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# Warning readers to avoid irrelevant information: When being vague might be valuable

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ABSTRACT

Students are often provided with instructions that are intended to influence their attention to particular sections or elements of their reading materials. To date, the bulk of the work on such prereading instructions has focused on drawing reader attention to relevant text information. In the current project, we examined whether instructions might also be useful in helping readers *ignore* irrelevant (albeit inherently interesting) information in text. In two experiments, prereading instructions asked readers to (a) focus on specific relevant text segments, (b) ignore specific irrelevant text segments, (c) maintain an awareness that the text contained irrelevant segments without specifically identifying them, or (d) read without warnings. Participants generally exhibited longer reading times and enhanced recall for irrelevant segments compared to base content, except in cases for which general instructions warned about but did not specifically identify those irrelevant elements. The implications of these findings for research on seductive details and text processing, as well practical applications for the design of reading instruction, are discussed.



## 1. Introduction

Student assignments often include explicit instructions about the requirements necessary to obtain a good grade on a task. As examples, students might be told which sections of a chapter to read, asked to select from a list of materials and topics to write a paper, or directed to complete a set of procedures in a particular order (e.g., for book reports or science labs). These types of instructions are most commonly and explicitly provided by instructors, and attended to by students, in situations involving reading assignments. Not only are students asked to read specific segments of texts, but are often asked to read with particular goals (Kaakinen & Hyönä, 2007, 2008; Lehman & Schraw, 2002; Linderholm & van den Broek, 2002; Rothkopf & Billington, 1979; Schraw, Wade, & Kardash, 1993; van den Broek, Lorch, Linderholm, & Gustafson, 2001). The degree to which instructions help guide comprehension activities influences how readers will interact with textual material, and what they might remember after reading is completed.

To date, a large body of research has examined how prereading information influences readers' attention to and comprehension of text materials. The extant literature shows that titles (e.g., Lorch, 1989; Lorch & Lorch, 1996; Lorch, Lorch, & Inman, 1993; Sanchez, Lorch, & Lorch, 2001), knowledge activation tasks (e.g., Alvemann, Smith, & Readence, 1985; Alvermann & Hynd, 1989; Guzzetti, 1990; Guzzetti, Snyder, Glass, & Gamas, 1993; Spires & Donley, 1998), and guided prereading instructions (e.g., Jetton & Alexander, 1997; McCrudden, Magliano, & Schraw, 2010; McCrudden, Schraw, & Hartley, 2006; McCrudden, Schraw, & Kambe, 2005; Rothkopf & Billington, 1979; Rothkopf & Kaplan, 1972) influence what readers pay attention to during reading and what they remember on post-reading tasks (which is used as evidence for learning). For example, prereading instructions asking readers to focus on instructor-identified relevant segments of texts appear to improve recall of those segments after reading is completed.[1] In one study, McCrudden et al. (2005) used instructions to draw reader attention to particular segments of an expository passage. Participants who received rele-

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[1] Relevance can be instantiated for readers in a variety of ways, such as based on the inherent semantic associations between text content and the global topic of a text, as well as through task instructions that suggest the need for attending to text information (e.g., whether elements of a text are fodder for an exam). To date, studies of relevance instructions have investigated the combined effects of these conditions, and the current project does so as well, for a more powerful investigation of instructional impacts on reader attention and memory.

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vance instructions were (a) asked, prior to reading, to rate their interest in particular text-specific questions and (b) told to focus on those questions during reading. Participants who did not receive relevance instructions were simply asked to read and remember the text. Individuals who received the instructions showed greater recall for question-relevant segments of the text than participants who did not receive them, with no accompanying difference in moment-by-moment reading times. In other words, instructional effects were obtained at retrieval but not at encoding. These data suggest that focusing instructions can influence knowledge acquisition, but any effects obtain after reading is completed (see also Anderson & Pichert, 1978).

However, the instructions that students receive on their assignments are rarely limited only to those that direct attention to particular elements of texts. Students are also often told which segments of texts to steer clear from or ignore in their reading assignments; such warnings might be used for materials that are orthogonal to lesson plans and content, or to help readers avoid distracting information (e.g., Goldman & Bisanz, 2002). These types of instructions, in contrast to those described previously, provide information about upcoming *irrelevant* information that students should disregard. Warnings of this type can be provided in at least two ways: (1) Specific information may be highlighted as sections of text to be ignored completely (e.g., "You should skip the section on Alexander Graham Bell's experiments on his dog on p. 248."), or (2) readers might generally be told that sections of a text are less than relevant (e.g., "We won't be concerned with some of the material in Chapter 2."). Although instructors often provide such warnings, the question remains as to whether they help readers ignore irrelevant information, particularly when the information is integrated into the body of the text or inherently interesting.

While evidence from existing literatures on memory processes might prove informative for answering this question (see Bjork, 1998), the findings are mixed. Research on memory priming indicates that when a to be ignored stimulus is later presented as a potential target, response latencies for those previously ignored targets slow down as compared to response latencies for targets not designated to be ignored (e.g., Niell & Westberry, 1987). The ignored targets may have been suppressed, necessitating increased processing as participants "recover" from having previously ignored the information (for a review see Fox, 1995). If irrelevance instructions similarly lead readers to ignore text segments, this would prove useful in helping to reduce attention to unnecessary or extraneous information (as identified by the instructions), particularly if the information is never referred to again or relatively unimportant for the unfolding description. However, other studies indicate that attempts to actively ignore specific information can actually increase processing (e.g., Wegner, Schneider, Carter, & White, 1987). When tasked with ignoring concepts or ideas, participants sometimes report difficulty suppressing such information, and exhibit increased activation when given the opportunity to consider those concepts. These findings pose an interesting question as to the effects of irrelevance instructions – instructions could either reduce attention to irrelevant information, or actually lead readers to be drawn to or to think about the information more than they should.

Studies of relevance instructions have tended to separate prereading directions into two categories that prove useful for the current project (McCrudden & Schraw, 2007). "Specific" relevance instructions explicitly prompt the reader to focus on particular text segments. They may use "what" questions (e.g., "What causes muscles and bones to weaken in space?") or "why" questions (e.g., "Why is it difficult to detect the orientation of the parts of the body when first entering space?") to encourage reader attention to important definitional and explanatory elements of the text (McCrudden et al., 2005). In contrast, "general" relevance instructions provide broader conceptualizations or considerations for the reader. They might require readers to engage with a text for a particular purpose (i.e., reading for study versus entertainment, van den Broek et al., 2001) or to consider the text from a particular perspective (i.e., reading from the perspective of a story character, Anderson & Pichert, 1978). For general instructions, readers must decide how to process the material while potentially evaluating the text elements that might be relevant, rather than relying on explicit criteria identifying those relevant features. Both categories of instructions have been examined for their utility in enhancing attention to texts, but neither has been examined for drawing attention away from text information. One could imagine specific irrelevance instructions (e.g., "Ignore the dates associated with Alexander Graham Bell on page 5.") and general irrelevance instructions (e.g., "Some portions of this text are uninformative and should be ignored.") that could guide reader attention away from content.

Traditionally, instruction-based investigations have utilized texts that contain separate categories of informative content, to demonstrate how instructions can focus readers on one category versus another (e.g., space travel facts versus physiological changes, McCrudden et al., 2005). However, no research has as of yet investigated how instructions might also be used to encourage readers to specifically avoid irrelevant elements of texts. In the current study, and for the most dramatic test of the utility of irrelevance instructions, we investigated the impact of instructions on text elements that, to date, have proven rather impervious to manipulations intended to guide readers away from them – seductive details.

*Seductive details* have been described as entertaining and interesting, but irrelevant (e.g., topically-related but unnecessary for understanding the text) information for understanding a text (Garner, 1992; Harp & Mayer, 1997; Sanchez & Wiley, 2006). They are typically used to increase reader interest and engagement with the material. However, seductive details can have detrimental effects on comprehension (Garner, Alexander, Gillingham, Kulikowich, & Brown, 1991; Garner, Gillingham, & White, 1989; Harp & Mayer, 1997, 1998; Hidi & Baird, 1988). Reader attention is often drawn to these details, such that memory for relevant text information is hindered when seductive details are present. For example, Harp and Mayer (1998) presented readers with a passage outlining a scientific explanation for lightning. For some readers, the passage included six seductive details (e.g., "...Eyewitnesses in Burtonsville, Maryland, watched as a bolt of lightning tore a hole in the helmet of a high school football player during practice. The bolt burned his jersey and blew his shoes off..."), while for other readers the passage excluded those details. Participants who read the version containing seductive details recalled fewer main ideas from the passage than participants who read the passage omitting the details. These results obtained even when participants were asked to attend specifically to relevant segments of the passage.

Thus, texts containing seductive details allow for examining the types of instructions that might usefully divert reader attention away from irrelevant information. On the one hand, prereading instructions could be beneficial in this regard. Specific irrelevance instructions highlighting seductive details may help readers ignore their allure both during reading and during recall. However, seductive details may prove so alluring that specific irrelevance instructions may act to only further increase reader interest in the topics. General irrelevance instructions might counteract such effects, given that they avoid highlighting the content of seductive details. But because seductive details are inherently interesting, avoiding their mention does not in any way directly address their allure. An additional consideration with general instructions is that readers must figure out what information might or might not be relevant as they read. To do this, readers might consider the

**Table 1**
Hypotheses.

| | Unavoidable attraction | Increased attraction | Decreased attraction |
|---|---|---|---|
| Definition | Irrelevance instructions cannot reduce reader attention to seductive details | Irrelevance instructions further draw reader attention to seductive details | Irrelevance instructions help decrease reader attention to seductive details |
| Reading times | Seductive details should take longer to read than base sentences across instructional conditions | Seductive details should overall take longer to read than base sentences across instructional conditions; seductive details also should take longer to read following relevance and irrelevance instructions as compared to a no instructions control | Seductive details should take longer to read than base sentences in relevance and no instructions conditions, but not in irrelevance instruction conditions |
| Recall | Seductive details should be recalled more than base sentences across instructional conditions | Seductive details should overall be recalled more than base sentences across instructional conditions; seductive details also should be recalled more following relevance and irrelevance instructions as compared to a no instructions control | Seductive details should be recalled more than base sentences in relevance and no instructions conditions, but not in irrelevance instruction conditions |

underlying logic of the material, whether segments are coherent with previous arguments, the difficulty of the content, and so on. Considering these factors during reading might actually detract from comprehension.

The materials in the current project were adapted from previous studies that have examined the role of instructions and seductive details on text processing and memory. Participants were provided a passage describing the physical effects of space travel on the body (Experiment 1; adapted from McCrudden et al. (2005)), or an explanation of lightning formation (Experiment 2; adapted from Harp and Mayer (1998)). In both experiments, participants were provided with one of four types of prereading instructions asking them to (a) focus on specific concepts described as relevant (in line with previous relevance instruction manipulations), (b) ignore specific concepts described as irrelevant, (c) simply be aware that the text might generally contain irrelevant elements, or (d) read without having been provided any guiding instructions. We collected two measures to investigate the impact of the instructions on processing and memory. First, participants' reading times to the text segments were collected to analyze whether instructions differentially influenced focus during reading. Second, participants' recalls of text information, both expository base sentences (heretofore referred to as base sentences) and seductive details, were collected to examine memory for the texts after reading was completed.[2]

## 2. Experiment 1

The purpose of Experiment 1 was to examine whether irrelevance instructions influence the online processes and offline products of reading. More specifically, we examined whether irrelevance instructions affect reading time and recall for seductive details. As a useful framework, we identified three possible hypotheses that outline the potential impacts of instructions on each dependent measure (see Table 1).

The reading time measure examined the amount of time participants spent reading each sentence in the text (including both seductive details and base sentences), presented one sentence at a time on a computer screen, as an indicator of readers' moment-by-moment attention to the text. The first hypothesis, which we term the *unavoidable attraction hypothesis*, suggests that seductive details are so inherently interesting that irrelevance instructions cannot reduce attention to their contents. Previous work has shown that attention is drawn to seductive details (e.g., Sanchez & Wiley, 2006; Schraw, 1998), with concomitant decreases in attention to expository content (Lehman, Schraw, McCrudden, & Hartley, 2007). This hypothesis would be supported if reading times to seductive details were longer than base sentence reading times across instructional conditions. However, irrelevance instructions might exert an impact on the processing of seductive details in at least two ways. The *increased attraction hypothesis* predicts that irrelevance instructions actually draw reader attention to seductive details. This possibility would be supported if the instructional conditions (i.e., relevance and/or irrelevance) led to longer reading times for seductive details than reading times observed in the no instruction condition, and in comparison to reading times for base sentences. In contrast, the *decreased attraction hypothesis* predicts that irrelevance instructions decrease reader attention to seductive details. Support for this hypothesis would obtain if participants in the irrelevance conditions spent less time reading seductive details than participants in the relevance and no instruction conditions.

The text recall measure examined reader memory for text content (i.e., the proportion of seductive details and base sentences mentioned), providing insight into the products (i.e., memory) of a reading experience. We utilized the same hypotheses here as with reading times. The unavoidable attraction hypothesis suggests that readers across all four conditions will recall more seductive details than base sentences, which again, is consistent with previous research on seductive details (Harp & Mayer, 1997, 1998; Lehman et al., 2007). The increased attraction hypothesis suggests that participants in the relevance and/or irrelevance conditions will recall seductive details to a greater degree than base text, as compared to participants in the no instructions condition. In contrast, the decreased attraction hypothesis suggests that participants in the irrelevance conditions will recall fewer seductive details than those in the relevance and no instructions conditions.

We should note that the type of irrelevance instructions, specific or general, might prove differentially effective at influencing attention to and memory for seductive details. At this point in the project, though, we did not have predictions as to differential effects, focusing instead on whether irrelevance instructions might prove useful at all.

## 3. Method

### 3.1. Participants and design

Sixty-eight undergraduates from introductory psychology courses participated for partial fulfillment of course credit. Participants were randomly assigned to one of four instructional conditions: relevance (i.e., focus on designated text elements), specific

[2] This methodological framework is analogous to that used by others in goal-focusing and text-focusing studies, in which instructions encourage strategic goals or intentions on the part of the reader, reading times are used to measure readers' attention allocation during reading, and recall is utilized as a proxy for learning (McCrudden et al., 2010).

irrelevance (i.e., ignore designated text elements), general irrelevance (i.e., ignore any unimportant material), or no instructions (control).

### 3.2. Materials

#### 3.2.1. Instructions

Each condition began with the instructions: "In this experiment you will be asked to read a short passage. We want you to read the passage carefully, remembering as much of the passage as possible. Later, you will be given a test to see how well you understood what you read." The instructions that followed this introduction differed based on the experimental conditions. Participants in the relevance instructions condition read the following: "At the beginning of textbook chapters, authors usually include guiding questions to help students understand important material. These questions may appear useful or interesting to students, and in fact they may actually help readers understand a passage." Participants receiving the specific irrelevance instructions read: "Often, materials such as textbooks contain exciting but irrelevant details that attract students' attention. These details may be unimportant for understanding the text. At the beginning of textbook chapters, authors usually include guiding questions to help students understand important material. These questions, however, also sometimes focus readers on irrelevant information. While these questions may appear useful or interesting to students, in fact they may not actually help readers understand a passage." Both the relevance and specific irrelevance instruction conditions also received the same six prereading questions (e.g., "How can astronauts fix their hair in space?") that targeted the seductive details (e.g., "Inundating their hair with gel defuses scraggly hair from lack of gravity and maintains an earth-like appearance.") (see Appendix A for the complete list). Participants were asked to rate each question for interest on a 5-point Likert scale (1 = *Not at all interesting* to 5 = *Very interesting*) to ensure they had processed the instructions, as in McCrudden et al. (2005).

General irrelevance instructions provided readers with prereading instructions but without specific prereading questions. These instructions read: "Often, materials such as textbooks contain exciting but irrelevant details that attract students' attention. These details may be unimportant for understanding the text. . .Keep in mind that there are irrelevant details in the passage that will not be useful for your understanding of the text; they may actually hinder your comprehension of the passage." Finally, participants in the no instructions condition did not receive any additional instructions beyond the introduction. Thus, the general relevance instructions condition and the no instructions condition did not include prereading questions.[3]

#### 3.2.2. Text

We adapted the text entitled *Space Travel* from McCrudden et al. (2005). The text described the effects of space travel on the body and was modified from the original to include six seductive details interspersed throughout the passage (see Appendix B for the revised text). The text totaled 1271 words including the title, and contained two core sentence types. Each of these sentence types was based on the categorical designations established by McCrudden and colleagues, with minor changes as described below. *Base sentences* described factual information about space travel and human physiology, unmodified from the original text. These sentences provided a textbook-style account of the topic (e.g., "While in space, the body no longer experiences the downward pull of gravity to distribute blood and other body fluids to the lower parts of the body, especially the legs."). *Seductive detail sentences* included interesting content but were tangentially related to the overall topic of the passage. Each seductive detail, while fictional, was written to sound plausible and realistic (e.g., "Michael Jackson was inspired by the effects of zero gravity on walking when he created his popular 'moonwalk'.").[4]

To ensure the sentences were appropriate for the project, we evaluated the perceived importance of base and seductive details for the text topic. If seductive details were identified as highly important for understanding the text topic, and/or base sentences were identified as of little importance, this would fail to align with designations of the materials from previous work, invalidating the utility of the text content for testing the project questions. For the norming study, 29 undergraduate participants, none of whom participated in the experiment proper, were asked to read the entire space travel text presented on a computer screen. After this initial reading, participants were given the following directions (adapted from Lehman et al. (2007)): "Whenever someone reads a passage, some information is more important to the passage than others. Now, we would like you to rate the importance of each of the sentences in the 'Space Travel' passage to the text's overall meaning." Participants rated each sentence, one at a time, on a 4-point Likert scale labeled 1(very unimportant) to 4 (very important). The results supported the roles designated to the sentences: base sentences ($M = 2.91$) were rated as more important than seductive details ($M = 1.52$) ($t\ (63) = 6.802$, $p < .001$, $d = 3.244$).

As additional insurance that the sentence categories and the tokens assigned to them were appropriately distinguished, we also conducted a norming study on readers' perceptions as to which sentences were relevant and irrelevant to the text topic. Forty undergraduate participants, none of whom participated in the experiment proper, were provided with a text packet containing the space travel text preceded by one of two sets of directions. One set of directions asked participants to circle any irrelevant information, with the following instructions: "You will read a short passage on space travel that contains irrelevant details. These details will be highly interesting, yet unimportant to the central ideas of the text. We would like you to read the passage carefully and circle any such irrelevant details that exist in the text. You may circle as many sentences as you believe meet the criteria of being an irrelevant detail. Think specifically about what the text intends to convey and circle those sentences that you believe are meant to allure the reader and are unimportant to the lesson." The other set of directions asked participants to circle any relevant information, with the following instructions: "In this task you will be asked to read a short passage on space travel that contains relevant information. This information will provide important, factual details that support the central ideas of the text. We would like you to read the passage carefully and to circle any sentences that contain relevant information that you find in the text. You may circle as many sentences as you believe meet the criteria of conveying rel-

[3] We note that the prereading questions and rating task could potentially make the seductive details more important or relevant, rather than or along with their actual content. For the current project though, any increase in the allure of these sentences only serves to further highlight the utility, or lack thereof, of guiding instructions.

[4] The base sentences in these texts likely varied as a function of inherent interest, complexity, familiarity, as well as other characteristics. Similarly, the seductive details might vary on sentence-level characteristics. Each of these characteristics could influence readers' processing of and memory for their contents (e.g., Zwaan & Rapp, 2006). We opted to model the global, dichotomous categorizations that have been used in previous work, identifying sentences solely as a function of whether they were relevant to the text topic (i.e., base) or irrelevant to that topic (i.e., seductive details), rather than evaluating the particular characteristics of each individual sentence. While this type of categorization does not specifically consider the above-mentioned characteristics in an analysis of focusing effects, it nevertheless provides a tractable set of materials for critically evaluating the impact of irrelevance instructions. We also note that this categorization has previously served to provide useful understandings of the impact of relevance on text comprehension (as examples, see McCrudden & Schraw, 2007; McCrudden et al., 2006; McCrudden et al., 2010).

evant information. Think specifically about what the text intends to convey and circle those sentences that you believe are factual and important to the lesson."

For each participant, we calculated the proportion of sentences that we had pre-identified as base or seductive and were actually assigned by participants to each of those categories as a function of the instructional task. When provided with instructions to circle irrelevant sentences, participants identified a higher proportion of seductive detail sentences ($M = .892$) than base sentences ($M = .120$) ($F\ (1, 19) = 260.925$, $Mse = .311$, $p < .001$, $\eta_p^2 = .932$). In addition, at least three of the six seductive detail sentences were identified as irrelevant by almost all of the participants (95%), and an overall majority of the participants (60%) identified all six sentences as irrelevant. When provided with instructions to circle relevant sentences, participants identified a higher proportion of base sentences ($M = .408$) than seductive detail sentences ($M = .017$) ($F\ (1, 19) = 96.097$, $Mse = .350$, $p < .001$, $\eta_p^2 = .835$); consider that 21 of the 60 base sentences were identified as relevant by over 50% of the participants. It is also worth noting that seductive detail sentences were rarely identified as relevant (only 10% of participants ever circled a sentence in this case, and never more than one of the sentences).[5] These norming data helped verify the categorizations assigned to the text sentences.

#### 3.2.3. Recall test

Instructions for the recall test read: "We would now like you to recall everything you can about the passage you just read entitled *Space Travel*. Don't worry about spelling and punctuation. Try to remember as much as you can. If you only remember some of the meaning from a sentence, include that too. There is no time limit, so write down as much as you can."

#### 3.2.4. Postreading questionnaire

The postreading interest included various items assessing participants' overall interest in the passage. Participants rated each item using a 5-point Likert scale (1 = Strongly Disagree to 5 = Strongly Agree) (see Appendix C for the complete questionnaire).[6]

### 3.3. Procedure

The instructions were presented as a printed packet. Participants in the relevance and specific irrelevance conditions rated prereading questions related to the upcoming practice passage using pen and paper. Next, participants read a practice story on the computer screen presented one sentence at a time in a self-paced reading paradigm. Participants pressed the spacebar to advance as they read, and could not go back in the text. To familiarize participants with the procedure, practice mirrored the assigned instructional condition on a different topic (i.e., making sweet tea). After completing the practice story, participants in the relevance and specific irrelevance conditions again rated prereading questions, this time for the space travel text (with pen and paper). Participants then read the experimental text on the computer screen. After completing the text, participants completed a 10-min distractor task involving basic mathematics problems. Following the distractor, participants completed the recall task with pen and paper, followed by the postreading interest questionnaire. Participants were then debriefed.

### 3.4. Scoring

#### 3.4.1. Reading times

Reading times were recorded to the nearest millisecond. For each participant, their total reading time for base and seductive detail sentences was divided by the number of sentences read for each sentence type (i.e., 60 and 6 respectively) and converted to seconds (i.e., divided by 1000) (based on calculations by McCrudden et al., 2005). As an example for illustrative purposes, if a participant took 223,172 ms to read all of the base sentences, this number was first divided by 60 (i.e., the number of total base sentences read), leading to 3719.533 ms per base sentence. This number was then divided by 1000 to convert the measure to seconds, resulting in 3.780 s per base sentence. For the entire *Space Travel* text, the average base sentence length was 19.44 words per sentence, with a range of 8–39 words per sentence. The average seductive detail sentence length was 20.33 words per sentence, with a range of 15–32 words per sentence. An independent samples *t*-test revealed no significant differences in sentence length between the two sentence types $t\ (63) = -.28$, $p = .68$, $d = 6.532$.

#### 3.4.2. Recall protocols

Coding of recall protocols was based on a rubric provided by Matthew T. McCrudden, used previously to code the *Space Travel* story. The rubric propositionalized the text into 79 idea units (i.e., single pieces of information consisting of verb–noun combinations). In addition, we included six idea units to represent each of the seductive detail sentences that had been integrated into the passage. Two coders, blind to condition, evaluated the contents of each recall to determine matches with idea units in the original text. A segment of a recall was considered a match if it was recalled verbatim or paraphrased a proposition from the rubric. No code was assigned if the segment did not identifiably match with an original text segment. The recalls were scored by summing the total number of base (79) and seductive detail (6) segments, with proportions calculated by dividing the sum total for each participant by the total number of possible propositional units for each text type. Raters coded all of the recalls and their agreement was reliably high ($k = .80$). Disagreements were resolved by discussion.

## 4. Results

### 4.1. Reading times

We began by analyzing reading times to each text sentence (see Table 2). As in McCrudden et al. (2005), we eliminated reading times falling more than four standard deviations above the mean, resulting in a loss of 0.6% of the data. The data were analyzed using a 4 (type of instruction: relevance, specific irrelevance, general irrelevance, and no instructions) × 2 (type of sentence: base, seductive detail) mixed measures ANOVA. There was a main effect of sentence type ($F\ (1, 59) = 77.655$, $MSe = .446$, $p < .001$, $\eta_p^2 = .578$) with planned contrasts revealing that participants overall took longer to read seductive details ($M = 5.77$ s per sentence) than base sentences ($M = 4.72$ s) ($F\ (1, 62) = 75.186$, $MSe = .908$, $p < .001$, $\eta_p^2 = .548$). There was no main effect of instruction type and no significant interaction between instruction and sentence type ($Fs < 1$). Thus, the increase in reading times to seductive details was relatively consistent across instructional conditions. Overall, readers focused to a greater degree on seductive details than other text content, regardless of their prereading instructions, consistent with the unavoidable attraction hypothesis.

[5] Based on our norming study, we noted that five base sentences were consistently identified by more than half of the participants as irrelevant sentences. Besides the analyses we report in this paper, we additionally conducted analyses that categorized these five sentences as seductive details rather than base sentences. The patterns of reading time and recall results from these analyses were largely the same as those reported in the paper.

[6] These responses were aggregated to create a postreading interest score. There were no significant differences for interest ratings between prereading and postreading interest scores as a function of instruction type ($Fs < 1$), so we do not discuss them further.

**Table 2**
Reading times (seconds per sentence with *SD* in parentheses) and recall (proportion of idea units) in Experiment 1.

| Measure | Instructional condition | | | |
|---|---|---|---|---|
| | Relevance | Specific irrelevance | General irrelevance | No instructions |
| *Reading times* | | | | |
| Base segment | 4.78 (1.1) | 4.69 (1.1) | 4.80 (0.9) | 4.57 (1.1) |
| Seductive detail | 6.21 (1.2) | 5.66 (1.4) | 5.60 (1.2) | 5.60 (1.4) |
| *Recall* | | | | |
| Base segment | 0.26 | 0.33 | 0.31 | 0.33 |
| Seductive detail | 0.57 | 0.51 | 0.29 | 0.49 |

### 4.2. Recall

We first analyzed the impact of instructions on participants' recalls of the texts using two separate ANOVAs for base and seductive detail sentences as a function of the proportion of idea units recalled for each sentence type (see Table 2). There was no effect of instructions on recall of base sentences ($F < 1.5$). However, there was a main effect of instructions on seductive detail sentences ($F\ (3, 59) = 4.240$, $p < .01$, $\eta_p^2 = .177$). Planned contrasts revealed that participants recalled fewer seductive detail sentences in general irrelevance than in specific irrelevance ($t\ (59) = 2.537$, $p < .05$, $d = 0.660$), relevance ($t\ (59) = 3.383$, $p < .01$, $d = 0.881$), and no instructions conditions ($t\ (59) = 2.240$, $p < .05$, $d = 0.583$). These data are consistent with the decreased attraction hypothesis.

Next, we analyzed recalls with a mixed measures ANOVA as a function of proportion of idea units recalled (see Table 2). There was a main effect of sentence type ($F\ (1, 59) = 28.938$, $MSe = .123$, $p < .001$, $\eta_p^2 = .329$) with planned contrasts revealing that participants overall recalled seductive details ($M = .47$ of the total possible recallable segments for that text type) more so than base ideas ($M = .31$) ($F\ (1, 62) = 21.408$, $MSe = .157$, $p < .001$, $\eta_p^2 = .257$). In addition, there was a marginal main effect of type of instruction ($F\ (3, 59) = 2.361$, $MSe = .242$, $p = .080$, $\eta_p^2 = .107$) and a significant interaction between instruction and sentence type ($F\ (3, 59) = 6.587$, $MSe = .123$, $p < .01$, $\eta_p^2 = .251$). Planned contrasts revealed that participants proportionally recalled fewer base ideas than seductive details following relevance ($F\ (1, 16) = 53.761$, $MSe = .141$, $p < .001$, $\eta_p^2 = .793$), specific irrelevance ($F\ (1, 16) = 6.478$, $MSe = .372$, $p < .05$, $\eta_p^2 = .288$), and no instructions ($F\ (1, 16) = 5.714$, $MSe = .267$, $p < .05$, $\eta_p^2 = .305$); however, following general irrelevance instructions, participants recalled an equivalent proportion of base ideas and seductive details ($F < 1$). Participants recalled fewer seductive details following general irrelevance instructions ($M = .29$) than relevance instructions ($M = .57$) ($F\ (1, 13) = 20.599$, $MSe = .327$, $p < .01$, $\eta_p^2 = .613$), and marginally fewer seductive details following general irrelevance than specific irrelevance instructions ($M = .51$) ($F\ (1, 13) = 3.619$, $MSe = .703$, $p = .080$, $\eta_p^2 = .218$), or no instructions ($M = .49$) ($F\ (1, 13) = 4.127$, $MSe = .656$, $p = .063$, $\eta_p^2 = .241$). Again, these findings are consistent with the decreased attraction hypothesis.

## 5. Analysis of results

Overall, the reading times from Experiment 1 provide strong evidence for the unavoidable attraction hypothesis: Participants spent more time reading seductive details than base sentences, and were more likely to recall those seductive details than base information. Instructions did not seem to influence participants' attention to seductive details during their reading of the texts. However, instructions appeared to influence participants' recall of seductive details, with fewer seductive details recalled following general irrelevance instructions as compared to the other instructional conditions. This pattern of recalls offers modest evidence for the decreased attraction hypothesis as a function of general irrelevance instructions.

The fact that moment-by-moment reading times for seductive details were statistically indistinguishable across conditions, while recall patterns differed as a function of one type of instructional condition, indicates that instructions might exert their impact at retrieval rather than at encoding. Previous work on the impact of seductive details has argued that moment-by-moment processing measures fail to predict the degree to which readers will remember what they read (in line with the *no-increased-effort hypothesis* offered by McCrudden et al., 2006). This indicates that any observable impact of instructions might be due to readers' considerations of what is appropriate as they complete their recalls, rather than as they read. A growing body of work has contended that readers fail to engage in careful evaluation during reading (e.g., Gilbert, 1991; Marsh, Meade, & Roediger, 2003; Rapp, 2008; Rapp & Kendeou, 2007; Rapp & Kendeou, 2009), unless they are given specific tasks or goals that encourage such processing. For the current project, the recall task, coupled with general irrelevance instructions, may have encouraged more careful evaluation of what was appropriate to remember from the text. Of course, the general irrelevance instructions were not entirely effective, or else readers would have completely discounted the seductive details as appropriate for recall. But nevertheless, the observed instructional effects should not be understated. Previous work has articulated the difficulties in helping readers avoid the allure of seductive details, and thus any reduction in their recall represents an important step towards enhancing reading comprehension (Garner, 1992).

Because the general irrelevance instructions appeared to reduce recall of seductive details in comparison to other instructional conditions, we believed a replication was necessary for the project. This is especially important as previous attempts to help readers avoid the allure of seductive details have been relatively ineffective. For Experiment 2 we investigated whether the effects would obtain with a text (and topic) that has received substantial attention in work on seductive details (and notably, the power of those seductive details has proven unresponsive to experimental intervention). This second examination also enabled us to test whether any benefits of general irrelevance instructions are restricted solely to recall measures. And importantly, Experiment 2 allowed for the application of specific predictions concerning the potential effects of the specific and general irrelevance instructional conditions.

## 6. Experiment 2

In Experiment 2, participants read an expository text providing a scientific explanation of the types and causes of lightning. Versions of this text have been used in previous research assessing and validating the problematic influence of seductive details (e.g., Harp & Mayer, 1997, 1998; Lehman et al., 2007; Mayer, Heiser, & Lonn, 2001). Given the differential instructional effects obtained in Experiment 1, we now had more specific expectations as to the impact of irrelevance instructions on our two measures. First,

we expected to see little in the way of differences across instructional conditions with respect to reading times for seductive details. That is, readers should again show longer reading times for seductive details than for base ideas, consistent with the unavoidable attraction hypothesis. Second, we expected increased recall of seductive details as compared to base ideas (also consistent with the unavoidable attraction hypothesis), but importantly and in contrast, with general irrelevance instructions we expected to observe reduced recall of seductive details (consistent with the decreased attraction hypothesis). A failure to replicate the impact of general irrelevance instructions would indicate that the previous effects were specific to that particular text, rather than generally useful across expository reading experiences.

## 7. Method

### 7.1. Participants and design

Sixty-four undergraduates participated from introductory psychological courses for partial fulfillment of course credit. The experimental design was identical to Experiment 1.

### 7.2. Materials

#### 7.2.1. Instructions

The instructions were identical to those in Experiment 1.

#### 7.2.2. Text

Studies on seductive details have most often utilized texts that describe the process of lightning. We modified the prototypical lightning text from Harp and Mayer (1998) to include additional factual information from the *World Book Encyclopedia (2007)* (see Appendix B). The goal of the modifications was to better equate the text lengths across Experiments 1 and 2. The text contained 1122 words including the title. Base sentences described factual information about the nature of lightning, types of lightning, and a scientific explanation of the process of lightning formation (e.g., "Lightning is typically the discharge of electricity resulting from the difference in electrical charges within and between clouds, the cloud and the air, and between the cloud and the ground."). Seductive details were inherently interesting but tangentially related sentences, taken from the prototype text as well as various sources including the Wikipedia entry on lightning (Lightning, 2007) (e.g., "Once, an 8' ball of lightning struck into a dimly lit church in England and burned off the back of a man's head."). Prereading instructions were modified from Experiment 1 to focus on information in the lightning text rather than the space travel text, but were otherwise identical. Prereading questions were constructed to fit the lightning text (e.g., "What does 'Love at first sight' in French and Italian literally translate to in English?").

As with Experiment 1, we conducted a norming study to evaluate readers' perceived importance of the base and seductive details, as a means of assessing the appropriateness of the categories for the project. Thirteen undergraduate participants, none of whom participated in the experiment proper, read the text on a computer screen. After the initial presentation, participants were provided the following directions: "Whenever someone reads a passage, some information is more important to the passage than others. Now, we would like you to rate the importance of each of the sentences in the 'Lightning' passage to the text's overall meaning." Each sentence was rated on a 4-point Likert scale labeled 1(very unimportant) to 4 (very important). The results supported the sentence categorizations: Participants rated base sentences ($M = 2.80$) as more important than seductive details ($M = 1.49$) ($t$ (56) = 8.032, $p < .001$, $d = 3.954$).

We also normed the materials, as in Experiment 1, to determine which sentences were considered relevant and irrelevant to the text topic. The same group of forty undergraduate participants who normed the earlier space travel text for these characteristics also completed the norming study for the lightning text. When provided with instructions to circle irrelevant sentences, participants identified a higher proportion of seductive detail ($M = .758$) than base sentences ($M = .118$) ($F$ (1, 19) = 52.289, $Mse = 1.030$, $p < .001$, $\eta_p^2 = .733$). In addition, at least four of the six seductive detail sentences were identified as irrelevant by almost all of the participants (90%), and all six sentences were identified as irrelevant by 25% of the participants. When provided with instructions to circle relevant sentences, participants identified a higher proportion of base ($M = .669$) than seductive detail sentences ($M = .117$) ($F$ (1, 19) = 103.978, $Mse = .449$, $p < .001$, $\eta_p^2 = .846$). Forty-three out of the 51 base sentences were identified as relevant by over 50% of the participants, and seductive detail sentences were rarely identified as relevant (only 10% of participants ever circled a seductive detail in this case). As before, these norming data confirmed the categorizations assigned to the text sentences.[7]

#### 7.2.3. Recall test

The recall test was the same as in Experiment 1.

#### 7.2.4. Postreading questionnaire

The postreading questionnaire was identical to that presented in Experiment 1.[8]

### 7.3. Procedure

The procedure was identical to Experiment 1.

### 7.4. Scoring

#### 7.4.1. Reading times

Consistent with Experiment 1, total reading times were recorded to the nearest millisecond, calculated by sentence, and converted to seconds. The average base sentence length was 18.73 words per sentence, with a range of 8–30 words per sentence. The average seductive detail sentence length was 24.50 words per sentence, with a range of 18–31 words per sentence. An independent $t$-test revealed a marginally significant difference in sentence length between the two sentence types $t$ (55) = −1.97, $p = .071$, $d = 0.984$.

#### 7.4.2. Recall

We created a recall protocol by propositionalizing the base text into a rubric of 67 separate idea units. We also included the six idea units representing the six seductive details that had been integrated into the passage. The coding procedure was identical to Experiment 1. The agreement between raters was reliably high ($k = .93$), with disagreements resolved by discussion.

## 8. Results

### 8.1. Reading times

We eliminated reading times falling more than four standard deviations above the mean, resulting in a loss of 0.2% of the data (see Table 3). The data were analyzed using a 4 (type of instruction: relevance, specific irrelevance, general irrelevance, and no

[7] None of the base sentences were consistently identified by participants as irrelevant.

[8] As in Experiment 1, interest scores did not differ between conditions ($F < 1$), so we do not discuss them further.

**Table 3**
Reading times (seconds per sentence with *SD* in parentheses) and recall (proportion of idea units) in Experiment 2.

| Measure | Instructional condition | | | |
|---|---|---|---|---|
| | Relevance | Specific irrelevance | General irrelevance | No instructions |
| *Reading times* | | | | |
| Base segment | 5.53 (1.1) | 4.95 (1.0) | 4.66 (0.8) | 5.50 (1.1) |
| Seductive detail | 6.66 (1.5) | 5.55 (1.4) | 4.13 (1.1) | 6.48 (1.4) |
| *Recall* | | | | |
| Base segment | 0.20 | 0.20 | 0.23 | 0.26 |
| Seductive detail | 0.70 | 0.58 | 0.36 | 0.45 |

instructions) × 2 (type of sentence: base, seductive details) mixed measures ANOVA. As in Experiment 1, there was a main effect of sentence type ($F$ (1, 60) = 16.243, $MSe$ = .577, $p$ < .001, $\eta_p^2$ = .213). Planned contrasts revealed that participants took longer to read seductive details ($M$ = 5.70 s per sentence) than base sentences ($M$ = 5.16 s) ($F$ (1, 63) = 12.247, $MSe$ = .766, $p$ < .01, $\eta_p^2$ = .163). In contrast to Experiment 1, there was a main effect of instruction type ($F$ (3, 60) = 8.729, $MSe$ = 2.269, $p$ < .001, $\eta_p^2$ = .304) and a significant interaction between instruction and sentence type ($F$ (3, 60) = 7.852, $MSe$ = .577, $p$ < .001, $\eta_p^2$ = .282). Planned contrasts revealed that participants took longer to read seductive details than base sentences following relevance ($F$ (1, 15) = 11.175, $MSe$ = 1.807, $p$ < .01, $\eta_p^2$ = .427), specific irrelevance ($F$ (1, 15) = 7.505, $MSe$ = .778, $p$ < .05, $\eta_p^2$ = .333), and no instructions ($F$ (1, 15) = 22.504, $MSe$ = .679, $p$ < .001, $\eta_p^2$ = .600). Importantly, participants were actually marginally slower to read base sentences ($M$ = 4.66) than seductive details ($M$ = 4.13) following general irrelevance instructions ($F$ (1, 15) = 3.430, $MSe$ = 1.356, $p$ = .084, $\eta_p^2$ = .186). This provides modest support for the decreased attraction hypothesis during reading.

### 8.2. Recall

We began our analysis of the impact of instructions on recall using two separate ANOVAs for base sentences and seductive details as a function of the proportion of idea units recalled (see Table 3). As in Experiment 1, there was no main effect of instruction on recall for base sentences ($F$ < 1.2), but a main effect of instructions on recall for seductive detail sentences ($F$ (3, 60) = 7.858, $p$ < .001, $\eta_p^2$ = .282). Planned contrasts revealed that participants recalled fewer seductive detail sentences following general irrelevance than specific irrelevance ($t$ (60) = 2.926, $p$ < .01, $d$ = 0.755) and relevance instructions ($t$ (60) = 4.494, $p$ < .001, $d$ = 1.160), but not no instructions conditions ($t$ < 1). As before, these results are consistent with the decreased attraction hypothesis.

Next, we analyzed participants' text recalls using a mixed measures ANOVA as a function of the proportion of idea units recalled (see Table 3). There was a main effect of sentence type ($F$ (1, 60) = 108.290, $MSe$ = .129, $p$ < .001, $\eta_p^2$ = .643) with planned contrasts revealing that participants overall recalled more seductive details ($M$ = .52 of the total possible recallable segments for that text type) than base idea units ($M$ = .22) ($F$ (1, 63) = 79.593, $MSe$ = .176, $p$ < .001, $\eta_p^2$ = .558). In addition, there was a main effect of type of instruction ($F$ (3, 60) = 4.321, $MSe$ = .143, $p$ < .01, $\eta_p^2$ = .178) and a significant interaction between instruction and sentence type ($F$ (3, 60) = 8.591, $MSe$ = .129, $p$ < .001, $\eta_p^2$ = .300). Planned contrasts revealed that participants recalled proportionally fewer base ideas than seductive details following relevance ($F$ (1, 15) = 80.465, $MSe$ = .240, $p$ < .001, $\eta_p^2$ = .843), specific irrelevance ($F$ (1, 15) = 60.291, $MSe$ = .188, $p$ < .001, $\eta_p^2$ = .801), general irrelevance ($F$ (1, 15) = 5.529, $MSe$ = .270, $p$ < .05, $\eta_p^2$ = .269), and no instructions conditions ($F$ (1, 15) = 7.661, $MSe$ = .338, $p$ < .05, $\eta_p^2$ = .338). However, participants recalled fewer seductive details following general irrelevance instructions ($M$ = .36) than relevance ($M$ = .70) ($F$ (1, 15) = 22.057, $MSe$ = .384, $p$ < .001, $\eta_p^2$ = .595) or specific irrelevance instructions ($M$ = .58) ($F$ (1, 15) = 10.385, $MSe$ = .346, $p$ < .01, $\eta_p^2$ = .409). These results remain consistent with the decreased attraction hypothesis.

## 9. Analysis of results

For the lightning text, as for the space travel text from Experiment 1, readers attended to seductive details, consistent with the unavoidable attraction hypothesis. However, a general warning to ignore potentially irrelevant information was most effective for reducing focus on seductive details, supporting the decreased attraction hypothesis. While in Experiment 1 these results were obtained for recall, in Experiment 2 concomitant effects were obtained for both reading times and recall measures. Earlier we surmised that instructional impacts might be a function of processes occurring during retrieval rather than at encoding. The current results also suggest that text content may play a role such that different texts can encourage differential evaluative processes at both the encoding and retrieval stages of comprehension activity.

## 10. General discussion

The purpose of this study was to investigate whether particular types of instructions might be effective at reducing readers' propensities towards attending to irrelevant information. We examined whether specific and general irrelevance instructions might influence reader attention to irrelevant text segments. In Experiment 1, participants read an expository text about space travel that included irrelevant information (i.e., seductive details) interspersed throughout the passage. While there were no differences in reading times for seductive details across conditions, participants in the general irrelevance condition, as compared to other instructional conditions, recalled fewer seductive details. The irrelevance instructions appeared to impact outcomes at retrieval but not during moment-by-moment reading. In Experiment 2, participants read an expository text about lightning which also included seductive details throughout the passage. As before, readers attended to seductive details across all conditions, but participants in the general irrelevance condition spent less time reading them. Participants in the general irrelevance condition also recalled fewer seductive details than in other conditions. That is, irrelevance instructions impacted both reading and recall. Overall, seductive details draw reader attention, but particular types of instructions appear useful at reducing the effects of those details on attention and memory for text.

Across the two experiments, we observed that general irrelevance instructions tended to reduce attention to seductive details, without any impact, positive or negative, on attention to or memory for base information. In a sense then, general irrelevance instructions did not appear to directly enhance experiences of core content. To what degree, then, is it worth providing readers with

general irrelevance instructions given that core content seems unaffected? This question seems particularly important in that seductive details can actually serve a useful purpose, drawing the interest of readers to topics that they might rarely peruse of their own volition. Nevertheless, it is crucial to note that previous work has shown, quite consistently, that the attention drawn to seductive details can have detrimental effects on text comprehension (e.g., Garner et al., 1989, 1991; Harp & Mayer, 1997; Lehman et al., 2007), even though the base recall patterns in the current experiments did not reveal differences between no instructions and instruction conditions. Additionally, instructions that focus attention away from irrelevant information might be especially useful in a variety of situations. For example, time constraints might limit how much information individuals can hope to cover in their readings, so a strategy of skimming or ignoring some information can be helpful (Duggan & Payne, 2009). Some tasks might require the careful allocation of attention to multiple activities at the same time (i.e., reviewing a handout while simultaneously listening to an instructor), and under such dual task conditions the freeing up of resources can help alleviate processing burdens. Individual differences in cognitive resources (e.g., low versus high working memory capacity) can also limit the strategies readers rely on during reading; any processing decrements that emerge as a function of capacity limits might be addressed through the use of instructions that focus limited attentional resources away from irrelevant material.

The above possibilities reflect the potential that prereading instructions have in helping readers focus on and ignore unimportant text elements. But to what underlying mechanisms might we attribute the effectiveness of general irrelevance instructions? Earlier we discussed that the impact of general irrelevance instructions might be due to readers' evaluations of what is appropriate in a text. Previous work has demonstrated that reader evaluation of text content can have beneficial effects on comprehension. For example, readers asked to evaluate text segments are more likely, as compared to readers without such a goal, to detect mismatches in story plot (e.g., Egidi & Gerrig, 2006), revise narrative understandings (e.g., Rapp & Kendeou, 2007), engage in updating of inaccurate beliefs (Guzzetti, 1990), and identify meaningful segments of text (McCrudden & Schraw, 2007). It is worth noting that these studies have often provided vague instructions, in the sense that participants are not told exactly what to look out for but to generally and carefully consider the content of the text. A mechanistic explanation, then, might appeal to the notion that general irrelevance instructions encourage critical evaluation, without priming knowledge about the particular contents that readers should avoid contemplating. Priming seems crucial to consider in any explanation, as instructions that ask readers to avoid text content that has been directly highlighted for them might actually increase reader interest in those ideas. For example, simply mentioning what not to pay attention to might lead individuals to prefer reading that information (e.g., Zajonc, 2001), or at least a failure to disregard that information when it is encountered in a text. This type of mere exposure effect can have direct impressions on what audiences find familiar, valid, and memorable (e.g., Wegner, Wenzlaff, Kerker, & Beattie, 1981). Thus, the underlying effectiveness of general irrelevance instructions may arise from at least two factors: (1) An appeal for the reader to carefully evaluate the text content and (2) careful avoidance in making readers any more familiar with or interested in irrelevant content.

The utility of this mechanistic account could be usefully tested by considering the scope of effects incurred by prereading instructions. For example, the instructions used in the current experiments tended towards suggestions of what text content potentially can do (e.g., "These questions...may actually help/may not actually help readers understand a passage."), rather than more confident claims about their effects. The degree to which instructions inspire confidence as to the power of their contents might motivate readers to process texts to a greater or lesser degree. Additionally, tests of the effects of instructions have generally been limited to evaluations of the specifically read texts and their contents. Investigation as to whether instructions to avoid or focus on text information might lead to transfer effects would be informative. Transfer in this case might involve the application of acquired knowledge towards answering inferential questions, as well as transfer of the skills encouraged by instructions to evaluate what matters and what does not in texts.

Based specifically on the findings of the current study, the effects of the general irrelevance instructions occurred most consistently during retrieval (i.e., on recall). In contrast, an influence of general irrelevance instructions on encoding (i.e., reading times) was also observed for the text materials in Experiment 2.[9] One possibility is that processing of seductive details is not just influenced by the nature of reading instructions, but also by the content and structure of a text (e.g., McNamara, Kintsch, Songer, & Kintsch, 1996; O'Reilly and McNamara, 2007). For example, obviously irrelevant segments in a text are read slower than those closely tied to the text's topic (e.g., Schraw, 1998; Wade, Schraw, Buxton, & Hayes, 1993). Thus, the cohesiveness of a text may influence the degree to which readers encode seductive details into memory. Additionally, individual differences across readers likely affect whether seductive details are attended to or disregarded. Interest in text topics, as well as differences in prior knowledge (e.g., Kendeou & van den Broek, 2005; McNamara et al., 1996; O'Reilly and McNamara, 2007), working memory capacity (e.g., Daneman & Carpenter, 1980; Sanchez & Wiley, 2006), and reading goals (e.g., Linderholm & van den Broek, 2002; van den Broek, Risden, & Husebye-Hartmann, 1995; van den Broek et al., 2001) all influence attention allocation during encoding and retrieval. The current project provides a first pass examination of the effects of instructions on processing and memory for seductive details, but as with other investigations, a complete account will necessitate consideration of the impact of the above factors (Rapp & van den Broek, 2005).

As we suggested in the introduction to this article, there is a ubiquity of instructions in educational settings intended to direct readers to both attend to and ignore information. Our experiments indicate that providing a general warning to readers about upcoming irrelevant information prompted them to attend to the information to a lesser degree than if the information was specified beforehand. These findings suggest at least two educational considerations. The first is that teachers should be aware of the variety of instructions that influence student work. Previous research has shown the power of teacher guidance in directing students to focus on aspects of course material (e.g., Jetton & Alexander, 1997). Knowing *how* to instruct students to avoid unnecessary details when learning important material is a crucial goal for teachers to impart to students. General irrelevance instructions can remind students of the harmful impacts of upcoming

[9] One possibility for the differences in reading time effects across Experiments 1 and 2 might be a function of the ease with which participants could identify the seductive details. That is, participants may have found it easier to identify seductive details in Experiment 2, whereas they may have found it more difficult to identify those details in Experiment 1. However, at least two pieces of data speak against this notion. The first is that the reading times to seductive details in Experiments 1 and 2 were comparable. The second, perhaps more direct reason, is that the norming data failed to reveal any difficulty on the part of participants to identify sentences as seductive or base in either text. Nevertheless, the degree to which seductive details are more or less obvious in a text likely has an impact on readers' noticing and processing of information (as it does with inconsistencies; see Rapp & Kendeou, 2007; 2009). We thank an anonymous reviewer for raising this issue.

irrelevant material; such instructions can be used in many situations, including in-class discussions of the course material, homework assignments outlining key points of the assigned chapter, and examination reviews. A second consideration is that general irrelevance instructions are relatively simple to administer. A teacher need only provide a short set of instructions generally emphasizing the harmful effects of irrelevant information on comprehension of a particular text. For example, a history instructor might say, "Aspects of this text might not be related to the core argument and not useful to understanding the overall claim." Or a science teacher might tell students, "Sections of the textbook describe information that is not relevant to the facts and processes we will cover, so ignore that information in favor of core content." This could be enough to impact readers' attention without requiring additional time explicating specific irrelevant sections, which might be confusing and counter-productive (e.g., Schwarz, Sanna, Skurnik, & Yoon, 2007).

Modifications to the impact of seductive details on text memory also have important implications for everyday experiences in learning from discourse. Research has overwhelmingly documented the harmful effects of seductive details on knowledge acquisition (Garner et al., 1989, 1991; Harp & Mayer, 1997, 1998; Lehman et al., 2007; Sanchez & Wiley, 2006; Schraw, 1998). Studies of this type have, at least in part, been motivated by the amount of seductive information commonly found in textbook chapters, likely included as a means of promoting reader interest and engagement with the material (Garner, 1992). (We note that similar writing decisions are often made with newspaper and magazine articles in attempts to attract reader attention.) An intriguing question for this area of study involves the degree to which writers are aware of the impacts of their design decisions. Authors have a repertoire of strategies to increase interest for expository content, such as providing attention grabbing stories at the beginning of a chapter, peppering materials with narrative asides about surprising events, sectioning off text boxes or appendices to include supplemental information, or explicitly marking that the text content should fascinate the reader. Extended study of the effects of instructions on seductive details might inform design decisions and raise care in their implementations. The findings presented here indicate that regardless of authors' decisions, instructions can help reduce the problematic allure of seductive details on readers' learning experiences with texts.

## Appendix A

### A.1. Prereading questions

#### A.1.1. Experiment 1

1. How can astronauts fix their hair in space?
2. What happens after break dancing or gymnastics?
3. At what events do roller coaster enthusiasts often get motion sickness?
4. How much larger should astronauts' baseball hats be in order to fit while in orbit?
5. What influenced Michael Jackson to create the 'moonwalk'?
6. Where were the monkeys thrown a party?

#### A.1.2. Experiment 2

1. What does "Love at first sight" in French and Italian literally translate to in English?
2. What did the ancient Greeks and Romans think lightning was?
3. How did ball lightning injure a man in an English church?
4. What occurred when a softball sized hailstone fell in Texas in 2000?
5. How did Benjamin Franklin show that lightning was electrical?
6. How often does lightning strike the Empire State Building?

## Appendix B

### B.1. Space travel

(To illustrate the irrelevant information, we have boldfaced seductive details. All other sentences are base text. The Space Travel text has been adapted from McCrudden et al. (2005). The Lightning text has been adapted from Harp & Mayer (1998) and World Book Encyclopedia (2007).)

When space travel was first considered, it was unknown how the weightless environment of space would influence humans. Thus monkeys, who have body systems that are very similar to humans, were among the first pioneers of space travel. Much is now known about the effects of space travel on the body. The body is an extraordinary and complicated system that automatically detects and responds to dramatic environmental changes that surround it, particularly to the lack of gravity. The body is an integrated system, with different parts of the body in constant communication with each other. When an astronaut goes into space, his or her body will immediately begin to experience several changes that cause the astronaut to feel and look differently. Inundating their hair with gel defuses scraggly hair from lack of gravity and maintains an earth-like appearance.

Within the inner ear there is a balance organ called the vestibular organ. During movement, the brain receives information from the vestibular organ about the speed and direction of the body in relation to gravity. While this occurs, the brain also integrates information from the senses, muscles, and joints, which allows a person to monitor body movement. On Earth, there is a natural "up" and "down", as determined by gravity. Although, after break dancing or gymnastics, people's sense of direction can be confused on Earth. But in space, there is no natural "up" or "down" because of the lack of gravity. In an environment with virtually no gravity, the brain receives conflicting signals about the body's orientation.

When first entering space, it is difficult to detect the orientation of the body parts, particularly the arms and legs, because of an inability to feel their weight. One astronaut recalls: "We closed our eyes and they asked us, 'Now, which way is up?' With my eyes closed, I could not distinguish up and down." Another astronaut reported waking in the dark and seeing a glow-in-the-dark watch floating in front of him. He realized moments later that the watch was around his own wrist. The body has learned to function in Earth's gravity and becomes confused by the sudden lack of gravity in space. Therefore the brain has to re-learn how to process movements to determine the body's orientation.

Upon entry to micro-gravity, nearly all astronauts are troubled to some extent by a condition called space motion sickness, which is similar to car sickness. Monkeys who swing from branches in dense forests are less susceptible to motion sickness, which means they were well-suited for early space exploration. On Earth, the brain learns to process the signals from the eyes (what you see), ears (what you hear), and the nerves in the skin (what you touch) to provide information about the body in relation to one's surroundings. In the space environment, the sight, hearing, and touch signals do not match as they do on Earth. This sudden combination of confusing signals being sent to the brain causes many astronauts to feel sick. Avid rollercoaster enthusiasts participating in marathon rollercoaster riding events also report having similar motion sickness symptoms. Fortunately for most astronauts, the

symptoms of space motion sickness seem to last only the first few days of the mission. The current record holder for the most consecutive days on a space station is a Russian cosmonaut, who spent a total of 418 days in space.

While in space, the body no longer experiences the downward pull of gravity to distribute blood and other body fluids to the lower parts of the body, especially the legs. In fact, the blood and fluids make what is called a head-ward shift, which means that these fluids redistribute to the upper part of the body. Fluid redistribution to the upper body leads to some interesting effects. Astronauts' faces look puffy because there is more fluid in the upper body, and their legs become much smaller because there is less fluid in the lower body. Some astronauts prefer to wear baseball hats when in orbit, but in order to fit the hat must be at least one size larger than what they would normally wear on Earth. As a result of the head-ward shift, the body senses a "flood" of fluids in the chest and head area. Lung and heart sensors send messages to the kidneys to eliminate the excess fluid that has pooled in the upper body. In addition, astronauts do not feel thirsty and drink less fluid. As fluid elimination increases and fluid consumption decreases, body fluid levels become lower then normal. This leaves astronauts more susceptible to infections because less fluid makes it more difficult for cells within the body to function efficiently. It is not surprising that Ham the chimpanzee was happy to receive a fluid-rich apple after returning from a space mission in 1963.

In addition, the heart no longer has to work as hard, partly because there is less fluid to pump throughout the body, but also because floating on a spacecraft requires less energy than physical activity on Earth. Because it no longer has to work so hard, the heart shrinks.

Another interesting consequence of space travel is muscle loss. After leaving the Earth's gravitational field, astronauts no longer use the full strength of their skeletal and muscular systems. When muscles are used infrequently, they become smaller. Not only do muscles weaken, but weight-bearing bones also deteriorate and become weaker. While on a spacecraft, astronauts typically float, rather than walk. Michael Jackson was inspired by the effects of zero gravity on walking when he created his popular 'moonwalk'. If they are floating, they are not using their leg muscles and bones to walk. Much like a football player whose muscles shrink when he stops lifting weights, the astronauts' leg muscles shrink when he stops using them to walk. Therefore, without gravity, astronauts lose muscle and bone strength. To prepare for the physical demands of space travel, Enos the chimpanzee completed 1250 h of intense physical training. He jumped for joy and ran around the deck of the recovery ship, enthusiastically shaking the hands of his rescuers, following two orbits around Earth.

Bone loss can pose another possible problem. When bones degenerate, larger-than-normal amounts of minerals, such as calcium, enter the blood. The blood is filtered by the kidneys. As noted earlier, the rate of kidney filtration increases in space. When greater amounts of minerals are in the blood and the kidney filtration rate increases, the potential for painful kidney stones becomes greater.

What happens when the astronauts do return to Earth? As the shuttle reenters the Earth's atmosphere, astronauts immediately feel the pull of gravity. It quickly becomes clear that the lack of gravity in space has taken its physical toll. Upon reentry, the body must change from a "space-normal" condition back to an "earth-normal" condition.

Monkeys helped pave the way for space travel by humans by providing valuable information about the effects of space travel on living organism. In fact, their participation was celebrated with parties in the woods after returning with lots of bananas and room to swing endlessly from trees. Successful human exploration of space depends on understanding how the human body is influenced by the environment in outer space. An added benefit of this research is that the effects of space travel on humans can help us to better understand many ailments suffered by people on Earth, such as high blood pressure and other heart problems. In addition, muscle and bone research in space can give us added important insights into muscle degeneration and loss of calcium in the bones, all of which are health problems facing society today.

### *B.2. Lightning*

Lightning is typically the discharge of electricity resulting from the difference in electrical charges within and between clouds, the cloud and the air, and between the cloud and the ground. Lightning often looks so extraordinary that it became an expression for "love at first sight" in French and Italian that literally translates to mean "bolt of lightning." Types of lightning can be classified in two ways: (1) by the source and destination of the charges and (2) by the appearance of the flash. The most common type of lightning is known as intracloud lightning, which occurs within a cloud. Intracloud lightning neutralizes positive and negative charges that have built up in a thundercloud and the charges that flow from the cloud to the air create cloud-to-air lightning. Also, a flow of charges between two clouds – a relatively rare event – produces cloud-to-cloud lightning. However, lightning between a cloud and the earth may be either cloud-to-ground lightning or ground-to-cloud lightning, depending on the direction in which the charges first flow. Most of the lightning that people see is cloud-to-ground lightning that is brought about by a build-up of negative charge in the lower part of the thundercloud.

Until the mid-1700s, lightning was a great mystery of nature and the ancient Greeks and Romans thought it was a weapon of the gods.

Since then, people have given names to various aspects of lightning: forked lightning; streak lightning; ribbon lightning; bead lightning, also called chain lightning; heat lightning; sheet lightning; and ball lightning.

Forked lightning is a flash that has several visible branches. Streak lightning appears to illuminate a single jagged line. Ribbon lightning appears as parallel streaks of light and occurs when wind separates the individual strokes of a flash. Bead or chain lightning is a flash that breaks up into a dotted line as it ends. Heat lightning, often seen on summer nights, seems to occur without thunder. Actually, it is lightning that occurs so far away from an observer that its accompanying thunder cannot be heard. Generally, the distance from the observer is beyond about 15 miles (24 km), but the people underneath heat lightning experience a normal thunderstorm. Sheet lightning appears as an illumination in the sky. The flashes that produce sheet lightning are either so far away that their characteristic shape cannot be seen, or the flashes are hidden by clouds. Ball lightning usually occurs after a cloud-to-ground flash. It appears as a glowing, fiery ball that floats for several seconds before disappearing. Once, an 8′ ball of lightning struck into a dimly lit church in England and burned off the back of a man's head. There are many theories of how ball lightning forms, but none have been proven by creating ball lightning in a laboratory.

The following description explains what actually happens during the formation of lightning, specifically cloud-to-ground lightning. Other types of lightning occur in a similar manner. When the surface of the earth is warm, moist air near the earth's surface becomes heated and rises rapidly, producing an updraft. As the air in these updrafts cools, water vapor condenses into water droplets and forms a cloud. The cloud's top extends to a very high altitude where the air temperature is well below freezing, so the upper portion of the cloud is composed of tiny ice crystals. Eventually, the water droplets and ice crystals in the cloud become too large to be suspended by updrafts. As raindrops and ice crystals fall

through the cloud, they drag some of the air from in the cloud downward, producing downdrafts. The rising and falling air currents within the cloud may cause hailstones to form. When downdrafts strike the ground, they spread out in all directions, producing gusts of cool wind people feel just before the start of the rain. Dangerous hail may also be produced during this period. In 2000, a 19-year-old from Texas died after being hit in the head by a softball sized hailstone.

Within the cloud, the moving air causes electrical charges to build, although scientists do not fully understand how it occurs. Most believe that the charge results from the collision of the cloud's light, rising water droplets and tiny pieces of ice against hail and other heavier, falling particles. The negatively charged particles fall to the bottom of the cloud, and most of the positively charged particles rise to the top.

The first stroke of a cloud-to-ground lightning flash is started by a stepped leader. Many scientists believe that it is triggered by a spark between the areas of positive and negative charges within the cloud. A stepped leader moves downward in a series of steps, each of which is about 50 yards long, and lasts for about 1 millionth of a second. As the stepped leader nears the ground, positively charged upward-moving leaders travel up from such objects as trees and buildings, to meet the negative charges. Usually, the upward moving leader from the tallest object is the first to meet the stepped leader and complete a path between the cloud and earth. The two leaders meet generally about 165 feet above the ground. Negatively charged particles then rush from the cloud to the ground along the path created by the leaders. It is not very bright and usually has many branches.

As the stepped leader nears the ground, it induces an opposite charge, so positively charged particles from the ground rush upward along the same path. This upward motion of the current is the return stroke and it reaches the cloud in about 70 μs. The return stroke produces the bright light that people notice in a flash of lightning, but the current moves so quickly that its upward motion cannot be perceived. The lightning flash usually consists of an electrical potential of hundreds of millions of volts. In 1752, Benjamin Franklin showed that lightning is electrical when he flew a kite attached to a metal key in a thunderstorm and sparks jumped from the key to his knuckle. Intense heating of lightning processes causes the air to expand explosively, producing a sound wave we call thunder.

Generally, lightning strikes the earth about 100 times each second. The Empire State Building is struck by lightning about 23 times a year, and was once struck eight times in just over 20 min. A lightning flash has one or more strokes and appears as a single brightening of a channel (path) between the cloud and the ground. Typical cloud-to-ground flashes are up to 10 miles (16 km) long. Flashes in clouds may travel horizontally through lines of clouds for more than 100 miles (160 km). People can sometimes see the individual strokes of a flash. At such times the lightning appears to flicker.

## Appendix C

### C.1. Interest questionnaire

In this part we want you to rate how you responded to the space travel passage overall. Please indicate how strongly you agree or disagree with each statement using the 5-point scale below. Circle the number that corresponds to your rating.

1----------2----------3----------4----------5

Strongly Disagree Undecided Strongly Agree

1. I thoroughly read the entire passage.
2. The irrelevant details made the story confusing.
3. I felt I did a good job recalling the story.
4. I felt that the questions helped me guide my reading.
5. I felt there were details in the text that did not help me understand the main idea of the passage.
6. I thought I was successful in ignoring the irrelevant details.
7. The questions made the story confusing.
8. I thought the story was very interesting.
9. I thought the story's topic was fascinating.
10. I would like to read more about this topic in the future

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