (Eds.), Sources of comprehension in reading (pp. 375-398). Hillsdale, NJ: Erlbaum.

McKoon, G., & Ratcliff, R. (1980). Priming in item recognition: The organization of propositions in memory for text. Journal of Verbal Learning and Verbal Behavior, 19, 369-386.

McKoon, G., & Ratcliff, R. (1992). Inference during reading. Psychological Review, 99, 440-466.

Miller, G. A. (1956). The magic number seven, plus or minus two: Some limits of our capacity for processing information. Psychological Review, 63, 81-97.

Myers, J. L. Shinjo, M., & Duffy, S. A. (1987). Degree of causal relatedness and memory. Journal of Memory and Language, 4, 453-465.

Nielsen, J. (1993). Usability engineering. San Diego, CA: Academic Press.

O'Brien, E. J. (1995). Automatic components of discourse comprehension. In R. F. Lorch & E. J. O'Brien (Eds.), Sources of comprehension in reading (pp. 159-176). Hillsdale, NJ: Erlbaum.

O'Brien, E. J., Albrecht, J. E., Hakala, C. M., & Rizzella, M. L. (1995). Activation and suppression of antecedents during reinstatement. Journal of Experimental Psychology: Learning, Memory and Cognition, 21, 626-634.

O'Neill, G. W., & Johnston, J. M. (1976). An analysis of test item types as a determinant of student academic performance and study behavior. Journal of Personalized Instruction, 1 (2), 123-127.

Peterson, L. R., & Peterson, M. J. (1959). Short-term retention of individual verbal items. Journal of Experimental Psychology, 58, 193-198.

Rathus, S. (1999, June). Using profiles in psychology to teach introductory psychology, Presentation at the Sixth Annual American Psychological Society Institute on the Teaching of Psychology, Denver, CO.

Reder, L. (1987). Strategy selection in question answering. Cognitive Psychology, 19, 90-138.

Reder, L., & Wible, C. (1984). Strategy use in question-answering: Memory strength and task constraints on fan effect. Memory and Cognition, 12, 411-419.

Richardson, R. S. (1967). The star lovers. New York: The Macmillan Company.

Schank, R. C. (1979). Interestingness: Controlling inferences. Artificial Intelligence, 12, 273-297.

Schraw, G. (1998). Processing and recall differences among seductive details. Journal of Educational Psychology, 90, 3-12.

Schraw, G., Lehman, S., & Hartley, K. (2001, April). The effect of seductive details on text reading times. Poster session presented at the annual meeting of the American Educational Research Association, Seattle, Washington.

Schultz, D. P., & Schultz, S. E. (1998). Psychology and work today: An introduction to industrial and organizational psychology (7th Edition). Upper Saddle River, NJ: Prentice Hall.

Severn, J., Belch, G. E., & Belch, M. A. (1990). The effects of sexual and non-sexual advertising appeals and information level on cognitive processing and communication effectiveness. Journal of Advertising, 19 (1), 14-22.

Shirey, L. L., & Reynolds, R. E. (1988). Effects of interest on attention and learning. Journal of Educational Psychology, 80, 159-166.

Shneiderman, B. (1992). Designing the user interface: Strategies for effective human-computer interaction (2nd ed.). Reading, MA: Addison-Wesley Publishing Company.

Singer, M. (1991). Question-answering strategies and conceptual knowledge. Bulletin of the Psychonomic Society, 29, 143-146.

Sulin, R. A., & Dooling, J. (1974). Intrusion of a thematic idea in retention of prose. Journal of Experimental Psychology, 103 (2), 255-262.

Van den Broek, P. (1990). The causal inference maker: Towards a process model of inference generation in text comprehension. In D. A. Balota, G. B. Flores d'Arcais, and K. Rayner (Eds.), Comprehension processes in reading (pp. 423-445). Hillsdale, NJ: Erlbaum.

Van den Broek, P., & Lorch R. F. (1993). Network representations of causal relations in memory for narrative texts: Evidence from primed recognition. Discourse Processes, 16, 75-98.

Van den Broek, P., Risden, K. & Husebye-Hartmann, E. (1995). The role of readers' standards for coherence in the generation of inferences during reading. In R. F. Lorch & E. J. O'Brien (Eds.), Sources of coherence in reading (pp. 159-176). Hillsdale, NJ: Erlbaum.

Wade, S. (1992). Effects of interest on attention and learning. In K. A. Renninger, S. Hidi, & A. Krapp (Eds.), The role of interest in learning and development (pp. 255-277). Hillsdale, NJ: Erlbaum.

Wade, S. E., & Adams, R. B. (1990). Effects of importance and interest on recall of biographical text. Journal of Reading Behavior, 22, 331-353.

Wade, S. E., Schraw, G., Buxton, W. M., & Hayes, M. T. (1993). Seduction of the strategic reader: Effects of interest on strategies and recall. Reading Research Quarterly, 28, 3-24.

Yang, J., Verheul, I. C., Verhelst, N., & Van Essen, E. (1985). Meningen over meerkeuze- versus open vragen toetsen en vershil in studieactiviteiten onder invloed van toetsverwachting: Verslag van een enquete [Opinions about multiple choice- and open questions-tests and differences in study activities as a result of test expectation: Report of a questionnaire]. Tijdschrift-voor-Onderwijsresearch [Review of Educational Research], 10 (4), 179-188.

VITA

Personal History

Name: Gregory Scott Johnston

Date of Birth: September 5, 1967

Place of Birth: Atlanta, Georgia

Education

1993 - 1996 University of Kentucky, M. S. in Psychology

1992 - 1993 Memphis State University, Graduate School

1991 - 1991 University of Alicante, Spain, minor in Spanish

1989 - 1992 Memphis State University, B. A. in Psychology

1985 - 1987 Middle Tennessee State University

Professional History

Research Subject Pool Administrator (2000)

Department of Psychology, University of Kentucky

Manuscript Reviewer (1999 – 2000)

PSI-CHI Journal of Undergraduate Research

Website Developer (1996)

Department of Psychology, University of Kentucky

http://www.uky.edy/ArtsSciences/Psychology/

Teaching Assistant (1994 – 2000)

Department of Psychology, University of Kentucky

Research Assistant (1993 - 2000)

Department of Psychology, University of Kentucky

Research Assistant (1993 - 1994)

Bluegrass Prevention Project, Lexington, Kentucky

Undergraduate Research Assistant (1992 – 1993)

Cognitive Science Laboratory of Department of Psychology

Memphis State University, Memphis, Tennessee

Organizational Assistant (1992)

Conference of the International Association for the Empirical Study of Literature

Memphis, Tennessee

Undergraduate Research Assistant (1990 – 1991)

Pediatric Research Group of the Department of Psychology

Memphis State University, Memphis, Tennessee

Honors and Awards

March, 1998 Graduate Student Assistance Grant

Teaching and Learning Center, University of Kentucky

March, 1995 Honorable Mention for Outstanding Teaching Assistant Award

Department of Psychology, University of Kentucky

May, 1992 Graduated with Cum Laude Honors

Memphis State University, Memphis, Tennessee

Professional Memberships

1992 - 2001 American Psychological Society

1993 - 2000 American Psychological Association

1994 - 2000 Midwestern Psychological Association

1995 - 2000 Representative for the American Psychological Association of Graduate Students

1997 - 2000 Division 2 of American Psychology Association, Society for the Teaching of Psychology

1998 - 2000 Division 3 of American Psychological Association, Division of Experimental Psychology

Presentations and Publications

Graesser, A. C., McMahen, K., & Johnston, G. S. (1992). Perspectives on literary comprehension. International Association for the Empirical Study of Literature, Memphis, Tennessee.

Graesser, A. C., Person, N. P., & Johnston, G. S. (1996). Three obstacles in the empirical research on aesthetics and literary comprehension. In R.J. Kreuz & M.S. MacNealy (Eds.), Empirical approaches to literature and aesthetics. Norwood, NJ: Ablex.

Johnston, G. S. (1996). Effects of the adversative connective "but" on text processing and cued-recall. Sixty-Eighth Annual Meeting Midwestern Psychological Association, Chicago, Illinois.

Johnston, G. S. (1997) Interacting with cognitive psychology: Using multimedia in the classroom. University of Kentucky Faculty Multimedia Showcase, Lexington, Kentucky.

Johnston, G. S. (1998). Get a C.L.U.E.: The cognitive laboratory for undergraduate experimentation. Tenth Southeastern Conference of the Teaching of Psychology, Atlanta, Georgia.

Johnston, G. S. (1998). Intra-sentence positioning of causal and adversative connectives: Effects on comprehension processes. Seventieth Annual Meeting Midwestern Psychological Association, Chicago, Illinois.

Johnston, G. S. (1999). Get CLUED in: The cognitive laboratory for undergraduate experimentation. Sixth Annual APS Institute on the Teaching of Psychology, Denver, Colorado.

Johnston, G. S., Ritchey, K. (1999). Concepts are key to organizing information. Eleventh Annual Convention of the American Psychological Society, Denver, Colorado.

Lemberger, C., Lorch, R., & Johnston, G. S., Brannon, K. (1998). Monitoring of topics during reading. Seventieth Annual Meeting Midwestern Psychological Association, Chicago, Illinois.

Lorch, R. F., Hyona, J., Lemberger, C., Ritchey, K., Johnston, G. S., Kaakinen, J. (1999). Monitoring topics while reading. Fortieth Annual Meeting of the Psychonomic Society, Los Angeles, California.

Magliano, J., Johnston, G. S., Baggett, W., & Graesser, A. C. (1993). Strategic inference generation. Society for Text and Discourse, Boulder, Colorado.