

THE INFLUENCE OF INTEREST AND WORKING MEMORY ON LEARNING

By

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To Tracy Linderholm, without whose patience, support, and aid this would not have  
been possible

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Text factors and working memory capacity were studied in terms of how they contribute to perceiving a narrative text as interesting and how these factors, separately and combined, facilitate inference-making and learning from narrative texts by using a series of mixed factors, repeated measure ANOVAs. The text-based factors manipulated in this study were absolute interest by including or not including a concept of violence, romance, or death and unexpectedness in terms of causal constraint by making the outcome of the text explicit, highly likely, or providing an alternate outcome. The average interest rating of the texts was higher if the text included a concept of absolute interest but was not influenced by level of causal constraint. The percent of correct inference generation was higher for texts that were explicit or high constraint compared to low constraint. The average number of correct responses to open ended questions and the proportion of the text recalled was higher for texts that included a concept of interest. There was also a significant interaction such that recall was particularly higher for texts that included a concept of interest and had a low level of constraint. Working memory capacity did not have an effect on interest ratings or learning outcomes. The results of this study indicate that readers are more likely to

perceive a text as interesting, to be able to answer open ended questions about the text, and recall the text if the text includes a concept of absolute interest. Theoretical implications, future directions, and educational applications of the findings are discussed.

## CHAPTER 1 THE INFLUENCE OF INTEREST AND WORKING MEMORY ON LEARNING

Most theories of interest posit that interest arises from an interaction between the individual and the environment (Dewey, 1913; Krapp, 2002; Schank, 1979), but there is a gap in the research regarding how individual and environmental factors interact so that interest arises and how these interacting factors of interest contribute to the potential benefits of interest. One benefit of interest is that interest is associated with increases in reading comprehension across different age groups and topics (Ainley, Hidi, & Berndorff, 2002; Bray & Barron, 2003-2004; Lin, Zabucky, & Moore, 1997; Schiefele, 1999). The goal of this study is to investigate how environmental factors and individual factors, in this case elements of the text and working memory capacity, respectively, contribute to perceiving a narrative text as interesting and how these factors, separately and combined, facilitate inference-making and learning from narrative texts.

There are many text factors that have been found to generally elicit interest for most readers. Research has shown that important characteristics of a stimulus, such as a text, that make it interesting include the content and the structure (Hidi, 1990). Content can be specific to the individual or common to most people; Schank (1979) indicates that there are inherent concepts of absolute interest that elicit interest including: death, danger, power, and sex. Regarding the structure of a text, characteristics that tend to make a text more interesting include unexpectedness and coherence (McDaniel, Waddill, Finstad, & Bourg, 2000; Wade, Buxton, & Kelly, 1999). Finally, topics that are closely aligned with an individual's goals elicit interest if they are at the appropriate level relative to the individual's current knowledge and skill set

(Dewey, 1913; Krapp, 2002). Therefore, interest can be elicited by using literary devices that include concepts that are of absolute interest, increase unexpectedness, and matching the text with the individual's current abilities, such as working memory capacity.

One means of manipulating interest at the text level could be including a concept of absolute interest. Specifically, an outcome of a text could either include a concept of absolute interest or not include a concept of absolute interest. For example, death is a concept of absolute interest; therefore, an outcome of the woman dying is more interesting than an outcome of her getting a bruise. Because absolute interest is a powerful way to elicit interest, it will be manipulated in the current study.

In addition to manipulating the content in terms of absolute interest, another means of making a text interesting is to increase unexpectedness which can be done by manipulating a text's causal structure. Causal text constraint is a means of providing varying levels of relevant information so that the extent that the reader can predict a particular consequence or outcome, and therefore generate a predictive inference, would also vary (Linderholm, 2002). For example, "The tipsy actress fell from the ledge of the 19<sup>th</sup> story rooftop" has a causal text structure that strongly constrains the prediction that the actress will die as a result of the fall. If the actress had fallen from the top of the stairs, the constraint would be low or weak. There are several possible outcomes such as she could die, break her ankle, get a bruise, etc. While explicit texts provide all the relevant information for knowing what will happen next, implicit texts remove some pieces of information or provide unrelated information so that readers are unable to expect, with certainty, a particular outcome. Therefore, texts that have lower

levels of causal constraint are more unexpected, and potentially more interesting, than texts with higher levels of causal constraint. For this reason, unexpectedness, manipulated by level of causal constraint, is one means of manipulating interest at the text level used in the current study.

As previously mentioned, interest is understood as resulting from an interaction between an individual and the environment, in this case texts. In the current study, texts were manipulated to enhance interest by including concepts of absolute interest and decreasing the constraint toward a particular outcome so that the outcome is more unexpected. Reader characteristics may interact to determine whether such text manipulations will be considered interesting and lead to the benefits of interesting texts, such as increasing comprehension (Asher, Hymel, & Wigfield, 1978; Bray & Barron, 2003-2004; Durik & Matarazzo, 2009). Unfortunately, readers are not equally capable of generating inferences or resolving coherence when the inference generated does not match the outcome. Readers who have low working memory capacity struggle to make predictive inferences, particularly when there is a low level of constraint so that the story events may lead to multiple possible outcomes (Linderholm, 2002). Readers with low working memory capacity also have difficulty recovering when their original interpretation of a text is proved incorrect (Daneman & Carpenter, 1983). These readers may not be able to create a coherent representation when the texts have low levels of constraint because they are not able to generate a possible outcome nor recover if their predicted outcome proves incorrect. Therefore, while all readers may be able to benefit from texts that are interesting due to inclusion of absolute interest concepts, working memory capacity may limit some readers from being able to benefit from texts that are

more interesting by increasing their unexpectedness using varying levels of causal constraint.

In order to better understand how text-based factors and individual factors contribute to interest and how these factors may influence readers' comprehension based on their working memory capacity, a discussion of interest and working memory capacity will follow. First, a review of research on interest will include a discussion of the situational interest, the text-based factors of content including individual interest and structural factors commonly used to manipulate interest, and the influence of interest on learning. A discussion of the characteristics of working memory capacity and how it influences reading comprehension will follow. Finally, the review will be summarized in terms of the hypotheses of the study.

### **Interest**

“Psychologically, interest and attention are closely allied events. They are frequently regarded as the subjective and objective aspects of the same activity,” (Dewey, 1976, p. 253). Interest is the emotion that arises from recognizing the importance of the task or object to the self (Dewey, 1913) and is expressed with a decrease in blinking and glancing away as well as an increase in head stillness (Reeve, 1993) indicating a focus of attention. Interest has been researched both as an emotion triggered by a situation's stimuli, known as situational interest and as a more enduring set of preferences for particular domains, known as individual interest (Krapp, Hidi, & Renninger, 1992; Silvia, 2006). While theories of interest development propose that individual interest develops from situational interest that continues to arise from similar situations (Hidi & Renninger, 2006; Krapp, 2002), situational interest is also triggered by including content that is central to the reader's individual interests as well as structural

factors (Hidi, 1990) if these factors match with the reader's goals and abilities (Dewey, 1913; Krapp, 2002). One of the goals of this study is to understand how text-based interest, that is content and structural factors designed to elicit interest, and the individual factor of working memory capacity combine to generate situational interest.

### **Situational Interest**

Situational interest is thought of as an emotional state aroused by stimuli in the situation (Schiefele, 1991). According to Dewey (1913, 1976), interest depends on a balance of new and old so that the individual is neither overwhelmed or discouraged by too much new information nor bored by too much old information. Reading researchers, such as (Kintsch, 1980), agree that a slight deviation from expectations is optimal in a text because it allows for the stimulation of interest without becoming incoherent based on the reader's prior knowledge. Therefore, texts that provide information that is somewhat different from current knowledge structures or is unexpected should be the most interesting. The new information may cause readers a degree of confusion, but if interested, the reader will continue reading in order to construct a coherent representation of the text. While topic interest helps readers anticipate whether they will enjoy a particular text, and therefore occurs before reading, situational interest occurs during the act of reading (Ainley, Hidi et al., 2002).

Situational interest is thus triggered when factors of the environment, in this case texts, match with individual factors. Factors of the text that can trigger interest include content factors that match with readers' individual interests and structural factors (Hidi, 1990). Content factors are those that include concepts that the reader is interested in, that is, domains of particular concern to that one individual or concepts of absolute

interest that are of concern to most individuals. Structural factors are those that concern how the text is written.

### **Individual Interest**

Individual interest refers to the individual's preferences for certain domains or topics and is considered relatively stable and is associated with increased knowledge, positive emotions, and greater value to the self (Dewey, 1913; Hidi & Renninger, 2006). In terms of reading research, this form of interest is usually described as topic interest. One way that topic interest affects reading is by providing a point of reference, similar to the effect of perspectives. Perspectives facilitate reading by providing a basis to evaluate relevance, guiding attention to information that is relevant, and activating related ideas (Di Vesta & Di Cintio, 1997). Providing a specific perspective to readers increases their interest in perspective related information (Ramsay & Sperling, 2010). Topic interest may be understood as a perspective that the reader brings to the text. For example, a reader who is interested in bicycling would likely approach an article on how to efficiently change gears while bicycling with interest. The reader would fill in the gaps of their knowledge of bicycling and gear shifting with the information provided in the article. A text does not need to be on the exact topic of interest to the reader in order to be interesting. The same reader would also approach an article on how race car drivers change gears with keen interest because the reader would apply the knowledge to bicycling. The reader's interest would activate the related idea of bicycle gear shifting and the reader would evaluate relevance based on its applicability to bicycling. However, information is relevant to the self based on the reader's current knowledge and goals. If the reader is a gear shifting guru or owns a one-gear bicycle, the information will not be viewed as useful or important. Therefore, although individuals

certainly have individual interests, the extent that the situation matches the individual's goals and abilities determines the level of interest in a particular situation or stimulus, which elicits the emotions and level of attention that may influence reading comprehension.

While many topics are of interest to only particular individuals, there are some topics that are generally of interest to most people (Schank, 1979). Shank (1979) provides several examples of concepts of absolute interest including: noise, death/harm/danger, sex, romance, destruction, and inappropriate behavior, such as private behavior in a public place. This is not an exhaustive list, but provides an idea of topics that are of absolute interest. Thus, including a concept that is of interest to most people is a means of tapping into the reader's individual interest. However, even these topics are mostly interesting within context. Contexts that make the concepts more interesting are those that include unusual descriptions, unexpected events, and personal relatedness (Schank, 1979). For example, a passage about a death is more interesting if the death is unusual, unexpected, or personally significant- such as the death of a friend at a young age by drinking too much water- in contrast to a death that is common, expected, and not personally relevant- such as the death of an unknown elderly person by a long-standing disease. In addition, if there are competing interests in a text, the individual will attend to the information that is more interesting (Schank, 1979), which is also tied to the context. In fact, topics that are not necessarily of absolute interest become quite interesting based on the context. Therefore, including topics that are of interest to most people is a means of potentially triggering interest, but

the context and individual factors that a person brings to the situation will determine whether situational interest arises.

### **Structural Text-Based Interest**

As previously mentioned, Schank (1979) indicated that there are particular concepts that tend to arouse interest, but that the interest is particularly aroused if the context is unusual, unexpected, or personally relevant. Other researchers have indicated that characteristics of texts that are more interesting include unexpectedness, descriptiveness, and coherence (Kintsch, 1980; McDaniel et al., 2000; Wade et al., 1999). Finally, based on a review of literature, Silvia (2006) found that theories converge on what is interesting: complexity, novelty, uncertainty, and conflict. According to Silvia, people appraise events in terms of the event's complexity, novelty, etc., and relevance to a goal, as well as appraise their ability to cope with the event. Information is interesting when it is not immediately understood, but it is understandable. Characteristics of a text can affect both the appraisal of novelty as well as the appraisal of the reader's ability to cope with the new information. While the unexpectedness arouses conflict, the coherence provides a support for coping with the information. This proposal is supported by evidence that interest increases as a function of surprise particularly if the story has a resolved ending (Iran-Nejad, 1987). In this study, Iran-Nejad found that the degree of surprise significantly affected interest ratings for stories with resolved endings but not for stories with unresolved endings. Therefore, unexpectedness is a useful means of increasing interest, if the text provides information for the reader to resolve the conflict that led to unexpectedness.

One means of increasing unexpectedness in a text is by manipulating its causal structure. Causal text constraint is a means of providing varying levels of relevant

information so that the extent that the reader can expect a particular outcome, and therefore generate a predictive inference would also vary (Cook, Limber, & O'Brien, 2001; Klin, Guzman, & Levine, 1999; Linderholm, 2002). Inferences are generated based on the context immediately preceding the inference combined with information from earlier parts of the text (Gueraud, Tapiero, & O'Brien, 2008). Gueraud et al. (2008) found that readers made different inferences to the same inference-inducing statement based on earlier contexts. Texts are highly predictable when there are few alternative consequences possible and inferences are readily available based on general knowledge and constrained by the context of the text (Fincher-Kiefer, 1996). Therefore, texts are more unexpected when there are multiple alternative consequences and the context does not have a high level of causal text constraint.

Texts that are explicit have low unexpectedness and do not require a predictive inference because the outcome is mentioned prior to the occurrence. Highly constrained texts are somewhat unexpected because a particular outcome is highly probable but the reader must make the inference. Lower constrained texts lead to either no particular outcome or multiple, therefore have the greatest amount of unexpectedness, because the correct outcome is more difficult to predict. For example, having a low level of constraint so that a singular predictive inference cannot be made would make an outcome more unexpected.

There have been several studies on causal constraint and the effects of such constraint on readers' ability to generate an inference. Research using causal constraint has shown that inferences are more likely to be generated, and generated faster, with text versions than constrain the text to be explicit or highly constrained versus text

versions that imply multiple possible outcomes (Klin, Murray, Levine, & Guzman, 1999; Murray, Klin, & Myers, 1993). In addition, texts with varying levels of causal constraint have also distinguished predictive inference generation abilities for readers of at varying working memory capacity levels (Linderholm, 2002). Readers with high working memory capacity, but not readers with low working memory capacity, were able to correctly predict the target word when texts had a high level of constraint and read sentences that confirmed the target prediction faster for high texts with a high level of constraint relative to a low or moderate level of constraint. Readers with low working memory capacity did not benefit as much from texts with a high level of causal constraint. However, both readers with low and high working memory capacity read high constraint texts faster when the target prediction was confirmed compared to when it was contradicted. These results indicate that while readers with low working memory may reap some benefit from high constraint texts in terms of reading efficiency, readers with high working memory capacity are able to obtain more benefit from reading high constraint texts both in terms of reading efficiency as well as ability to generate predictive inferences.

An alternative explanation for these findings is that predictive inference generation was different based on other text manipulations than just level of causal constraint. When the passages are manipulated to create different versions for explicit, implicit, high constraint, low constraint, or control, the versions often differ not only in terms of their level of constraint but also in the extent that the outcome is interesting in terms of unexpectedness or the use of a concept of absolute interest. Often the high constraint versions of the texts included a concept of absolute interest whereas the low

constraint versions of the text did not include a concept of absolute interest. For example, in a story of a disgruntled waitress, events or the characteristics of the waitress lead to distinctly different outcomes of dumping the spaghetti on the customer in the high constraint texts or leaving to dump the spaghetti in the trash or get a fresh plate in the low constraint texts (Gueraud et al., 2008; Klin, Guzman et al., 1999; Murray & Burke, 2003). The first outcome is rather violent and therefore includes a concept of absolute interest whereas the second outcome is neither violent nor includes any other concept of absolute interest. In another example, a husband struggling with temper issues either throws a vase against the wall (the high constraint version) which will likely prompt his wife to leave, or he leaves and gets some milk (the low constraint version) (Weingartner, Guzman, Levine, & Klin, 2003). In this example both violence and romance are in one version and neither is really present in the control version. Therefore, while the researchers were studying the use of constraint on predictive inference generation, the stories were usually not equivalent in terms of absolute interest.

An additional course of study using causal constraint is contradicting a predictive inference that is strongly anticipated by the text, and is therefore highly constrained by the text. While several studies describe text versions in terms of consistent versus inconsistent (Estevez & Calvo, 2000; Klin, Murray et al., 1999; Murray & Burke, 2003), most studies do not consider the concept that inconsistent texts, if resolved at the end, are also more interesting due to unexpectedness. However, if predictive inference models used both the concept of constraint as well as interest in predicting readers' ability to generate inferences and learn from the text, a more complex model may be

developed. Including the concept of interest in inference models may be important partially because predictive inferences seem to be held in working memory even with sentences intervening between the prediction-inducing phrase and the resolution (Fincher-Kiefer, 1996; Klin, Guzman et al., 1999). Generating predictive inferences that are not immediately confirmed or contradicted may leave readers in a state of anticipation (if they are able to maintain the inference in working memory), while the inability to make a predictive inference due to multiple potential outcomes may lead to a sense of unexpectedness; both anticipation and unexpectedness are related to interest.

Although both decreasing causal constraint and providing contradictions to highly constrained information are likely to increase interest, the current study will focus on simply decreasing the constraint of the text to increase interest. Lower levels of causal constraint leading to the text being more unexpected may be why readers find implicit versions of a story more interesting than explicit versions (Campion, Martins, & Wilhelm, 2009; Kim, 1999), supporting the idea that lowering text constraint is a means of increasing the unexpectedness in a text.

Kim (1999) investigated the relationship between inference generation and text-based interest using implicit and explicit versions of the same story. Implicit versions, requiring the reader to make more bridging inferences, were rated more interesting than explicit versions of the same story except when inference generation was prevented by presenting the stories at a rate that is too fast to make inferences. The conclusion drawn is that perceiving a text as interesting is influenced by the extent the reader draws inferences. This is also supported by the results of Campion et al. (2009) who found that interest ratings were higher when texts elicited a predictive inference. In

addition to using texts that elicited predictive inferences, texts were manipulated to either be consistent, inconsistent or neutral (Campion et al., 2009). The researchers found that interest was higher for inconsistent texts compared to consistent or neutral texts.

An additional relation that is possible between interest and inference generation is based on the theory that readers will make inferences that lead to more interesting outcomes (Schank, 1979). This may be of particular concern when texts have low constraint and therefore lead to multiple potential outcomes. According to Schank (1979) readers are more likely to think about and infer the more interesting outcome. For the current study, inference generation will be treated as a dependent variable with the prediction that texts that include concepts of absolute interest will lead to greater comprehension including inference generation. The current study will attempt to trigger interest in narrative stories using text-factors related to content interest in the form of concepts to absolute interest (Schank, 1979) and text-factors related to structural interest in the form of unexpectedness (McDaniel et al., 2000; Schank, 1979; Wade et al., 1999); all texts will be coherent. These forms of text manipulations are expected to trigger situational interest and lead to positive learning outcomes.

### **Interest and Learning**

Interest is associated with a variety of positive learning outcomes including higher recall at both the sentence level (Shirey & Reynolds, 1988) and for passages (Wade et al., 1999), increased reading comprehension (Ainley, Hidi et al., 2002; Bray & Barron, 2003-2004; Schiefele, 1999), and more predictive inferences (Lin et al., 1997). These studies indicate that interest is associated with learning from the text at various levels. Schiefele (1996) suggests that readers may be particularly aided by interest in

terms of deep learning such as text representation and meaning processing; readers generated stronger propositional representations when the text was interesting.

Research on interest and learning outcomes have measured interest and learning outcomes in a variety of ways. Interest defined by topic preference, text manipulations, and post-reading interest ratings have all been associated with positive learning outcomes, particularly reading comprehension and recall. However, there is some evidence that situational interest is more strongly related to learning outcomes than personal interest (Ainley, Hidi et al., 2002; Flowerday, Schraw, & Stevens, 2004; Lin et al., 1997; Schiefele, 1999). Schiefele (1999) conducted a meta-analysis of studies researching interest and comprehension and found that both individual and situational interest influence learning. Comparative statistics between the two types of interest were not provided, but the results indicate that the relation between situational interest and reading comprehension is the same, if not greater, than the relation between individual interest and reading comprehension. For example, the relation between situational interest and reading comprehension had an average correlation of .33 and the average correlation between individual interest and reading comprehension was .27.

A few other studies that compared the relation between individual and situational forms of interest with reading comprehension indicate a trend toward situational interest facilitating reading comprehension more than individual interest. For example, situational interest based on readers' interest ratings after reading the text was related to higher quality essays in response to the text, but individual interest based on expected interest based on titles was not related to higher quality essays (Flowerday et al., 2004). Lin et al. (1997) found a small but positive and significant relationship

between situational interest and reading comprehension, but no relationship between topic interest and reading comprehension. Specifically, Lin et al. (1997) found that situational interest, measured as ratings after reading the text, predicted readers' ability to answer inference questions after reading. In a study using different measures of interest, Ainley, Hidi, et al. (2002) found that persistence was a better predictor of reading comprehension than topic interest or expected interest, based on readers' evaluating the passage title. In the studies by Ainley and colleagues, persistence is an indirect measure of situational interest because it indicates that readers were interested at the time of reading or during the situation of reading. In contrast, expected interest based on the topic is a measure of individual interest because the expectation is based on being interested in similar texts. In summary, both situational and individual interest are associated with facilitating reading comprehension, with some evidence suggesting a trend toward situational interest having a stronger relationship with reading comprehension.

In addition to specific learning outcomes, there is evidence that interesting texts facilitate reading processes that enable comprehension. Readers of interesting texts read faster (Shirey & Reynolds, 1988), have increased reading efficiency (Miller, Cohen, & Wingfield, 2006), attend a second stimulus faster (McDaniel et al., 2000; Shirey & Reynolds, 1988), and have fewer off task thoughts (Smallwood, Nind, & O'Connor, 2009) than readers of less interesting texts. These studies indicate that interest is involved in helping readers maintain attention on the text, which may support the theory that attention may be automatically allocated to content that is interesting (Hidi, 2001). Similarly, Schiefele (1999) proposed that the positive relation between interest and

learning is that interest decreases the amount of volitional control needed to engage with the material that would normally draw on attentional resources and interfere with learning. If attention is automatically allocated when the learner is interested, then the attentional resources can be committed to other processes (McDaniel et al., 2000). The availability of attentional resources during reading may be particularly beneficial for readers who have fewer attentional resources to allocate, such as those with low working memory capacity.

The relation between interest and comprehension may be affected by factors within the individual such as prior knowledge (Durik & Matarazzo, 2009; Schiefele & Krapp, 1996; Smallwood et al., 2009) and gender (Ainley, Hillman, & Hidi, 2002; Naceur & Schiefele, 2005; Stevens, 1980). Although attention has been theoretically linked to interest (Dewey, 1913; Hidi & Renninger, 2006), few studies have investigated the relation between interest and working memory capacity, which limits the amount of attention and mental resources a learner can allocate to a task. However, working memory capacity is just one of many individual factors that may interact with interest to affect learning from a text.

### **Individual Factors and Interest**

The most common individual factors that have been studied in conjunction with interest and learning are prior knowledge and sex (Schiefele, 1999). In addition to these factors, working memory capacity should also be considered an individual factor that may influence the effect of interest on learning.

Although it may seem that prior knowledge and topic interest would be strongly related, researchers have found that interest and prior knowledge are not correlated (Schiefele, 1996; Smallwood et al., 2009). However, Durik and Matarazzo (2009) found

that while high domain interest was associated with a full range of prior knowledge, low interest was never associated with high prior knowledge. Therefore, while prior knowledge is not necessary for someone to have interest in the topic, learners may need to have some level of interest in order to seek and attain higher level of knowledge in a topic. Furthermore, as mentioned previously, the absolute knowledge in the domain of the text is not as important as the extent of prior knowledge relative to the information provided. In this way, prior knowledge is important in terms of having just enough knowledge to find the information useful or meaningful, but not having so much knowledge that the information overlaps with what is already known (Kintsch, 1980). In addition, prior knowledge may be relevant to a reader's interest in an expository text, but less important to a reader's interest in a narrative story.

Similar to the debate regarding whether prior knowledge affects the relation between interest and comprehension, gender has also been considered as an individual variable that may affect the relation. Several studies have found that interest affects learning outcomes for boys more than girls (Asher & Markell, 1974; Baldwin, Peleg-Bruckner, & McClintock, 1985; Oakhill & Petrides, 2007; Stevens, 1980). However, Schiefele (1999) found that there was no interaction between gender and interest on reading comprehension. Importantly, all of the studies that have found a difference in the effect of interest on learning have used topic interest as the predicting variable. The reason that topic interest may not predict reading comprehension for girls is because girls tend to rate topics higher in general (Ainley, Hillman et al., 2002) therefore, the degree of variability may not be sufficient for interest to be an adequate predictor for girls. These studies consistently found that both genders perform similarly when the

texts are of high interest, but males perform worse when texts are of low interest.

However, if the level of interest is varied by manipulating the causal structure of the text and using concepts interesting to people in general rather than self-report, then the level of variability is likely to be equal across gender.

The final individual factor of concern is working memory capacity. One reason that working memory capacity may influence a reader's perception of a text as interesting or influence a reader's ability to benefit from interesting texts is that not all readers may successfully generate the elaborative or predictive inference that would enable resolving coherence when the text is ambiguous or the prediction is not consistent with the text's conclusion; readers with lower working memory capacities have particular difficulty in such instances (Daneman & Carpenter, 1983). For this reason, readers with lower working memory capacity may find texts that have low causal constraint to be incoherent, and therefore uninteresting.

Unfortunately, there has been very little research using this individual factor in relation to interest. A notable exception is a study that found that working memory is not related to interest ratings (Miller et al., 2006). Miller and colleagues (2006) had participants in various age groups read texts with or without a title then rate the texts on interest and enjoyment and recall as much as they could. The ratings of interest and enjoyment were then combined into a single interest factor. Within each age group, participants were identified as having either low or high working memory capacity using a median split on scores from the loaded sentence span task (a form of the reading span task). While working memory capacity was related to reading efficiency and recall, it was not related to interest (Miller et al., 2006). Instead, interest was related to the

presence of a title which provided contextual knowledge. Interest was related to reading efficiency even after controlling for contextual knowledge (presence of title), working memory capacity, and age.

For the current study, concepts of absolute interest, a form of a content text-factor, and unexpectedness, a form of a structural text factor, will be used to trigger situational interest. Both forms of text-based interest are expected to independently and combined contribute to increases in recall and reading comprehension. However, situational interest arises not simply based on the situation presented but based on how the situation matches with the individual's goals and abilities. Because interest and attention are so closely aligned (Dewey, 1913), the effect of text-based interest factors on situational interest and reading comprehension is predicted to be influenced by the level of readers' working memory capacity which is a significant determinant in the amount of available attentional resources (e.g., Engle, 2002). Therefore, a discussion of working memory capacity and its relation to reading comprehension will follow.

### **Working Memory Capacity**

Working memory involves processes of controlled attention that could be used to suppress irrelevant information while maintaining focus on information that is relevant. Working memory includes both a storage component limited by short term memory capacity as well as a processing component used for retrieving or activating information and maintaining focus (Daneman & Merikle, 1996; Engle, 2002). Because there are few individual differences in adults' storage capacity, individual differences in working memory may be primarily due to individual differences in the processing component. Engle (2002) proposes that individual differences in working memory are primarily due to an individual's capacity for controlling attention.

While interest engages and connects the reader to the content of the text, potentially automatically allocating attention to specific topics (Hidi, 1990), working memory allows readers to selectively allocate attention to multiple pieces of information. Specifically, individual differences in working memory capacity may reflect the ability to attend to and focus on aspects of the task that are relevant and important (Engle, 2010). The amount of information that can be attended and manipulated at a given time is also constrained by working memory capacity. Working memory capacity, like interest, is related to attention, so it is not surprising that working memory capacity is associated with increases in learning factors, including reading comprehension (Daneman & Carpenter, 1980; Just & Carpenter, 1992). However, there is debate regarding whether individuals' working memory capacity, and the effect on learning, varies depending on the domain.

### **Domain Specificity of Working Memory**

Although some researchers support the view that working memory capacity is domain specific (Daneman & Carpenter, 1980; Just & Carpenter, 1992), the current study will be based on the theoretical perspective that attention, maintenance, and inhibition are not domain specific but domain general (Engle, 2002). This view is supported by research indicating that tasks that require attention, maintenance, and inhibition predict performance on other tasks that require these processes even if they are not in the same domain. For example, maintaining a word after reading a sentence (reading span), maintaining a word after performing a math problem (operation span), and maintaining a list of digits while counting targets and ignoring distracters (counting span), all predict similar outcomes on cognitive tasks such as reading and listening comprehension, reasoning, and following directions (Engle, 2002).

In order to better understand the extent that working memory capacity is domain specific or domain general, Engle et al. (1992) conducted a series of studies to test the relationship between working memory capacity and reading comprehension. If working memory capacity is domain specific then reading span would predict reading comprehension and recall better than operation span because the former measures the ability to maintain words or letters after reading a sentence, whereas operation span measures the ability to maintain a word or letter after performing a math problem. Reading span involves a measure that is of the same domain as the predicted variable, reading comprehension or recall whereas operation span does not have an overlapping domain of reading.

The researchers found that working memory capacity measured by the operation span task, requiring participants to perform mathematical operations and remember a word, predicted reading comprehension and that the correlation was not significantly different from the correlation with reading span (operation span and reading comprehension,  $r = .34$ ; reading span and reading comprehension,  $r = .40$ ). The researchers concluded that individuals differ in their capacity to actively attend information and their ability to control attention and that both reading span and operation span are able to measure these differences.

For this study, working memory capacity will be understood in terms of the ability to control attention and maintain information in an active, quickly retrievable state as described by Engle (2002). Both the operation span task and the reading span require attention shifting, but the operation span task is based on the conceptualization of working memory capacity as non-task specific (Cantor & Engle, 1993). In addition,

although the operation span task predicts comprehension and verbal SAT scores, it is not dependent on reading ability, therefore the variance explained by operation span task is more specific to the ability to control and maintain attention rather than including general reading skills as well. When working memory is measured as reading span to predict reading comprehension, the predictive variable shares many operations as the predicted variable potentially inflating correlations (Waters & Caplan, 1996). Therefore, the operation span task is more appropriate due to theoretical perspective of working memory capacity as domain general. Whether measured using domain specific or domain general tasks, working memory capacity predicts reading comprehension as well as a variety of tasks involved in reading.

### **Working Memory and Reading Comprehension**

There are a variety of ways that working memory capacity affects reading comprehension. Relative to low working memory capacity readers, high working memory capacity readers tend to have higher levels of recall (Daneman & Carpenter, 1980; Di Vesta & Di Cintio, 1997; Miller et al., 2006) and their errors tend to indicate a higher level of understanding (Daneman & Carpenter, 1980). One reason for the increased recall is that readers who have a higher working memory capacity are more effective at using contextual information such as prior knowledge (Kaakinen, Hyönä, & Keenan, 2003) and reading purpose (Linderholm & van den Broek, 2002). Using reading purpose or perspective when reading facilitates global coherence because the purpose or perspective provides a framework for understanding the text; therefore readers who are not effective in using reading purpose are at a disadvantage when attempting to understand the text at a global level. This is supported by research that found differences in readers' ability to comprehend texts at a global level based on the

readers' working memory capacity (Whitney, Ritchie, & Clark, 1991). The researchers found that low working memory readers tend to make specific elaborations to connect sentences at the expense of keeping multiple interpretations in mind to create a more accurate text representation, while readers with higher working memory tend to have better reading comprehension at the global level (Whitney et al., 1991).

An additional reason that readers with higher working memory capacity tend to have better recall particularly at a global level may be related to their ability to generate inferences. Readers with higher working memory capacity make more global inferences (Trabasso & Suh, 1993) as well as more predictive inferences (Calvo, 2001; Linderholm & van den Broek, 2002). Although readers with lower working memory capacities can make predictive inferences, readers with higher working memory capacities are more efficient and take less time to generate those inferences (Estevez & Calvo, 2000; Linderholm, 2002). Just and Carpenter (1992) suggest that processes such as inferences slow down as demands on working memory capacity approach their upper limit. Because readers with lower levels of working memory capacity reach their upper limit before readers with higher levels of working memory capacity, readers with lower levels of working memory capacity struggle to generate predictive inferences.

The extent to which readers are able to comprehend a text including generating inferences while reading is related to individual factors, such as working memory capacity, and text-based factors. The likelihood of making predictive inferences, particularly due to causal constraint is important in this study because causal constraint also acts as a means of making a text unexpected, and therefore, more interesting.

## Hypotheses

In summary, the current study has two goals: 1) investigate how text-based factors and individual factors lead to situational interest in narrative stories and 2) examine how each of these factors, in terms of absolute concepts, text constraint, and working memory capacity, influence learning outcomes. The learning outcomes that will be measured are inference generation, responses to open ended questions, and recall of text units. Inference generation is indicative of creating a situation model (Cook et al., 2001; Graesser, Singer, & Trabasso, 1994) and interest may be more associated with deep rather than surface level learning (Naceur & Schiefele, 2005; Schiefele, 1999).

One of the primary goals of the study is to better understand how text-based factors and individual factors interact to arouse situational interest in a text. The first hypothesis is that concepts of absolute interest, causal text constraint, and working memory capacity will affect situational interest, measured by interest ratings conducted immediately after reading the text. Specifically, the inclusion of absolute interest and lower levels of causal constraint are each expected to increase interest ratings. In addition, readers with low working memory capacity may rate low constraint texts less interesting because they are less able to generate predictive inferences and resolve unexpectedness (which would increase with low causal constraint). However, this effect is expected to be present specifically for texts without a concept of absolute interest because absolute interest is expected to help readers allocate attention which may enable them to understand the text, a necessary component for finding the text interesting.

Because interest predicts reading comprehension (Ainley, Hidi et al., 2002; Schiefele, 1999) and previous studies tended to measure interest in terms of either

content or structural text-based factors, the second hypothesis is that each type of text-based interest, concepts of absolute interest and unexpectedness from low causal text constraint, are predicted to be related to better inference generation, reading comprehension, and recall than passages that have neither a concept of absolute interest nor a low level of constraint. Texts that are explicit, that is, they do not lead to any inference may be considered interesting solely based on their inclusion of concepts of absolute interest. Texts that have no concepts of absolute interest may be considered interesting based solely on whether they have lower levels of causal text constraint. Therefore, texts that have either a concept of interest or a lower level of constraint, or both, are expected to be related to better learning outcomes.

Finally, the third hypothesis is that the two forms of text-based interest manipulations will interact with working memory capacity to influence comprehension. This may be regarded as a more complete model of situational interest, measured by both text and individual factors, influencing comprehension. A reason for this interaction involves the potential of interest to automatically allocate attentional resources (Hidi, 1990). Shank (1979) proposes that interest specifically facilitates inference generation. If these theories are correct, then readers will generate more inferences when reading texts with concepts of absolute interest. Particularly, readers with lower working memory capacity, who normally struggle to generate inferences, may experience a boost in attentional resources which would facilitate inference generation when the text is interesting. Therefore, absolute interest, causal text constraint, and working memory capacity are expected to interact to predict learning outcomes of inference generation, comprehension, and recall such that as absolute interest concept is included, working

memory capacity will not interact with causal text constraint to predict comprehension. The presence of absolute interest may allow readers with lower working memory capacity to have enough attentional resources to construct a coherent understanding of the text when the causal text constraint is low so that they do not significantly differ in comprehension and inference generation from readers with higher working memory capacity. Therefore, when texts include a concept of absolute interest, working memory capacity is expected to not significantly influence comprehension. When a text does not include a concept of absolute interest, the text is not be as interesting and readers will not have as significant a boost in attentional resources and may find the low constraint texts to be incoherent. Thus, low working memory capacity readers will be less likely to make inferences and comprehend well when the combination of no absolute interest and low causal constraint exists in a text.

To test these hypotheses, participants will be asked to take a working memory capacity test and read a series of narrative texts that vary in terms of whether they include a concept of absolute interest and the level of unexpectedness (causal constraint). Working memory capacity and text manipulations are the independent variables whereas interest ratings and comprehension, measured by combining recall and responses to open questions, inference generation are the dependent variables. A repeated measures analysis of variance was conducted for each dependent variable.

## CHAPTER 2 METHOD

### **Participants**

One hundred thirty-nine undergraduate students volunteered to participate in the study, drawn from educational psychology courses. The data of participants who did not complete both parts of the study, whose error rates were higher than 15% on the working memory task (Unsworth et al., 2005), or whose data was not usable due to technical errors were removed. 42 participants (30%) were not included due to technical errors. Most of these errors were alleviated when participants were provided the use of computers with the working memory task program already installed. 34 (24%) participants were removed because their error rate was more than 15%. 3 (2%) participants were excluded due to other errors such as technical problems with the reading task. As a result, 60 participants' data was used. Participants were not paid, but could use the participation toward a class research requirement.

### **Materials and Procedure**

Participants completed a working memory task, completed a short demographic survey, and then read a series of narrative texts that were manipulated in terms of the degree of interest they evoked. During each story, participants made a predictive inference using a one-word response. The story then resumed with the conclusion. Participants rated how interested they were in the story and indicated the most interesting aspect of the story. Finally, participants recalled what they could from the story and answered open-ended comprehension questions about the story. In the following paragraphs, each step in the procedure and the corresponding materials are described.

The entire procedure was completed on a computer. Originally participants were able to use their own computers; however, due to several technical difficulties, the procedure was slightly modified to require participants to use university computers that already had the appropriate software program available. This standardization reduced technical errors significantly; however, the study was never completed in a controlled lab.

### **Working Memory Capacity Task**

Working memory capacity was measured using an operation span task (Turner & Engle, 1989). The operation span task is a more valid and reliable measure than reading span, a commonly used measure of working memory capacity in reading studies, because it does not overlap as much with the predicted variables of recall and reading comprehension (Conway et al., 2005; Waters & Caplan, 1996). This is because the reading span task overlaps with reading outcome tasks such as reading comprehension so that the sentence processing component has predictive value in addition to the capacity of working memory (Waters & Caplan, 1996). Therefore the operation span task was used because it does not overlap have overlapping components with the predicted variables except in terms of limitations in attention control that affect both the operation span task and learning tasks.

The operation span task was conducted using a computer program based on the automated operation span (Unsworth, N., Heitz, Schrock, & Engle, 2005). The automated operation span task allows participants to perform the entire task on a computer, using a mouse, and automatically calculates the operation span score in contrast to the more classic operation span task that required more intervention from the experimenter and manual calculation of the score. The operation span task involves

completing a mathematical equation with a simple multiplication or division problem followed by a simple addition or subtraction problem on one side of an equation followed by a question mark on the other side of the equation. The following screen then displays a single digit which correctly solves the problem in half of the trials. For example  $(1*2) + 1 = 3$  is correct and  $(1*2) + 1 = 2$  is incorrect. This processing component is then followed by a to-be-remembered letter. Therefore, an example trial would be a screen with  $(1*2) + 1 = ?$ . Participants are instructed to solve the problem as quickly as possible then advance to the next screen where a single digit displays. Participants then advance to a screen with True and False boxes by clicking the mouse. After selecting a response, the to-be remembered letter is shown. After 1000 ms, the next math problem would appear. Set sizes ranged from three to seven randomly, with three trials of each set size, for a total of 75 math problems and 75 letters. After each set, participants are shown a 4x3 matrix of letters. Recall consists of clicking the box next to the appropriate letters in the order presented during the trials. The score is the number of correct items recalled in the correct position. Participants were excluded if a certain level of processing accuracy, 85% correct, was not maintained as an indication that the participant was not putting forth a minimal amount of effort (Unsworth, N. et al., 2005). There is a practice session to familiarize participants with each task individually as well as combined and to estimate the amount of time the individual requires to solve a problem. In order to better understand differences between readers who have lower levels of working memory capacity as compared to readers at a higher level of working memory capacity, participants were divided into three groups using a tertiary split based on their score.

## **Demographics**

A short section of questions was used to understand the general demographics of the sample of participants. Participants indicated their age, sex, number of years of post-secondary education, and average number of hours per week that they spend reading.

## **Texts**

Text-based interest was varied by manipulating whether the text included a concept of absolute interest and the degree of unexpectedness based on degree of causal constraint (Schank, 1979). A set of texts from both previous investigations of predictive inferences and causal constraint (Klin, Murray et al., 1999) were used. The texts were revised so that they were varied by level of causal text constraint and inclusion of a concept of absolute interest such that a single text has six versions: the two levels of absolute interest (absolute interest, no absolute interest) each were varied by level of constraint (explicit, high constraint, low constraint). Level of causal text constraint refers to how likely a text leads to an inference. In the case of this study, the inference can be summarized by a single target word. Levels of constraint were operationalized as follows: explicit versions will include the target inference word in the second to last sentence or clause, high constraint texts will provide information that leads to only the target inference word, but does not include the target word, and low constraint texts will lead to the target inference word and an additional outcome. As such, each text was varied in terms of degree of anticipated interest in terms of absolute interest and unexpectedness. For example, the version that has neither a concept of absolute interest and is explicit is expected to be the least interesting version overall

whereas the version with a concept of absolute interest and a low level of causal constraint is expected to be the most interesting.

Participants read one of each text type: explicit/absolute interest, explicit/no absolute interest, high constraint/absolute interest, high constraint/no absolute interest, low constraint/absolute interest, and low constraint/no absolute interest. The stories were presented such that the two explicit versions were presented first, but counterbalanced for the inclusion of absolute interest. These versions acted as a baseline for participants' interest in the concepts of absolute interest. The final four versions were counterbalanced so that each version was presented an equal number of times in each position. Counterbalancing is used to mitigate potential order effects, such as fatigue (Girden, 1992).

All texts are locally coherent and provide a resolution, sometimes only after the text break where the reader was asked what will happen next, as in the cases of the high and low constraint texts. The original texts, used by Klin and Murray et al. (1999) were distinguished as low constraint, high constraint, and control. For this study, the control was changed to an explicit version. In addition, the control texts often led to a different outcome, for example a plane landing versus a plane crashing. These differences also reflect a difference in the inclusion of a concept of absolute interest: crashes are more interesting than landings. However, to fully investigate the influence of absolute interest, two storylines were developed using similar words. In one story, a concept of absolute interest is included in the context whereas the other version does not include a concept of absolute interest. Each of these storylines is then modified to vary the level of constraint. The texts used for the current study all lead to an inference

that can be summarized by the same word, though the actual inference is still different because of the context, for example a passenger plane versus a toy plane crashing. Therefore, while the original texts were used as a starting point, significant modifications were made, particularly for the versions that do not include a concept of absolute interest.

One of the purposes of the study was to learn how studies of causal constraint might be qualified if we manipulated the interest content in the stories. Thus, a series of stories were available to choose from that were examined in previous research pertaining to causality (Klin, Murray et al., 1999; Linderholm, 2002; Weingartner et al., 2003). Upon review of the stories, three concepts of absolute interest were apparent: violence, romance, and death. Thus, I chose to focus on those three.

The following is an example of the possible text manipulations. In this case the absolute concept of interest is violence, in the form of dumping spaghetti on a man's head. At the asterisk, participants were asked to predict what occurs next.

**Story Example: Concept: Violence; Target Word: Dump (in Trash; on Person)**

**No absolute interest and explicit.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As she became more upset, the man suddenly apologized. He had already eaten a bite, so she would have to dump the rest. Carol glanced at the trash can and lifted up the plate of spaghetti. \* Carol then dumped the rest in the trash.

**No absolute interest and high constraint.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager

had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As she became more upset, the man suddenly apologized. He had already taken a bite, so she couldn't return it to the kitchen. Carol glanced at the trash can and lifted up the plate of spaghetti. \* Carol then dumped the rest in the trash.

**No absolute interest and low constraint.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As she became more upset, the man suddenly apologized. He had already taken a bite, so she couldn't return it to the kitchen. Carol glanced at the trash can but heard her stomach growl as she lifted up the plate of spaghetti. \* Carol then dumped the rest in the trash.

**Absolute interest and explicit.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As he became louder and nastier, she lost control. He had already eaten half, so Carol knew he lied. She decided she should dump it on the man's head to truly reveal its temperature. Angrily, she lifted up the plate of spaghetti. \* Carol then dumped the spaghetti on the customer's head.

**Absolute interest and high constraint.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As he became

louder and nastier, she lost control. He had already eaten half, so Carol knew he lied. She wasn't thinking of the consequences when she lifted up the plate of spaghetti. \* Carol then dumped the spaghetti on the customer's head.

**Absolute interest and low constraint.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As he became louder and nastier, she lost control. He had already eaten half, so Carol knew he lied. She heard her stomach growl as she angrily lifted up the plate of spaghetti. \* Carol then dumped the spaghetti on the customer's head.

### **Predictive Inferences**

Participants were prompted to use one word to summarize what they thought would happen next. Participants were able to either provide a one-word response or indicate that they were unsure of the outcome. Participants' choices were matched to pre-defined target words to determine if they made an appropriate predictive inference. This method of measuring predictive inference generation is similar to that used by Linderholm (2002) in a study of predictive inferences. In part of that study, participants generated one or two words that depicted what would happen next before reading the last sentence. Similarly, breaking the text and asking participants what happens next in general has also been used in other research (van den Broek, Linzie, Fletcher, & Marsolek, 2000), however, for the current study, the participant was asked to reply with a single word rather than full sentence continuations. In the Klin et al. (2002) study from which the materials are derived, participants were presented with the word as a target and reading time of the target was measured. This method is not being used because

participants' vocalizations cannot be measured using an online method. However, the target words have not been modified from the original texts. Full credit was provided for responses that are synonyms of the target word. Partial credit was provided for related responses. Words that are synonyms and related were verified using an on-line thesaurus ([Merriam-webster.com/thesaurus](http://Merriam-webster.com/thesaurus)).

### **Interest Ratings**

Interest ratings were used to gauge the success of the text manipulations. Participants rated their level of interest and whether they would like to read more of the story using two 7-point likert scales ranging from "Not at all" to "Very much".

- How interesting did you find the above story?
- How much would you like to continue reading the above story?

These two scales are based on interest measures such as that used by Lin et al. (1997) who had participants rate on a scale of 1-7 the level of interestingness of each story and the concept that persistence, in terms of wanting to continue reading, is a measure of situational interest (Ainley, Hidi et al., 2002). In addition to the two interest ratings, participants indicated what part of the story was most interesting in order to check that the text-based manipulations, particularly the inclusion of the concept of absolute interest, was the reasons for differences in interest ratings.

### **Recall**

After completing the interest rating, participants were asked to write a summary of the story using as many details as possible in their own words. Participants were told that they may use as much time as necessary but a computerized message prompted them if they did not include enough detail in their recall. Passages are approximately 350-550 characters long (approximately 80-100 words), so participants were prompted

if they wrote less than 100 characters including spaces. One point was given for each correctly recalled idea unit. An idea unit was considered a subject-verb clause and the participant was given a point if the recalled clause is the same or has the same meaning as a clause in the original passage (van den Broek, Lorch, Linderholm, & Gustafson, 2001). Each passage was divided into idea units by two researchers and differences were resolved with discussion. This method of scoring recall is similar to that used by other researchers of reading and interest. In addition, 10% of the participants' responses were coded by two independent researchers. Interrater reliability was 95.6% and differences were resolved by discussion. The remaining recall responses were coded by the primary researcher, however the secondary researcher was consulted if there was ambiguity.

Each passage contains approximately 12-16 idea units; the difference in number of idea units for a single story across versions was minimized. However, the recall score was the proportion of correctly recalled idea units relative to the total number of idea units for that version.

### **Open Answer**

In addition, participants were asked to respond to three open ended questions about the story. These questions asked about characters' goals, emotions or mental states, therefore were designed to provide a measure of deeper comprehension. Because the stories often differed in terms of characters' goals and emotions between versions, the pre-defined answers sometimes differed between versions. Again, two researchers determined the pre-defined answers and differences were resolved with discussion. However, due to the unexpected nature of many of participants' responses, an answer was coded as correct if it has the same gist as the pre-determined answer or

showed comprehension of the story, partial credit was given when the response was partially correct. The gist of the story was agreed upon by two researchers including an expert in reading research. For the example above, questions and pre-defined answers were:

- Why was Carol angry? (a customer complained)
- How satisfied is Carol with her job? (she's fed up with her job)
- Is Carol good at controlling her emotions? (yes if she walks away, no if dumps)

The answer to the third question for this story was essentially eliminated because participants responded that Carol was not in control of her emotions when she walked away because she allowed the customer to see her upset. Therefore, participants could have answered "yes" or "no" reasonably in the scenario that she walks away, but only "no" in the scenario that she dumps spaghetti on the customer.

Similar to the recall coding, 10% of the participants' responses were coded by two independent researchers. Interrater reliability was 93.1% and differences were resolved by discussion. The remainder of open-ended question responses was coded primarily by the primary researcher; however the secondary researcher was consulted if there was ambiguity.

## CHAPTER 3 RESULTS

A mixed-factors, repeated measures analysis of variance was used to analyze the influence of absolute interest, causal constraint, and working memory capacity for each dependent variable: interest ratings, inference generation, recall, and question response. The independent variables of absolute interest and causal constraint were manipulated in the text versions so that each text varied both in terms of absolute interest and causal constraint. The study was a 2x3x3 design with two levels of absolute interest (included, not included), three levels of causal text constraint (low, high, explicit), and three levels of working memory capacity (low, medium, high). Each participant read one of each version type, therefore absolute interest and causal constraint are within subject variables, but working memory capacity was an individual factor, therefore it was a between subjects variable.

Participants were sorted into a level of working memory class using a tertiary split such that an approximately equal number of participants were in each group, but using a cluster analysis to verify appropriate group divisions. The possible score for working memory capacity ranged from 0 to 75. The range of working memory capacity for participants in this study ranged from 5 to 75, ( $N = 60$ ,  $M = 48.48$ ,  $SD = 18.49$ ). Participants in the low working memory capacity level earned scores ranging from 5 to 40, ( $n = 18$ ,  $M = 25.5$ ,  $SD = 11.73$ ). Participants in the medium working memory group earned scores ranging from 44 to 58, ( $n = 23$ ,  $M = 50.43$ ,  $SD = 4.64$ ). Participants in the high working memory group earned scores ranging from 61 to 75, ( $n = 19$ ,  $M = 67.89$ ,  $SD = 5.79$ ). Therefore while there was a wide range of scores, participants tended to

score above the midpoint of the scale so the most variability in scores was in the low working memory capacity groups due to an effort to keep group sizes similar.

The results of the repeated measures analysis of variance will be described first in terms of the within subjects factors, absolute interest and causal constraint, and then in terms of the between subject factor, working memory capacity, and finally in terms of any interactions. The significance level for all tests was set at .05. Effect size was measured using partial eta squared. Based on other research on interest and reading (Ainley, Hidi et al., 2002; Naceur & Schiefele, 2005; Schraw, Bruning, & Svoboda, 1995), 10-12% of variance in reading dependent variables was expected to be explained by the text manipulations. This amount of variance is expected for motivation variables predicting achievement (Uguroglu & Walberg, 1979), therefore a small, but practical, effect size is considered 1-6%, a moderate effect size is considered 6-15%, and a large effect size would be greater than 15%.

### **Demographics**

Sixty participants (50 females, 10 males) completed all parts of the study. Participants' ages ranged from 18-32 ( $M = 20.93$ ,  $SD = 2.60$ ). The amount of reading participants engaged in during a normal week ranged from 0-15 hours ( $M = 3.20$ ,  $SD = 3.84$ ). The average number of years of education since graduating high school ranged from 0-8 years ( $M = 2.75$ ,  $SD = 1.64$ ).

### **Description of Interest**

In order to verify that the concepts of absolute interest were of actual interest to the participants, participants described in writing their favorite part of each story. These descriptions were analyzed for the stories that included a concept of interest to provide a qualitative evaluation of whether the concept of interest was, in fact, interesting to

participants. Descriptions were categorized as including the concept of interest, anticipating the concept of interest, other, or none. All of the stories were categorized by two coders, the overall interrater reliability was 74%, the remaining items were resolved by discussion.

The stories with a category of romance were most ambiguous in terms of what was categorized as romance. For the story of John and Mary, aspects of the story that were considered romantic included John making time for Mary and visiting her, the elaborate snack, and watching the movie. Responses that involved anticipating these events such as moving to the couch together were considered anticipatory. Any other response that was not “none” or “nothing” was categorized as “other” such as that they wanted to be teachers.

For the story of George and Rachel, aspects of the story that involved their affair or the husband coming home during the affair were considered romantic and categorized as including the concept of interest. Responses that involved anticipating these events or simply responding with “the suspense” were categorized as “anticipation”. Any other response that was not “none” or “nothing” was categorized as “other” such as “the closet”.

For the stories that involved violence, any aspect of the story that involved violence was categorized as including the concept of interest, such as dumping the spaghetti or throwing the produce at the president. Responses that involved anticipating these events were categorized as “anticipation”, such as lifting the plate or waiting for the signal. Any other response that was not “none” or “nothing” was categorized as “other” such as her stomach growling or the worker’s emotion.

For the stories that included the concept of death, any aspect of the story that involved the outcome of jumping or crashing was categorized as including the concept of interest. Responses that involved anticipating these events were categorized as “anticipation”, such as standing at the ledge or seeing the mountains. Any other response that was not “none” or “nothing” was categorized as “other” such as her depression or the commotion of the passengers.

For each story, the most common category of response was the concept of absolute interest. The romance story regarding John and Mary watching a movie received the most responses for “none”, in contrast to the romance story in which George is having an affair with Rachel which had the most responses including the concept of interest and no responses of “none”. Therefore, although participants in general found the stories with the concept of interest more interesting (in terms of their rating scale) and responded that their favorite part of the story was the concept of interest, there are differences in how interesting the same concept is based on the specific content and context (Schank, 1979). However, when stories were collapsed across type of concept of interest (death, romance, and violence), the concept of absolute interest was most likely included in participants’ responses.

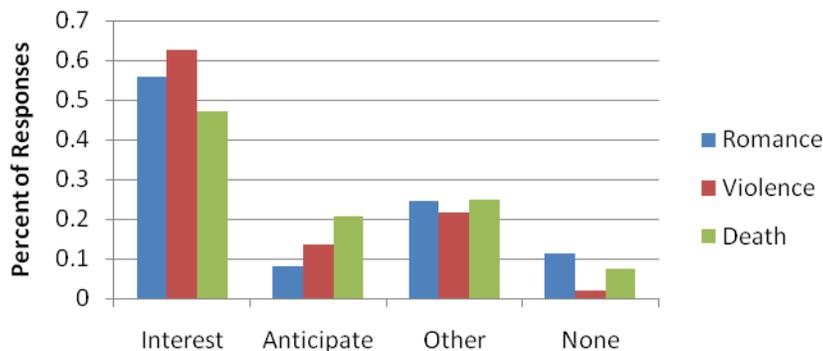


Figure 3-1. Participants’ responses regarding their favorite part of the story

In summary, this confirms that including absolute interest in terms of the concepts of death, romance, and violence was a way of making texts more interesting to readers.

### **Interest Ratings**

Based on previous research findings on interest, ratings were based on a combination of the level of interest the reader perceives at the end of the story (McDaniel et al., 2000) and how much the reader would like to continue reading the story (Ainley, Hidi et al., 2002). The reader rated each of these on a 7-point Likert scale ranging from Not at All to Very Much (0 to 6). These two ratings were averaged together to form one composite interest rating (0 to 6). The full range of the scale was used: there were participants who provided an overall rating of 0 for a given story and participants who provided an overall rating of 6 for a given story. The grand mean was 2.41 with an overall standard error of .16. Standard error is in terms of the standard error of the mean. The range of participants' averaged interest ratings across text manipulations was 1.31-3.47.

### **Main Effects: Within Subject Factors**

**Concept of interest.** There was a significant difference in interest ratings based on whether the texts included a concept of interest or not  $F(1, 57) = 101.22, p < .001, \eta_p^2 = .64$ . Texts with a concept of interest were rated higher ( $M = 2.98, SE = .17$ ) than texts without a concept of interest ( $M = 1.84, SE = .16$ ). The effect size was large; 64% of the variance in average interest ratings was accounted for by whether the text included a concept of absolute interest.

**Constraint.** There was no significant difference in interest ratings based on the three levels of constraint<sup>1</sup>,  $F(1.85, 105.65) = .49, p = .599 \eta_p^2 = .01$ .

### **Main Effects: Between Subject Factor**

**Working memory capacity.** There was no difference in interest ratings based on participants' working memory capacity,  $F(2, 57) = 1.13, p = .332 \eta_p^2 = .04$ .

### **Interactions**

There were no significant interactions. There was no significant interaction between concept of interest and constraint,  $F(2, 114) = .30, p = .742, \eta_p^2 = .01$ . There was no significant interaction between concept of interest and working memory capacity in interest ratings,  $F(2, 57) = .14, p = .867, \eta_p^2 = .01$ . There was no significant interaction between constraint and working memory capacity on interest ratings  $F(3.71, 105.65) = 2.22, p = .077, \eta_p^2 = .07$ . There was no significant interaction between all three variables,  $F(4, 114) = 1.46, p = .220, \eta_p^2 = .05$ .

### **Further Analysis**

In order to better understand if the concepts of interest were functioning similarly across the two texts that included the same concept of interest, a correlation analysis of interest ratings across texts was conducted. If the concept of interest was similar across the two texts, then the interest ratings for the two texts with the same concept of interest should correlate. In addition, if all of the concepts are similar because they all are a type of absolute interest, then there should be correlations across texts that include different concepts of interest, however, this should be lower than the correlation between texts with the same concept of interest.

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<sup>1</sup> Mauchly's test indicated that the assumption of sphericity was violated for constraint ( $X^2 = 9.049, p = .011$ ), therefore degrees of freedom were corrected using Huynh-Feldt estimates of sphericity ( $E = .927$ ).

The results indicate that texts with the same concept of interest were correlated. In addition, there was often a significant correlation between texts that had different concepts of interest. However, the correlation between texts with different concepts of interest were often higher than the correlations between texts with the same concept of interest.

Table 3-1. Correlations of interest ratings across texts

	Actress	Plane	Carol	Worker	George	John
Actress	1					
Plane	.41*	1				
Carol	.29	.73*	1			
Worker	.33	.66*	.66*	1		
George	0	.59*	.80*	.34	1	
John	.24	.73*	.58*	.52*	.64*	1

Pearson correlations of interest ratings between texts, a \* indicates that the correlation is significant. Actress and Plane have the concept of “death”, Carol and Worker have the concept of “violence”, and George and John have the concept of “romance”.

### Inference Question Performance

Participants were prompted to predict the end of each story using a single word to summarize their response. Responses that were correct were given one point, responses that were partially correct were given .5 points, and incorrect answers received zero points. The grand mean was .49 with an overall standard error of .02. The range of averaged inference generation ratios across text manipulations was .22 - .72.

### Main Effects: Within Subject Factors

**Concept of interest.** There was no significant difference in inference generation for texts based on whether they included a concept of interest or not  $F(1, 57) = .02, p = .895, \eta_p^2 = .00$ .

**Constraint.** There was a significant difference in the inference generation between the texts at the three levels of constraint,  $F(2, 114) = 5.42, p = .006, \eta_p^2 = .09$ . The effect size was moderate; 9% of the overall variance in inference generation was

accounted for by the level of constraint of the text. Post hoc tests, when adjusted for multiple comparisons using Bonferroni adjustment, revealed that inferences were less likely to be correct when there was a low level of constraint compared to a high level of constraint ( $p = .027$ ) or a low level of constraint compared to an explicit level of constraint ( $p = .011$ ). However, there was no significant difference in inference generation between high constraint and explicit constraint texts ( $p = 1.00$ ). On average, the percent of inference generation was the following: low constraint ( $M = .38$ ,  $SE = .04$ ), high constraint ( $M = .55$ ,  $SE = .04$ ), and explicit constraint ( $M = .55$ ,  $SE = .04$ ).

### **Main Effects: Between Subject Factor**

**Working memory capacity.** There was no difference in inference generation for texts based on participants' working memory capacity,  $F(2, 57) = .87$ ,  $p = .423$ ,  $\eta_p^2 = .03$ .

### **Interactions**

There were no significant interactions. There was no significant interaction between concept of interest and constraint on inference generation  $F(2, 114) = 1.39$ ,  $p = .254$ ,  $\eta_p^2 = .02$ . There was no significant interaction between constraint and working memory capacity on inference generation,  $F(4, 114) = .64$ ,  $p = .649$ ,  $\eta_p^2 = .02$ . There was no significant interaction between absolute interest and working memory capacity,  $F(2, 57) = .44$ ,  $p = .649$ ,  $\eta_p^2 = .02$ . There was no interaction among the three independent variables,  $F(4, 114) = .72$ ,  $p = .578$ ,  $\eta_p^2 = .03$ .

In summary, this confirms previous research that text constraint has a significant effect on inference generation (Klin, Guzman et al., 1999; Weingartner et al., 2003). Unlike previous research (Calvo, 2001; Linderholm, 2002), no evidence was found for the effect of working memory capacity on inference generation.

## Open Ended Questions

One measure of text comprehension was open answer questions about the text. Scores were based on total number of correct answers to the three questions presented, for a possible total of three points. The grand mean for correct answers to open ended questions was 2.77 (92% correct) with an overall standard error of .03. The averaged scores on open ended questions across text manipulations ranged from 2.50 to 2.96 (83% - 99% correct). Therefore, scores were around ceiling.

### Main Effects: Within subject factors

**Concept of interest.** There was a significant difference in number of correct answers for comprehension questions based on whether the text included a concept of interest or not  $F(1, 57) = 14.81, p > .001, \eta_p^2 = .21$ . The effect size was large; 21% of the variance in open ended question response was accounted for by whether the text included a concept of absolute interest. Texts with a concept of interest ( $M = 2.87, SE = .03$ ) were related to higher scores on the open ended questions than texts that did not contain a concept of interest ( $M = 2.66, SE = .05$ ).

**Constraint.** There was no significant difference in number of correct answers for comprehension questions based on the three levels of constraint,  $F(2, 114) = .97, p = .383, \eta_p^2 = .02$ .

### Main Effects: Between Subject Factor

**Working memory capacity.** There was no difference in number of correct responses to open ended questions for texts based on participants' working memory capacity,  $F(2, 57) = .18, p = .836, \eta_p^2 = .01$ .

## Interactions

There were no significant interactions. There was no significant interaction between constraint and concept of interest,  $F(2, 114) = 2.80, p = .065, \eta_p^2 = .05$ . There was no significant interaction between concept of interest and working memory capacity on responses to open ended questions,  $F(2, 57) = .59, p = .558, \eta_p^2 = .02$ . There was no significant interaction between constraint and working memory capacity on responses to open ended questions  $F(4, 114) = .67, p = .613, \eta_p^2 = .02$ . There was no significant interaction between all three variables on responses to open ended questions,  $F(4, 114) = 1.58, p = .185, \eta_p^2 = .05$ .

In summary, these results are consistent with research indicating that texts that are interesting are related to higher reading comprehension (Bray & Barron, 2003-2004; Durik & Matarazzo, 2009). However few questions were not answered correctly so the significance of these results may be minimal.

## Recall

An additional learning measure is recall. Recall was measured by counting the number of idea units written by participants as a function of the total number of idea units in the passage; therefore the recall value analyzed is a proportion of total idea units that could be recalled. The grand mean was .53 idea units recalled with an overall standard error of .02. The range of averaged recall scores across text manipulations was .42 - .64.

## Main Effects: Within Subject Factors

**Concept of Interest.** There was a significant difference in recall for texts based on whether they included a concept of absolute interest or not such that recall was higher for texts that included a concept of interest ( $M = .50, SE = .02$ ) compared to recall of

texts without a concept of interest ( $M = .56$ ,  $SE = .02$ ),  $F(1, 57) = 12.20$ ,  $p = .001$ ,  $\eta_p^2 = .18$ . The inclusion of absolute interest accounted for 18% of the variance in recall which is a large effect size.

**Constraint.** There was a significant difference between the proportion recalled for texts at the three levels of constraint,  $F(2, 114) = 6.44$ ,  $p = .002$ ,  $\eta_p^2 = .10$ . Constraint accounted for 10% of the variance in recall which is a moderate effect size. Post hoc tests, when adjusted for multiple comparisons using Bonferroni adjustment, revealed that fewer statements were recalled when the text was explicit compared to when the text had a high level of constraint ( $p = .002$ ) and fewer statements were recalled when the text was explicit compared to a low level of constraint ( $p = .044$ ), but there was no significant difference in recall between low constraint and high constraint ( $p = 1.00$ ). The average rate of recall across constraints was the following: low constraint ( $M = .54$ ,  $SE = .03$ ), high constraint ( $M = .55$ ,  $SE = .02$ ), and explicit constraint ( $M = .49$ ,  $SE = .02$ ).

### **Main Effects: Between Subject Factor**

**Working memory capacity.** There was no difference in recall for texts based on participants' working memory capacity,  $F(2, 57) = 1.17$ ,  $p = .317$ ,  $\eta_p^2 = .04$ .

### **Interactions**

There was a significant interaction between constraint and interest on recall  $F(2, 114) = 5.42$ ,  $p = .006$ ,  $\eta_p^2 = .09$ . This interaction had a moderate effect size accounting for 9% of the variance in recall.

When texts included a concept of interest, there was a significant difference in correct recall as a function of level of constraint,  $F(2, 118) = 11.51$ ,  $p > .001$ ,  $\eta_p^2 = .16$ . Post hoc tests, when adjusted for multiple comparisons using Bonferroni adjustment, revealed that more idea units were recalled when there was a low level of constraint ( $M$

= .60,  $SE = .03$ ) compared to an explicit level of constraint ( $M = .50$ ,  $SE = .03$ ,  $p > .001$ ). More idea units were recalled for high constraint texts ( $M = .58$ ,  $SE = .03$ ) compared to explicit texts ( $p = .003$ ). However there was no difference between rate of recall between texts with low constraint compared to high constraint texts ( $p = 1.00$ ).

When texts did not have a concept of interest, there was no significant difference in correct recall based on the level of constraint in the text,  $F(2, 118) = 2.21$ ,  $p = .114$ ,  $\eta_p^2 = .04$ .

For low constraint texts, the inclusion of a concept of interest significantly influenced the rate of correct recall,  $F(1, 59) = 20.23$ ,  $p > .001$ ,  $\eta_p^2 = .26$ . The rate of correct recall was higher for texts with a concept of interest ( $M = .60$ ,  $SE = .03$ ) compared to texts without ( $M = .49$ ,  $SE = .03$ ).

For high constraint texts, the inclusion of a concept of interest significantly influenced the rate of correct recall,  $F(1, 59) = 5.93$ ,  $p = .018$ ,  $\eta_p^2 = .09$ . The rate of correct recall was higher for texts with a concept of interest ( $M = .58$ ,  $SE = .03$ ) compared to texts without ( $M = .53$ ,  $SE = .03$ ).

For explicit texts, the inclusion of a concept of interest did not significantly influence the rate of correct recall,  $F(1, 59) = .24$ ,  $p = .625$ ,  $\eta_p^2 = .00$ .

There was no significant interaction between absolute interest and working memory capacity,  $F(2, 57) = .08$ ,  $p = .924$ ,  $\eta_p^2 = .00$ . There was no significant interaction between level of constraint and working memory capacity,  $F(4, 114) = 1.87$ ,  $p = .121$ ,  $\eta_p^2 = .06$ . There was no interaction among the three independent variables,  $F(4, 114) = .69$ ,  $p = .601$ ,  $\eta_p^2 = .02$ .

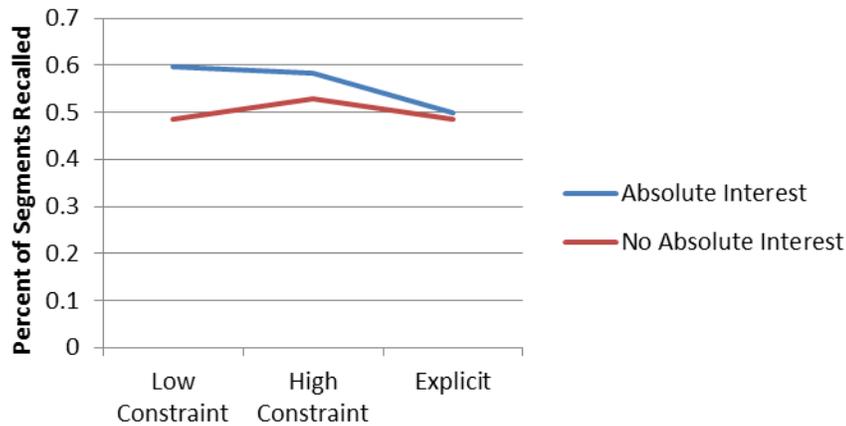


Figure 3-2. The effects of causal constraint and absolute interest on recall.

In summary, this indicates that text constraint, interest, and their interaction each have a significant effect on recall. Texts that had a low level of causal constraint and included a concept of interest had the highest recall rates.

### Further Analysis

In order to better understand the effects of the variables on recall, additional analyses were conducted. Schiefele and Krapp (1996) found that topic interest was related to both total recall and main idea recall. Therefore, an additional analysis of main idea recall was performed. A main idea was identified for each story that encompassed the most salient parts, those that pose that situation or problem and the outcome that represented the gist of the text (Kintsch & van Dijk, 1978; Trabasso, Secco, & van den Broek, 1984). Two coders agreed on the stories' main ideas. For example, Carol has a complaining customer and either dumps the spaghetti in the trash or on the customer. Most main ideas had two parts comprising the problem and the outcome. If the recall statement completely included the main idea, 1 point was given. If part of the idea was included in the recall .5 points were given. If no part of the main idea was included in the recall 0 points were given. Interrater reliability between two coders on 10% of the responses was 85.1% and differences were resolved by

discussion. The remaining recall responses were coded by the primary researcher, however the secondary researcher was consulted if there was ambiguity. The grand mean was .94 main ideas recalled with an overall standard error of .01. The range of averaged main ideas recalled across text manipulations was .81 – 1.00.

The only variable that was significantly related to main idea recall was the concept of absolute interest. There was a significant difference in recall of main ideas for texts based on whether they included a concept of absolute interest or not, such that recall of main ideas was higher for texts that included a concept of interest ( $M = .97$ ,  $SE = .02$ ) compared to recall of texts without a concept of interest ( $M = .91$ ,  $SE = .01$ ),  $F(1, 57) = 9.26$ ,  $p = .004$ ,  $\eta_p^2 = .14$ . The inclusion of absolute interest accounted for 14% of the variance in recall of main ideas which is a large effect size.

All other main and interaction effects were not significant. There was no difference in recall for texts based on the level of causal constraint,  $F(2, 114) = 1.97$ ,  $p = .145$ ,  $\eta_p^2 = .03$ . There was no difference in recall for texts based on participants' working memory capacity,  $F(2, 57) = .53$ ,  $p = .592$ ,  $\eta_p^2 = .02$ .

There was no significant interaction between absolute interest and level of constraint,  $F(2, 114) = 2.74$ ,  $p = .069$ ,  $\eta_p^2 = .05$ . There was no significant interaction between absolute interest and working memory capacity,  $F(2, 57) = .36$ ,  $p = .70$ ,  $\eta_p^2 = .01$ . There was no significant interaction between level of constraint and working memory capacity,  $F(4, 114) = 1.13$ ,  $p = .345$ ,  $\eta_p^2 = .04$ . There was no interaction between all three variables combined,  $F(4, 114) = .69$ ,  $p = .604$ ,  $\eta_p^2 = .02$ .

## CHAPTER 4 DISCUSSION

The goals of this study were to explore how text-based factors (absolute interest and causal constraint) and individual factors (working memory capacity) interact to generate (1) situational interest and (2) how these factors that lead to situational interest affect learning in terms of inference generation, responses to open ended questions, and recall of text idea units. In the following paragraphs I will first describe the results related to what factors increased text-based interest and then I will describe how the same factors influenced reading outcomes.

### **Interest Ratings**

First, the study results indicate that interest ratings were higher for texts with a concept of absolute interest compared to texts without the interest concept. These results are consistent with prior theoretical proposals and empirical findings that indicate situational interest arises from stimulus characteristics including content and structure (Hidi, 1990). Hidi discussed text-based interest in particular concluding that two types of factors lead to situational interest in a text: structural factors that increase unexpectedness or involve unexpected ideas and content that involves “universally interesting concepts” and human activity, particularly intense action. Worth noting however is that the interest ratings overall were somewhat low. Therefore, while interest ratings increased, participants were not necessarily really interested in the texts.

The current study used the absolute concepts of death, violence, and romance as the content based text characteristic to evoke situational interest based on Schank (1979). Among other topics, Schank proposed that these topics would elicit interest and therefore lead to increased attention and inference generation. The current findings

confirm that the topics of death, violence, and romance are related to increased interest in the text. Texts that included one of the concepts of death, violence, or romance had an average interest rating of 2.98 (out of 6) whereas similar texts that did not have such concepts had an average interest rating of 1.84 (out of 6). In addition, participants described their favorite part of texts with a concept of absolute interest most often in terms of that concept. This indicates that although interest ratings tended to be relatively low, texts that included a concept of interest elicited higher levels of situational interest. Finally, interest ratings were correlated for texts that had the same concept of interest and interest ratings were correlated across texts with a concept of interest even when the concepts were not similar. However, the correlation of interest ratings across different concept types were sometimes greater than the correlation of interest between texts with the same concept type. This indicates that while there is some support for absolute interest concepts, the texts labeled under the same absolute interest concept may not have been exactly the same concept. However, because there were only two texts for each concept, this is speculative. Additional research is needed to support that there is an “absolute” interest and that texts with similar concepts are interesting in the same way and influence learning outcomes in the same way.

Causal constraint was manipulated to provide differences in text structure that would affect situational interest. Causal constraint is generally not discussed in terms of being a characteristic of text-based interest; however, in a study comparing implicit and explicit texts, Kim (1999) found that implicit texts were rated higher on interest than explicit texts. This may be because implicit texts are more unexpected than explicit texts because explicit texts tell the reader exactly what is about to happen whereas implicit

texts leave some room for alternate outcomes. Unexpectedness has been proposed and shown by various studies to be a source of text-based interest (Kintsch, 1980; McDaniel et al., 2000; Wade et al., 1999). The current study was not able to confirm that causal constraint is a structural characteristic that increases situational interest. There was no main effect of causal constraint on interest ratings nor were there significant interactions that included causal constraint. Based on this study, situational interest is influenced by the inclusion of concepts of interest, however there is not enough evidence to support that situational interest is significantly influenced by causal constraint or the text-based factors (interest or constraint) matching the reader's cognitive abilities.

Therefore, because the inclusion of concepts of absolute interest predict increased interest ratings, differences in learning outcomes based on the manipulation of absolute interest in the text is probably associated with situational interest. However, causal constraint (manipulated as a form of manipulating unexpectedness) was not associated with differences in interest ratings: therefore differences in learning outcomes due to differences in causal constraint may not be associated with differences in interest.

### **Learning Outcomes**

In addition to learning more about the generation of situational interest from text and individual factors, the second goal of the study was to explore the extent that these factors contribute to learning from a text. Interest has been associated with various learning factors both theoretically and empirically, beginning with Dewey (1913) who proposed that interest is necessary for attention and internalizing the information being learned. Interest has been associated with various learning outcomes including short

term recall (Schiefele & Krapp, 1996; Schraw et al., 1995; Wade et al., 1999), long term recall (Naceur & Schiefele, 2005), and reading comprehension (Bray & Barron, 2003-2004). These studies tend to use topic interest or rating scales to measure interest rather than exploring the text and individual factors that elicit situational interest. One study that did manipulate interest at the text level, found that interest did not affect recall (McDaniel et al., 2000), however these texts were not manipulated in terms of concepts of absolute interest nor causal constraint. Therefore the current study sought to expand on prior studies by exploring potential text stimuli that elicit situational interest. The first learning outcome explored for this study was inference generation.

### **Predictive Inferences**

Inference generation was predicted to be increased with increased causal constraint and inclusion of absolute interest concepts. Causal constraint manipulation, almost by definition, should change the likelihood of predictive inference generation with low constraint texts leading to fewer correct inferences than texts that provide more information. Not surprisingly, the results of this study show that there was a main effect of causal constraint on predictive inference generation. Texts that had a low level of constraint, and thus could lead to multiple outcomes had a lower average of correct inferences. An additional analysis confirmed that the alternative outcome was sometimes predicted, particularly for the story of Carol the waitress and the story of the plane. The alternative of smoking for the actress, dressing for George, and leaving for John were mentioned but not frequently. This indicates that the low constraint manipulation appropriately led participants to consider the provided alternate outcome.

While Schank (1979) proposed that particular concepts of interest should lead to increased inference generation, the theory had not fully been empirically tested. In this

study, the concepts of death, violence, and romance did not lead to significant differences in inference generation. Therefore, the proposal that such concepts increase predictive inference generation is not supported.

However, while the analysis of variance shows that there is no difference between inference predictions for texts with a concept of interest versus those without a concept of interest, a qualitative analysis showed that interest may affect the predictions made if not the correct generation of the probe prediction word. Particularly, participants may be generating a mental model of the story that extends beyond the immediate prediction (Klin, Guzman et al., 1999). In addition, when the upcoming events are not interesting, participants may be more prone to alternative outcomes presented particularly if that outcome is interesting. Finally, the concept of death may affect readers differently than other concepts of interest. While other texts prompted more extreme versions of the outcome (throw versus dump, caught versus hide, kiss versus watch), the story of the plane crashing prompted responses of landing or even miracles.

The concept of death may be different than the other concepts of interest in terms of what people like versus what is interesting. Iran-Nejad (1987) found that interest was related to surprise but that liking was related to the outcome valence such that readers liked good outcomes better than bad outcomes (for example, when a woman is rescued versus a woman is murdered). Therefore predictions may, to some extent, be related to what readers want to happen which is based on what they like, good outcomes. However, the theory that a good outcome is liked more and therefore influences what is inferred does not fully explain the difference between death and the other concepts because the outcomes often inferred for the texts involving violence

(throwing or dumping food on someone) and being caught are not generally considered good outcomes. However, in these cases, readers may consider the outcomes good because the outcomes are perceived as deserved. For example, in one of the recall statements for the Carol story, a participant exclaimed “Good for her!” while another stated “sweet justice” after describing Carol dumping the spaghetti on the customer. Therefore, absolute interest did not affect correct predictions as measured in this study but may have influenced content such that the inference was made but was more extreme than the expected word such that participants may have inferred “dump” but went beyond that action to “throw” so that they would have correctly made the implicit automatic inference.

It should be noted that inference generation was measured in the current study by eliciting a predictive inference. In this way, the inference is directly measured, but requires the reader to stop and make an inference that may not have been generated without elicitation, therefore it was a strategic inference. The more common methods of measuring inference generation measure unprompted inferences, that is, these measures do not explicitly ask participants to make inferences. Therefore most other methods measure whether the reader automatically made the inference. Previous research has measured inference generation in a variety of ways including time to name the probe word (Klin, Guzman et al., 1999; Linderholm, 2002; Weingartner et al., 2003), reading time of subsequent sentences that were or were not predictable (Calvo, 2001), indicating whether the presented word (which sometimes was the probe word) was an actual word or not (Allbritton, 2004), and coding a think aloud while reading as a predictive inference (van den Broek et al., 2001). Therefore, the measure used in the

current study could be described in terms of *could* the reader make an appropriate inference while many of the measures of previous studies identify whether the reader *did* make an appropriate inference automatically without prompting. In addition, some of the measures of automatic inferences, particularly reading subsequent sentences, are able to detect whether the participant made an inference that matched the outcome of the story beyond a specific word. Therefore the method used in this study may not be sensitive enough to detect whether participants differentially predicted the next part of the story. The current study did not have a time limit to generate the inference yet limited what was considered a correct inference to the next immediate action. The method of measuring inference generation may affect who and what type of inference is generated because more readers are able to generate predictive inferences with more time (Estevez & Calvo, 2000) and readers may be generating inferences beyond the immediate action (Klin, Guzman et al., 1999). Therefore, the current study may represent readers' abilities to generate inferences under the best case scenarios, but differentiation between readers may be more evident under less ideal conditions such as test taking where time is constrained. Although this study does not provide evidence that absolute interest increases strategic inference generation, future studies should consider manipulating the level of absolute interest in texts to identify whether automatic inference generation varies based on the inclusion of absolute interest.

### **Comprehension**

In addition to inference generation, reading comprehension was analyzed in terms of responses to open ended questions and recall. The inclusion of absolute interest was associated with increased correct responses on the open ended questions as well as increased recall with effect sizes of 21% and 19% of variance explained

respectively. In addition, the inclusion of absolute interest also predicted recall of the main idea of the text. This supports previous findings that interest is associated with increased comprehension (Asher et al., 1978; Bray & Barron, 2003-2004) and recall (Naceur & Schiefele, 2005; Schiefele & Krapp, 1996). However, most studies used only interest ratings or topic interest to measure interest. The current study expands on previous research by showing the inclusion of absolute interest (a form of topic interest that may be general to most readers) increases both interest ratings (a measure of situational interest) and learning outcomes. This is particularly noteworthy given that participants interest ratings were not necessarily high; therefore, simply increasing reader's interest- not necessarily to the point of high interest- has a significant impact on learning outcomes.

Recall, though not responses to open ended questions, was also predicted by level of causal constraint and an interaction between causal constraint and the inclusion of absolute interest. While causal constraint was not associated with increased interest ratings, and therefore differences may not be due to situational interest, the direction of difference in recall ratings is consistent with the hypothesis that low constraint texts would lead to increased learning due to increased unexpectedness if these led to greater focus of attention on the task. Without considering interest in the equation, one may predict that explicit texts would lead to higher learning outcomes because these texts are easier to read in that they provide the reader with the outcome explicitly. However, the results indicate that texts that provided some level of unexpectedness (those with high and low constraint) led to better recall than explicit texts. Thus, recall

was higher for implicit texts, which is consistent with the theory that decreasing constraint increases unexpectedness, which increases interest.

An alternative reason for decreased causal constraint to be related to improved recall is related to the probability of elaboration hypothesis (Duffy, Shinjo, & Myers, 1990). Based on this theory, any related elaboration serves as a useful memory aid. This research found that when participants were asked to comprehend or study sentence pairs varying in causal relatedness, participants primarily generated inferences for sentence pairs that had a moderate level of relatedness rather than a direct link or a low level of causal relatedness. This may be because a direct cause, or an explicit text in the case of the current study, does not require a bridging inference or any other type of elaboration. Regarding the low constraint texts, participants may be able to identify many possible inferences but no particular inference is more likely.

In the current study, participants were asked to generate a prediction for all texts and were correctly generated the target inference for the explicit and high constraint texts than the low constraint. However, participants may not have actively been generating an inference for the explicit texts, but only strategically generating inferences for the implicit texts. Based on the probability of elaboration hypothesis that any inference, as long as the text can be resolved, aids in recall, the texts that allowed and prompted more elaborations would be better recalled (Duffy et al., 1990). Therefore, participants may have been generating more inferences and elaborations in the implicit texts thereby leading to increased recall.

Importantly, level of constraint interacted with concept of interest to affect recall such that there was a higher rate of recall for implicit texts when the text also included a

concept of interest. While the probability of elaboration hypothesis indicates that readers could generate many possible inferences for low constraint texts without knowing which particular inference the author intended, the results of this study indicate that for stories that included a concept of interest, participants often made predictions that indicated further elaboration than the target prediction. The most common non-target predictions for the texts with a concept of violence involved more violence: Carol throwing the spaghetti and the workers rioting or fighting. The most common non-target predictions for texts with a concept of romance involved what may occur after the target prediction: George getting caught (either on his way or in spite of hiding) and John and Mary kissing. These predictions could occur either as part of the story (Carol throwing the spaghetti versus dumping the spaghetti may be easily resolved by readers) or later in the story. Therefore these elaborations may still help the participants make sense of the story. In contrast, the most common non-target predictions for texts juxtaposed to those including a concept of violence involved Carol eating the spaghetti (which was contradicted after the prediction) or uncertainty in the text of the happy workers. The most common non-target predictions for texts juxtaposed to those including a concept of romance were throwing the gifts in the closet instead of simply hiding and the description of what John and Fred would watch (“basketball” or “game”). While these predictions describe events that did happen in the story and therefore could help recall, they do not elaborate beyond the text in the way that the inferences generated for the texts with a concept of interest. Therefore, participants may be more likely to elaborate and generate varied, potentially incorrect, inferences when the text is implicit but these

inferences may still help readers recall the texts because they elaborate beyond the text.

Text recall is a common learning outcome in interest research, however results are mixed in previous investigations. While some researchers have found text recall associated with interest (Naceur & Schiefele, 2005; Schiefele & Krapp, 1996), others have found no direct difference in recall based on interest both in terms of situational interest (Ainley, Hidi et al., 2002) and text based interest (McDaniel et al., 2000). The current study found that the inclusion of a concept of interest and the decreasing of causal constraint were associated with increased comprehension both in terms of responses to open ended questions as well as recall. Because the inclusion of absolute interest is associated with increased situational interest, as measured by interest ratings, this also lends support that situational interest is associated with increased comprehension.

In summary, text based interest, particularly the inclusion of absolute interest, increases reported interest and learning outcomes particularly for texts that are implicit by decreasing the level of causal constraint. Decreasing causal constraint so that the text is not explicit may be a means to increase situational interest due to the increase in unexpectedness of the text, however, this form of text manipulation leads to benefits dependent on other text factors, such as the inclusion of absolute interest.

### **Role of Working Memory Capacity**

Situational interest is understood to arise from an interaction between environmental (text-based) factors and individual factors (Dewey, 1913); therefore the current study was designed to investigate potential text and individual factors. Working memory capacity was selected as a potential individual factor because interest has

been theorized to improve learning outcomes through its affect on attentional resources (Hidi, 2001; McDaniel et al., 2000) and working memory capacity is related to the individual limits on attentional resources and how they are allocated (Engle, 2010; Unsworth, Nash & Spillers, 2010). Working memory capacity was not associated with differences in interest ratings, inference generation, or responses to open ended questions, or recall. Based on the concept of interest as arising from situational factors matching individual factors, it was expected that these text factors would interact with the individual factor of working memory capacity in eliciting situational interest and leading to increased performance on learning outcomes. This expectation was not supported.

An increase in situational interest and learning outcomes was seen for texts including a concept of absolute interest without dependence on working memory capacity. This makes sense because the recognition of concepts such as death, violence, and romance as being important or relevant to the self may be automatic and not requiring working memory resources to retrieve and maintain; these concepts may be at a high threshold for most people most of the time so that when the concept is mentioned, it becomes activated with minimal effort.

Effort is required, however, for unexpectedness to be appropriately resolved; readers with high working memory capacity tend to resolve inconsistent information more efficiently than readers with low working memory capacity (Estevez & Calvo, 2000). In order for readers to find a text interesting based on unexpectedness, the reader must be able to have an expectation, have that expectation not met, and then resolve the unexpected outcome so that it makes sense. The ability to resolve the

unexpected outcome is important because otherwise the reader will experience confusion rather than interest (Silvia, 2008). In fact, a previous study found that it was not the unexpectedness itself that was interesting, but the conflict resolution that occurred after the surprising event (Iran-Nejad, 1987). Therefore, it was predicted that implicit levels of causal constraint would be associated with increased situational interest and some learning outcomes partially dependent on reader's working memory capacity. Therefore, it is uncertain why working memory capacity did not interact with causal constraint to predict interest ratings or learning outcomes. One possible reason for the lack of effect of working memory capacity is that participants read the stories and generated the inferences in a self-paced manner. Linderholm (2002) found that both readers with both low and high working memory capacity could differentiate between highly likely and highly unlikely events, but only high working memory capacity readers could generate a correct inference when the delay was 250 or 500 ms. In addition, Estevez and Calvo (2000) found that readers with either high or low working memory capacity could make inferences, but that high working memory reduces the time taken to draw inferences. Therefore, the method used in the current study showed no differences dependent on readers working memory capacity when inference generation was strategic in nature, self-paced, and associated with easy texts.

### **Educational Applications**

Increasing readers' interest and increasing learning outcomes such as recall and comprehension and among educator's primary goals. Therefore, the results of this study have educational applications particularly for reading and learning. Including interest concepts such as romance, violence, and death were shown to improve participants' interest ratings as well as recall and responses to open ended questions. Although

interest ratings tended to be low overall, the results of this study indicate that increasing interest, even if the reader is not extremely interested, will influence learning outcomes. This is important because teachers may struggle to increase students' interest in learning in general; previous studies have found that reading interest decreases with age (Bray & Barron, 2003-2004). Recall was particularly improved for texts that were implicit and included an interest concept. Therefore, educators should consider selecting and writing texts that include such concepts; perhaps in illustrating an idea, educators can tie the idea to how it is related to concepts of interest or how it may affect concepts of interest. For example, in many educational texts the social psychology concept of the by-stander effect is illustrated using the case of the murder of Kitty Genovese (Manning, Levine, & Collins, 2007). In some ways this is a very good example because it includes the concept of death; readers may remember both the case and the concept of the by-stander effect better because it includes this concept of interest rather than if texts relied on more benign examples. However, this is also a case in which textbooks over-simplify and exaggerate the story, potentially in order to make it an exemplar or parable (Manning et al., 2007). While highlighting the concept of interest or including cases that included a concept of interest is worthwhile to increase readers' interest and potentially their learning outcomes, textbooks should be wary of relying on extreme cases particularly when the evidence supporting the case is later contradicted.

While this study used narratives and not expository texts, prior studies indicate that text interest also improves recall for expository texts (Schiefele & Krapp, 1996; Wade et al., 1999). However, these studies did not manipulate their texts based on the

inclusion of interest concepts. Schiefele and Krapp (1996) had participants rate how they expected to feel reading a particular topic and how important the topic was to them while Wade and colleagues (1999) used think aloud protocols to determine what information was interesting to the reader. Therefore, future research may explore the use of interest concepts in expository texts.

An additional application of the current research is the use of texts in standardized testing. Standardized tests often use a variety of texts including both expository and narratives with recall and comprehension questions to identify the learner's reading capabilities. If such tests are to understand the ability of a reader, then the test should provide texts that allow for readers to display their abilities in the best circumstances. Therefore, texts used in standardized tests should include concepts of interest. This suggestion is supported by a study that found that interest was related to improved comprehension in a testing situation (Bray & Barron, 2003-2004).

### **Future Directions and Current Limitations**

Although unexpectedness was manipulated in this study through causal constraint, unexpectedness can be elicited by other means, such as by contradicting common schemas or manipulating whether the predictive inference is confirmed or contradicted. For example, McDaniel et al. (2000) manipulated unexpectedness with the theme of the stories presented and were rated on their unexpectedness in a prior study. Alternate means of eliciting interest should be investigated both as factors that rely on individual factors, such as working memory capacity, and alone. In the current study, the concept of absolute interest did not rely on working memory capacity to elicit situational interest; however future studies should continue to explore the concept of absolute interest. Future studies may explore which concepts are most interesting and

whether certain concepts are more interesting to different demographics, although Schank (1979) proposed that the concepts were of absolute interest because they would be considered interesting to almost all people.

In addition, the current study used a measure of self-paced strategic inference generation which may not be as sensitive to differences in readers as measures of automatic inference generation. Future studies should investigate whether text based interest, such as including a concept of interest, affects inference generation when readers have a limited amount of time to generate the inference or are using the inference as they are reading later portions of the text. Although the current study did not provide evidence that including a concept of interest led to increased inference generation, participants often generated inferences that may have been correct with more sensitive measures as they were more extreme. These extreme strategic inferences may be under the same broad category of automatic inferences and therefore provide more information regarding the role of interest in inference generation. In some cases, participants inferences were completely contradicted (the story of the plane, particularly) but interest ratings were still high for these stories. The contradicted inference may be an indication that inferences are generated more based on liking or what the participant wants to happen; therefore one avenue of future research may be exploring the differences between predictions of good and bad outcomes versus outcomes that include or do not include a concept of absolute interest. An alternative avenue for future inference research would be exploring the role of interest using measures of inference in terms of readers' reactions to predictions that are contradicted. Champion et al. (2009) found that interest was increased for texts that elicited a

predictive inference and that interest was higher when stories were inconsistent, relative to those that were consistent or neutral. This is noteworthy because while inference research suggests that reading times are faster for texts when the outcome is correctly inferred (Klin, Murray et al., 1999; Murray & Burke, 2003), interest research indicates that reading times are faster for more interesting texts (Miller et al., 2006; Shirey & Reynolds, 1988).

Another limitation of this study is that the sample size was relatively small which may have led to issues of enough power to identify practical differences caused by the variables, particularly the individual factor of working memory capacity because the sample tended to have fewer participants who scored low on the working memory capacity scale. For example, average interest ratings were not shown to be significantly influenced by causal constraint or working memory capacity, yet the effect size for the interaction of causal constraint and working memory capacity on interest ratings was moderate (7%). The results that show no significant statistical effect yet a moderate effect size indicate that additional effects may have been identifiable with more power, potentially from a larger sample size or a sample that represented less skewed scores on the working memory capacity task.

Finally, the results of this study are limited to understanding the relations between the text based characteristics of absolute interest and causal constraint on interest ratings and learning outcomes. That both interest ratings and the learning outcomes of responses to open ended questions and recall were related to the manipulations of absolute interest concepts implies a relation between the outcomes, however, a direct relationship between situational interest, in terms of interest ratings,

and learning outcomes, in terms of open ended responses and recall, can not be assumed. In addition, no relationship was found between causal constraint and interest ratings. However, prior studies have found a relationship between interest ratings and learning outcomes (Bray & Barron, 2003-2004; Lin et al., 1997; Miller et al., 2006). This implies that a model of learning from the text may include a relationship such that the text based inclusion of concepts absolute interest leads to situational interest which leads to increased learning outcomes. Based on Ainley et al. (2002), the model may be further elaborated to include that situational interest leads to increased learning outcomes due to increased attention and persistence when the learner is involved in the subject matter. However, the exploration of this possible model was beyond the scope of this study. This study extends prior studies, which found relationships between interest and learning outcomes, by exploring how particular stimuli in terms of text characteristics are related to interest and learning outcomes.

APPENDIX A  
NARRATIVE TEXTS

**Concept: Death; Target Word: Jump (in Pool; to Street)**

**No absolute interest and explicit.** The eccentric actress was depressed until that evening. Her last three pictures had been box office failures but her agent had just called with a new offer. Although she was no longer young, life again seemed full. She went to the roof of her house for air and stared at the glorious lights in the deep pool below. No longer overwhelmed or feeling despair, she decided to jump into the cool water. She stepped toward the edge of the roof. \* The actress then jumped into the pool.

**No absolute interest and high constraint.** The eccentric actress was depressed until that evening. Her last three pictures had been box office failures but her agent had just called with a new offer. Although she was no longer young, life again seemed full. She went to the roof of her house for air and stared at the glorious lights in the deep pool below. No longer overwhelmed or feeling despair, she breathed deeply and thought of the cool water. She stepped toward the edge of the roof. \* The actress then jumped into the pool.

**No absolute interest and low constraint.** The eccentric actress was depressed until that evening. Her last three pictures had been box office failures but her agent had just called with a new offer. Although she was no longer young, life again seemed full. She went to the roof of her house for air and stared at the glorious lights in the deep pool below. No longer overwhelmed or feeling despair, she breathed deeply and thought of the cool water. With a cigarette in her hand, she stepped toward the edge of the roof. \* The actress then jumped into the pool.

**Absolute interest and explicit.** The eccentric actress was depressed that evening. Her last three pictures had been box office failures and her agent had not returned her calls. She was no longer young and beautiful and life seemed empty. She went to the roof of her penthouse for air and stared out at the lights of the city beneath her feet. With an overwhelming sense of despair, she decided to end her life with a single jump as she stepped toward the edge of the roof. \* The actress then jumped to her death.

**Absolute interest and high constraint.** The eccentric actress was depressed that evening. Her last three pictures had been box office failures and her agent had not returned her calls. She was no longer young and beautiful and life seemed empty. She went to the roof of her penthouse for air and stared out at the lights of the city beneath her feet. With an overwhelming sense of despair, she gazed down at the long drop below as she stepped toward the edge of the roof. \* The actress then jumped to her death.

**Absolute interest and low constraint.** The eccentric actress was depressed that evening. Her last three pictures had been box office failures and her agent had not returned her calls. She was no longer young and beautiful and life seemed empty. She went to the roof of her penthouse for air and stared out at the lights of the city beneath her feet. With an overwhelming sense of despair, the actress took out a cigarette. She gazed down at the long drop below as she stepped toward the edge of the roof. \* The actress then jumped to her death.

**Concept: Death; Target Word: Crash (Toy; Passenger Plane)**

**No absolute interest and explicit.** The toy airliner was losing altitude. For safety's sake, the child turned on the seat belt and no smoking signs. He created some

commotion from the struggling passengers. While pretending to manage the unresponsive controls, the child searched hard for a place to land. He decided to make the emergency become even more desperate by creating a mountain range. Looking up, the child decided to crash the toy into a mountain of bricks directly before him. He tensed up and took a deep breath. \* The plane crashed into the mountain and burst into pieces.

**No absolute interest and high constraint.** The toy airliner was losing altitude. For safety's sake, the child turned on the seat belt and no smoking signs. He created some commotion from the struggling passengers. While pretending to manage the unresponsive controls, the child searched hard for a place to land. He decided to make the emergency become even more desperate by creating a mountain range. Looking up, the child became excited as he spotted a mountain of bricks directly before him. He tensed up and took a deep breath. \* The plane crashed into the mountain and burst into pieces.

**No absolute interest and low constraint.** The toy airliner was losing altitude. For safety's sake, the child turned on the seat belt and no smoking signs. He created some commotion from the struggling passengers. While pretending to manage the unresponsive controls, the child searched hard for a place to land. He decided to make the emergency become even more desperate by creating a mountain range. Looking up, the child spotted a mountain of bricks with a flat top directly before him. He tensed up and took a deep breath. \* The plane crashed into the mountain and burst into pieces.

**Absolute interest and explicit.** The big airliner was losing altitude. For safety's sake the pilot turned on the seat belt and no smoking signs. He heard some commotion

from the struggling passengers. While failing to manage the unresponsive controls, the pilot searched hard for a place to land. The emergency became more desperate as they approached a mountain range. Looking up, the pilot knew they would crash into the tall mountain directly before him. He tensed up and took a deep breath. \* The plane crashed into the mountain and burst into pieces.

**Absolute interest and high constraint.** The big airliner was losing altitude. For safety's sake the pilot turned on the seat belt and no smoking signs. He heard some commotion from the struggling passengers. While failing to manage the unresponsive controls, the pilot searched hard for a place to land. The emergency became more desperate as they approached a mountain range. Looking up, the pilot became forlorn when he saw a tall mountain directly before him. He tensed up and took a deep breath. \* The plane crashed into the mountain and burst into pieces.

**Absolute interest and low constraint.** The big airliner was losing altitude. For safety's sake the pilot turned on the seat belt and no smoking signs. He heard some commotion from the struggling passengers. While failing to manage the unresponsive controls, the pilot searched hard for a place to land. The emergency became more desperate as they approached a mountain range. Looking up, the pilot saw a tall mountain with the flat plateau directly before him. He tensed up and took a deep breath. \* The plane crashed into the mountain and burst into pieces.

**Concept: Violence; Target Word: Dump (in Trash; on Person)**

**No absolute interest and explicit.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As she became

more upset, the man suddenly apologized. He had already eaten a bite, so she would have to dump the rest. Carol glanced at the trash can and lifted up the plate of spaghetti. \* Carol then dumped the rest in the trash.

**No absolute interest and high constraint.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As she became more upset, the man suddenly apologized. He had already taken a bite, so she couldn't return it to the kitchen. Carol glanced at the trash can and lifted up the plate of spaghetti. \* Carol then dumped the rest in the trash.

**No absolute interest and low constraint.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As she became more upset, the man suddenly apologized. He had already taken a bite, so she couldn't return it to the kitchen. Carol glanced at the trash can but heard her stomach growl as she lifted up the plate of spaghetti. \* Carol then dumped the rest in the trash.

**Absolute interest and explicit.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As he became louder and nastier, she lost control. He had already eaten half, so Carol knew he lied. She decided

she should dump it on the man's head to truly reveal its temperature. Angrily, she lifted up the plate of spaghetti. \* Carol then dumped the spaghetti on the customer's head.

**Absolute interest and high constraint.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As he became louder and nastier, she lost control. He had already eaten half, so Carol knew he lied. She wasn't thinking of the consequences when she lifted up the plate of spaghetti. \* Carol then dumped the spaghetti on the customer's head.

**Absolute interest and low constraint.** Carol was fed up with her job waiting on tables. Customers were rude, the chef was impossibly demanding, and the manager had made a pass at her just that day. The last straw came when a rude man at one of her tables complained that the spaghetti she had just served was cold. As he become louder and nastier, she lost control. He had already eaten half, so Carol knew he lied. She heard her stomach growl as she angrily lifted up the plate of spaghetti. \* Carol then dumped the spaghetti on the customer's head.

**Concept: Violence; Target Word: Throw (Flowers; Produce)**

**No absolute interest and explicit.** As the produce company president ended his speech, there were shouts from the crowd of workers. Since the reopening of the factory had been announced, the workers had become increasingly happy. Several in the crowd had been broke, unable to buy even bread or eggs for their families. Clutching the victory flowers, they were waiting for the signal to throw them. That signal came as the union leader got to his feet, cheered loudly, and raised his fist. \* The workers threw the flowers at the president.

**No absolute interest and high constraint.** As the produce company president ended his speech, there were shouts from the crowd of workers. Since the reopening of the factory had been announced, the workers had become increasingly happy. Several in the crowd had been broke, unable to buy even bread or eggs for their families. Clutching the victory flowers, they were waiting for the signal to throw them. That signal came as the union leader got to his feet, cheered loudly, and raised his fist. \* The workers threw the flowers at the president.

**No absolute interest and low constraint.** As the produce company president ended his speech, there were shouts from the crowd of workers. Since the reopening of the factory had been announced, the workers had become increasingly happy. Several in the crowd had been broke, unable to buy even bread or eggs for their families. Clutching the victory flowers and reaching for their comrades' hands, they were waiting for the signal. That signal came as the union leader got to his feet, cheered loudly, and raised his fist.\* The workers threw the flowers at the president.

**Absolute interest and explicit.** As the produce company president started his speech, there were shouts from the crowd of workers. Since the shutdown of the factory had been announced, the workers had become increasingly angry. Several in the crowd feared they would go broke, and brought bags of tomatoes, rotting vegetables, and eggs. Clutching the bags, they were only waiting for a signal to throw the contents. That signal came as the union leader got to his feet, cursed loudly, and raised his fist. \* The workers threw the produce at the president.

**Absolute interest and high constraint.** As the produce company president started his speech, there were shouts from the crowd of workers. Since the shutdown of

the factory had been announced, the workers had become increasingly angry. Several in the crowd feared they would go broke, and brought bags of tomatoes, rotting vegetables, and eggs. Clutching the bags, they were only waiting for a signal. That signal came as the union leader got to his feet, cursed loudly, and raised his fist. \* The workers threw the produce at the president.

**Absolute interest and low constraint.** As the produce company president started his speech, there were shouts from the crowd of workers. Since the shutdown of the factory had been announced, the workers had become increasingly angry. Several in the crowd feared they would go broke, and brought bags of tomatoes, rotting vegetables, and eggs. Clutching the bags and reaching for their family photos, they were only waiting for a signal. That signal came as the union leader got to his feet, cursed loudly, and raised his fist. \* The workers threw the produce at the president.

**Concept: Romance; Target Word: Hide (Gifts; Self)**

**No absolute interest and explicit.** George and Rachel had been wrapping gifts in their bedroom when they heard the children at the front door. The children had just returned from playing and were hungry for dinner. George jumped up in a panic as he heard the children racing up the stairs. He knew the gifts couldn't be seen looking like this. He spotted a place to hide the gifts in the closet and dashed across the room towards it. \* George quickly hid the gifts in the closet.

**No absolute interest and high constraint.** George and Rachel had been wrapping gifts in their bedroom when they heard the children at the front door. The children had just returned from playing and were hungry for dinner. George jumped up in a panic as he heard the children racing up the stairs. He knew the gifts couldn't be

seen looking like this. He spotted the closet and dashed across the room towards it. \* George quickly hid the gifts in the closet.

**No absolute interest and low constraint.** George and Rachel had been wrapping gifts in their bedroom when they heard the children at the front door. The children had just returned from playing and were hungry for dinner. George jumped up in a panic as he heard the children racing up the stairs. He needed to put on a fresh shirt and knew the gifts couldn't be seen looking like this. He spotted the closet and dashed across the room towards it. \* George quickly hid the gifts in the closet.

**Absolute interest and explicit.** George and Rachel were embracing passionately in her bedroom when they heard her husband at the front door. She had forgotten he would be home for dinner tonight. George jumped up in a panic as he heard Rachel's husband call up to her. He realized he couldn't leave without being seen. At last, he spotted the closet as a place to hide, and dashed across the room towards it. \* George quickly hid himself in the closet.

**Absolute interest and high constraint.** George and Rachel were embracing passionately in her bedroom when they heard her husband at the front door. She had forgotten he would be home for dinner tonight. George jumped up in a panic as he heard Rachel's husband call up to her. He realized he couldn't leave without being seen. At last, he spotted the closet, and dashed across the room towards it. \* George quickly hid himself in the closet.

**Absolute interest and low constraint.** George and Rachel were embracing passionately in her bedroom when they heard her husband at the front door. She had forgotten he would be home for dinner tonight. George jumped up in a panic as he

heard Rachel's husband call up to her. He realized he couldn't leave without being seen. Spotting his clothes near the open closet, he dashed across the room. \* George quickly hid himself in the closet.

**Concept: Romance; Target Word: Watch (Movie; Basketball)**

**No absolute interest and explicit.** John and Fred met in a college math class. Both wanted to be math teachers and had many other things in common. They tried to hang out together, but lately John had been extremely busy. That afternoon, John went to visit Fred. Fred made a snack with beer and chips. They talked about their favorite players. John told Fred that there was a basketball game that would be televised in a few minutes. John moved to the armchair. Fred picked up the remote so that they could watch the game. Fred sat on the couch. \* John and Fred watched the basketball game.

**No absolute interest and high constraint.** John and Fred met in a college math class. Both wanted to be math teachers and had many other things in common. They tried to hang out together, but lately John had been extremely busy. That afternoon, John went to visit Fred. Fred made a snack with beer and chips. They talked about their favorite players. John told Fred that there was a basketball game that would be televised in a few minutes. John moved to the armchair. Fred picked up the remote from the counter. Fred sat on the couch. \* John and Fred watched the basketball game.

**No absolute interest and low constraint.** John and Fred met in a college math class. Both wanted to be math teachers and had many other things in common. They tried to hang out together, but lately John had been extremely busy. That afternoon, John went to visit Fred. Fred made a snack with beer and chips. They talked about their favorite players. John told Fred that there was a basketball game that would be televised in a few minutes. John moved to the armchair. Fred picked up the remote from

the counter. Fred looked at the clock on the wall as he sat on the couch. \* John and Fred watched the basketball game.

**Absolute interest and explicit.** John and Mary met in a college math class. Both wanted to be math teachers and had many other things in common. They tried to spend time together, but lately John had been extremely busy. That afternoon, John went to visit Mary. John had made an elaborate snack with wine and cheese. They talked about their favorite actors. John told Mary that there was a movie they would enjoy that would be televised in few minutes. John moved to the couch. Mary picked up the remote so that they could watch the movie. Mary sat on the couch. \* John and Mary watched the movie.

**Absolute interest and high constraint.** John and Mary met in a college math class. Both wanted to be math teachers and had many other things in common. They tried to spend time together, but lately John had been extremely busy. That afternoon, John went to visit Mary. John had made an elaborate snack with wine and cheese. They talked about their favorite actors. John told Mary that there was a movie they would enjoy that would be televised in few minutes. John moved to the couch. Mary picked up the remote from the counter then she sat on the couch. \* John and Mary watched the movie.

**Absolute interest and low constraint.** John and Mary met in a college math class. Both wanted to be math teachers and had many other things in common. They tried to spend time together, but lately John had been extremely busy. That afternoon, John went to visit Mary. John had made an elaborate snack with wine and cheese. They talked about their favorite actors. John told Mary that there was a movie they would

enjoy that would be televised in few minutes. John moved to the couch. Mary picked up the remote from the counter. Mary looked at the clock on the wall as she sat on the couch. \* John and Mary watched the movie.

APPENDIX B  
TABLES OF MEANS AND STANDARD DEVIATIONS

Table B-1. Means and standard deviations for interest rating by text version

		WMC	Mean	Std. deviation	N
No absolute interest	Low constraint	Low	1.31	.99	18
		Mid	1.67	1.76	23
		High	2.61	1.49	19
		Total	1.86	1.55	60
	High constraint	Low	1.50	1.25	18
		Mid	1.98	1.70	23
		High	1.92	1.76	19
		Total	1.82	1.58	60
	Explicit constraint	Low	1.58	1.19	18
		Mid	2.39	1.54	23
		High	1.63	1.42	19
		Total	1.91	1.43	60
With absolute interest	Low constraint	Low	2.64	1.71	18
		Mid	3.24	1.78	23
		High	3.47	1.85	19
		Total	3.13	1.79	60
	High constraint	Low	2.47	1.50	18
		Mid	3.09	2.00	23
		High	3.03	1.32	19
		Total	2.88	1.66	60
	Explicit constraint	Low	2.94	1.32	18
		Mid	2.98	1.72	23
		High	2.95	1.39	19
		Total	2.96	1.48	60

Table B-2. Means and standard deviations for predictive inference by text version

		WMC	Mean	Std. deviation	N
No absolute interest	Low constraint	Low	.22	.43	18
		Mid	.37	.48	23
		High	.37	.50	19
		Total	.33	.47	60
	High constraint	Low	.72	.43	18
		Mid	.46	.45	23
		High	.61	.49	19
		Total	.58	.46	60
	Explicit constraint	Low	.58	.46	18
		Mid	.48	.51	23
		High	.61	.49	19
		Total	.55	.49	60
With absolute interest	Low constraint	Low	.42	.46	18
		Mid	.48	.44	23
		High	.45	.50	19
		Total	.45	.46	60
	High constraint	Low	.39	.47	18
		Mid	.52	.46	23
		High	.61	.46	19
		Total	.51	.47	60
	Explicit constraint	Low	.56	.45	18
		Mid	.48	.51	23
		High	.55	.47	19
		Total	.53	.47	60

Table B-3. Means and standard deviations for open ended questions by text version

		WMC	Mean	Std. deviation	N
No absolute interest	Low constraint	Low	2.50	.79	18
		Mid	2.61	.66	23
		High	2.76	.48	19
		Total	2.63	.65	60
	High constraint	Low	2.56	.70	18
		Mid	2.63	.46	23
		High	2.58	.69	19
		Total	2.60	.61	60
	Explicit constraint	Low	2.92	.26	18
		Mid	2.57	.57	23
		High	2.79	.42	19
		Total	2.74	.46	60
With absolute interest	Low constraint	Low	2.83	.38	18
		Mid	2.85	.35	23
		High	2.79	.54	19
		Total	2.83	.42	60
	High constraint	Low	2.94	.24	18
		Mid	2.96	.21	23
		High	2.95	.23	19
		Total	2.95	.22	60
	Explicit constraint	Low	2.78	.43	18
		Mid	2.89	.30	23
		High	2.87	.33	19
		Total	2.85	.35	60

Table B-4. Means and standard deviations for recall by text version

		WMC	Mean	Std. deviation	N
No absolute interest	Low constraint	Low	.42	.22	18
		Mid	.55	.23	23
		High	.46	.21	19
		Total	.48	.22	60
	High constraint	Low	.47	.15	18
		Mid	.58	.20	23
		High	.53	.28	19
		Total	.53	.22	60
	Explicit constraint	Low	.48	.17	18
		Mid	.48	.21	23
		High	.49	.23	19
		Total	.49	.20	60
With absolute interest	Low constraint	Low	.56	.21	18
		Mid	.63	.23	23
		High	.58	.25	19
		Total	.60	.23	60
	High constraint	Low	.51	.19	18
		Mid	.64	.19	23
		High	.58	.19	19
		Total	.58	.20	60
	Explicit constraint	Low	.46	.18	18
		Mid	.51	.15	23
		High	.53	.25	19
		Total	.50	.19	60

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