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TIME ESTIMATION AND MEMORY
FOR TEXT FOLLOWING MENTAL
TIME TRAVEL

by

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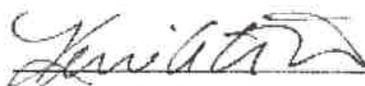
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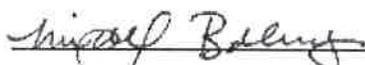
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Abstract

Time Estimation and Memory for Text Following Mental Time Travel

Jacquelyn B. Palmer

An individual's memory for information is reliant upon many circumstances such as environmental context (Godden & Baddeley, 1975), sensory cues (Balch & Lewis, 1996), mood (Eich, Macaulay, & Ryan, 1994), mental context (Sahakyan, Abushanab, Smith, & Gray, 2014), and cognitive processes such as working memory (McVay & Kane, 2012). Past research indicates that context change during encoding and retrieval facilitates forgetting of information and increases retrospective time estimation (Sahakyan & Smith, 2014). We investigated the effects of temporal context change on retrospective time estimation and memory for narrative information. We also explored working memory in relation to time estimation and recall. Results indicate slightly longer retrospective time estimates for participants who engaged in a temporally far context change compared to those who engaged in a temporally near context change or no context change. Recall of inference questions was more accurate for near-context change Ss than for far- or no-context change Ss. Working memory was unrelated to all measures in each context change condition. In the no-context condition, time estimation was positively correlated with all recall measures, suggesting that overestimates of time are related to better memory when no temporal context is present to aid in recall.

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Chapter One:

Introduction

Readers rely on retrieval of prior knowledge in order to comprehend and later remember information from a text (Bartlett, 1932; Rogers, Kuiper, & Kirker, 1977). Retrieval and comprehension of text has been associated with individual differences in working memory (McVay & Kane, 2004). In addition, the mental and environmental context in which one learns information affects how well the learned information is recalled (Godden & Baddeley, 1975; Krafka & Penrod, 1985; Smith, Glenberg, & Bjork, 1978). Furthermore, past research has shown that changing one's context – environmental, physiological, or mental -- creates costs associated with learning; information learned prior to the change in one's environment, physiological state, or mental state is not remembered as well as information learned subsequent to the context change (Sahakyan & Kelley, 2002). For example, if an individual learns information in Room A, but is tested on that information in Room B, the individual has removed oneself from the learning context, thus, may have changed their environmental context between encoding and retrieval.

The occurrence of a context change between learning and retrieval has also been associated with one's retrospective time estimation while recalling word lists (Sahakyan & Smith, 2014). In the example above, the individual is likely to make a longer time estimates of how much time has passed since the information was learned compared to

the individual learning and being tested on that information in the same environmental context. Retrospective time estimates have been proposed to offer a reliable method to assess the occurrence of individuals engaging in mental context change, where a change in context between encoding and retrieval elicits longer time estimates from when the information was encoded to its retrieval (Sahakyan & Smith, 2014). Furthermore, past research indicates that an individual's working memory can influence how well they engage in context change and, thus, recall information and report time estimations after engaging in context change. Therefore, another factor to consider with regard to context change, memory, and time estimation is the role of individual differences in memory performance.

Therefore, the present study investigated the effect of internal context change on individuals' memory for text and retrospective time estimation. In addition, the relationship between internal context change and individual differences in working memory was explored. Context-dependent memory and memory for text is first described followed by a discussion of research regarding individual differences in working memory and its relationship to internal context change and memory for text.

Memory for Text

When encoding and retrieving information from a text, individuals rely on semantic information presented in the text, as well as retrieval of prior knowledge which may include an individual's knowledge of the world and personal, episodic memories (Bartlett 1932; Rogers, Kuiper, & Kirker, 1977). This information aids in the individual's understanding of the events occurring in the text and helps to create predictions for possible events that may occur later in the text, as well as generate

inferences while reading. During the reading and encoding phase, individuals often rely on complex strategies which facilitate the encoding of information and, thus, better memory for recalling that information later. One of the encoding strategies used by individuals to better recall information is to relate the new information to one's prior knowledge or experiences (Bartlett, 1932). Moreover, recall for new information is increased when the individual relates the information to oneself, a phenomenon called the self-reference effect (Rogers et al., 1977).

Kintsch (1988) discussed a model for memory and comprehension of text. He explained that the cognitive processes are similar between list-learning and text learning. However, Kintsch suggested that more complex processes such as personal knowledge and experience from the reader are involved when readers are processing text, which supports past findings on text processing, such as readers' use of semantic knowledge to aid in their memory and comprehension of the text, as well as the self-reference effect during reading (Bartlett, 1932; Rogers et al., 1977). In addition, Kintsch, Kozminsky, Streby, McKoon, and Keenan (1975) found that participants' comprehension and memory for text is increased when individuals are familiar with the content contained within the text and when they can utilize their semantic knowledge to process the story.

Although past research indicates that there are similarities between cognitive processes during list learning and text learning (Kintsch, 1988), there is limited research focusing on the effect of mental context change on memory for text. Past research shows that changing one's context—environmental, psychopharmacological, or mental—affects how well newly learned information via word-list procedures is recalled later (Godden & Baddeley, 1975; Goodwin, Powell, Bremer, Hoine, & Stern, 1969; Sahakyan & Kelley,

2002), but this phenomena has not been investigated in memory for text. The current study investigated memory for text after participants engaged in mental context change while reading. The current study also explored the relationship between working memory and the effects of mental context change during reading.

Context-Dependent Memory

In addition to the retrieval of information being associated with one's prior knowledge or experiences, the context in which information from a text is encoded and retrieved also affects one's recall of information (Godden & Baddeley, 1975; Krafka & Penrod, 1985; Smith, Glenberg, & Bjork, 1978). During encoding, cues associated with the learning context are encoded along with the information to be remembered. External contextual cues associated with learned information can come from the individual's environment (Godden & Baddeley, 1975; Smith, 1986; Smith, Glenberg, & Bjork, 1978) and from sensory input (Balch & Lewis, 1996; Schab, 1990; Smith, 1985). Internal contextual cues related to learning include: psychopharmacological state (e.g., marijuana, alcohol; Crow & Ball, 1975; Goodwin et al., 1969); emotional state (Bower, Monteiro, & Gilligan, 1978; Eich, Macaulay, & Ryan, 1994); and mental state (Delaney & Sahakyan, 2007; Sahakyan & Kelley, 2002; Sahakyan & Smith, 2014).

In the classic experiment by Godden and Baddeley (1975), changes in one's external context resulted in forgetting of new information. In their experiment, participants learned a word list in one of two conditions, on land or underwater. Participants were then tested either in the context of which they learned the words or in the alternate external context. Participants whose learning context matched their retrieval context recalled more words than those whose learning and retrieval contexts

mismatched. These results show that the environment in which one learns information is associated with the information learned. Therefore, during retrieval, if the cues from the encoding environment are not available, recall of that information is reduced.

However, results from previous studies have shown that reinstatement of the original context can reduce the costs associated with environmental context change (Godden & Baddeley, 1975, Krafka & Penrod, 1985; Wong & Read, 2011). For example, in their second experiment, Godden and Baddeley investigated the reinstatement of an environmental context and its effect on memory for words. In this experiment, divers were assigned to one of two conditions. In the same context condition, participants studied a word list while floating on the surface of the water and then recalled the words while remaining above water throughout the entire duration of the experiment. Participants in the context reinstatement condition encoded a list of words, then dove 20 feet underwater; upon their resurfacing, they recalled the word list. Godden and Baddeley found that participants' memory for words did not differ significantly between the two conditions. They concluded that while a change in one's environmental context from encoding to retrieval can produce forgetting, reinstating the original context before retrieval can reduce the costs associated with changing one's context.

In addition, context reinstatement provides researchers with evidence that forgetting via environmental context change is not due to a cognitive disruption, but rather due to cues associated with the surrounding environment which are encoded along with the learned information (Godden & Baddeley, 1975). Physical context is not the only context with which cognitive processes associate information during encoding. Just as external context change affects recall of information, internal context has also been

linked to the forgetting and remembering of information (Jang & Huber, 2008; Sahakyan & Kelley, 2002; Sahakyan & Smith, 2014). Similar to external context change occurring when an individual is removed from one environment and placed in another, internal context change occurs when one removes oneself from their current cognitive state.

The internal context of mental state was first studied by Sahakyan and Kelley (2002) using a directed forgetting paradigm. During list-method directed forgetting, participants receive a list of words and then are given either instructions to remember or forget the list. They are then given a second list to learn. Later, participants are asked to recall all the words they can remember from both lists. In this paradigm, the group instructed to forget the first list shows reduced recall for that list, which researchers consider to be costs of directed forgetting, compared to the group asked to remember both lists. However, recall of the second list is increased in the group instructed to forget the first list, which researchers consider to be the benefits of directed forgetting. Sahakyan and Kelley hypothesized that these findings are because participants in the *forget* group engage in a mental context change, where participants utilize strategies to intentionally forget the information, such as thinking of something else instead of rehearsing the items on the first list.

Sahakyan and Kelley (2002) compared the recall of two lists between four groups – the forget group, the remember group, the forget-context change group, and the remember-context change group. The basic procedures of the directed forgetting paradigm were used during the forget and remember groups. However, the forget and remember- context change groups had an additional manipulation using a diversionary paradigm, in which the two groups were instructed to imagine what they would do if they

were invisible. By introducing these instructions into these two groups, Sahakyan and Kelley were able to compare the results of established directed forgetting procedures with the recall of participants engaging in mental context change (e.g. engaging in imagining they are invisible).

Sahakyan and Kelley (2002) found that reduced recall for list one and increased recall for list two in the forget group was similar to recall found in both context change groups. They concluded that cognitive strategies used in these three different groups are similar, in which participants in these three groups engaged in mental context change. These findings suggest that, by engaging in mental context change, participants perform similarly to groups instructed to intentionally forget information, which is also similar to Godden and Baddeley's (1975) results regarding environmental context change.

In Experiment 2, Sahakyan and Kelley (2002) introduced reinstatement instructions into their procedures. When participants first entered the lab, they were exposed to a memorable environmental context where the theme song to *Star Wars* was playing. In this experiment, Sahakyan and Kelley investigated recall between three groups: remember, forget, and remember-context change. In addition, these three groups either had their mental context reinstated from the original context --- The *Star Wars* theme song – by having the researcher instruct participants to think back to the start of the experiment and try to imagine anything from the beginning that they can, or the participants' context was not reinstated. By using these procedures, Sahakyan and Kelley were able to test the effect of context reinstatement, as previously studied in Godden and Baddeley's (1975) second experiment. The results from this experiment showed increased recall for list one when the original context was reinstated in the forget and

remember-context change groups and increased recall for list two compared to the remember group. These results indicate that the costs and benefits of directed forgetting and mental context change can be eliminated if the original context is reinstated, as previously shown in Godden and Baddeley's environmental context change study.

The effect of internal context change on memory for words was also studied by Sahakyan and Smith (2014) who investigated retrospective time estimates as a marker for engaging in internal context change after studying lists of words. Sahakyan and Smith referred to Block and Reed's (1978) research regarding the relationship between retrospective judgments of time duration and context change. Specifically, Block and Reed investigated retrospective time estimates after participants learned words using either shallow or deep processing methods. They found that participants who engaged in deeper encoding were likely to give larger time estimates compared to participants who engaged in shallow encoding processes, and that recall was related to time estimates, where the more individuals recalled, the shorter they perceived the duration of the task. Block and Reed suggested that the farther individuals remove themselves from their current context, the longer they retrospectively estimate the time duration to be. Therefore, Sahakyan and Smith investigated these findings to determine if similar contextual changes occur during directed forgetting with diversionary procedures, and if these changes in mental context can be reliably predicted by retrospective time estimates.

In their first experiment, Sahakyan and Smith (2014) used the list-method directed forgetting paradigm to test the effects of internal context change on retrospective time estimation and recall of words. The list-method directed forgetting paradigm consists of words segmented into lists, and participants would receive either a forget or remember

cue following the presentation of the list. Following the presentation of all word lists, participants estimated how much time they thought had passed since the beginning of the experiment. Then, all participants recalled the second list of words. Sahakyan and Smith found that the forget group recalled fewer words and overestimated the duration of the experiment compared to the remember group. Specifically, the forget cue served as an internal context change to participants, due to the mental segmentation between being directed to forget versus being directed to remember information.

In Experiment 2, Sahakyan and Smith (2014) replicated the effects of Experiment 1 using a slightly different list-learning procedure, the list-before-last paradigm. The list-before last paradigm consists of word lists that participants are instructed to learn for a later memory test. When given the recall test, participants are asked to recall as many words as they can remember from the list prior to the last list they received. Furthermore, the no context change group restudied a list of words, whereas the context change group was tested on a list of words. Sahakyan and Smith explained that participants remained in the same mental context when instructed to restudy words, remaining in the same mental context throughout the experiment. However, when tested, the testing creates a mental segmentation, which breaks up the experiment into three portions- the study phase, the test phase, and the second study phase. Similar to their first experiment, participants estimated how much time had passed throughout the experiment and then recalled the list before the last list presented. Sahakyan and Smith found that participants engaged in internal context change when they were tested on list one compared to participants who were asked to restudy the list. Results from this experiment were similar to the results

from the first experiment, where the context change group recalled fewer words and overestimated the time length of the experiment compared to the restudy group.

Sahakyan and Smith (2014) suggested that retrospective time estimation experiments as related to mental context change are important to understanding and building theoretical foundations for the context change literature. Using retrospective time estimates as markers for individuals engaging in mental context change allows researchers to not only rely on participants' recall of information to infer context change. In addition, the effects of context change on the remembering and forgetting of information is dependent upon individual differences in working memory.

According to Delaney and Sahakyan (2007), there may be individual differences in the extent to which individuals rely on contextual information during encoding and retrieval. Delaney and Sahakyan investigated context change using procedures similar to Sahakyan and Kelley's (2002) experiment (e.g. forget group, remember group, and remember-context change group). However, in this experiment, the diversionary procedure instructed participants to imagine and describe their parents' house as if they were walking through it. In addition, participants were assessed on verbal working memory capacity (WMC) using the OSPAN (Turner & Engle, 1989). Delaney and Sahakyan found that in the remember-context change and forget conditions, high WMC individuals' recall was worse compared to low WMC individuals, whereas high WMC individuals recalled more words in the remember condition. These results indicate that high WMC individuals were hindered in their performance when they engaged in context change. Delaney and Sahakyan concluded from these results that the amount of information later recalled by participants after learning word lists and engaging in a

change of context is dependent upon the individual's working memory capacity. High WMC individuals show a larger detriment in their performance due to their reliance on contextual cues during encoding and retrieval. WMC is an important individual differences construct that has been shown to predict performance in a wide variety of areas such as recall during context change tasks (Delaney & Sahakyan, 2007), as well as reading comprehension and other higher order cognitive tasks (Baddeley, 1983; Daneman & Merikle, 1996).

Working Memory

Working memory capacity (WMC) suggests that individuals have a limited capacity at which they are able to perform higher order cognitive tasks such as reasoning, comprehending, and learning (Baddeley, 1983; Daneman & Merikle, 1996). However, individuals rarely perform at their capacity due to external and internal influences (Engle, 2002). For example, internal factors such as stress, hunger, and fatigue, and environmental factors such as visual or auditory distractions can decrease performance on a primary task of working memory.

One theory that explains individual differences in WMC is the executive control theory (Engle, 2002). This theory states that the executive control system monitors, and is responsible for, controlling attention, thus blocking intrusions and information that is not relevant to an individual's current situation (Engle & Kane, 2004). Therefore, high WMC individuals are more efficient at blocking out irrelevant information, as well as external and internal influences as mentioned previously, and, thus, encoding relevant information. The efficiency of executive control varies from person to person. Thus,

individual differences in performance on working memory tasks leads researchers to investigate causes for performance variability.

WMC assessments can be categorized into simple span and complex span tasks. Tasks used to assess short-term memory (STM) consisted of participants recalling a list of items in the order they were presented immediately following their presentation. These lists can consist of letters, figures, words, or digits. The number of items correctly recalled determined the individual's short-term abilities. These simple span tasks were used to assess an individual's ability to temporarily store information; however, the advent of complex span tasks has allowed researchers to assess cognitive abilities (e.g. WMC) which have been shown to be more strongly correlated with higher order cognitive abilities such as reading comprehension, learning, and reasoning (Baddeley, 1983; Daneman & Merikle, 1996). Methods of assessing WMC with complex span tasks vary depending on whether verbal WMC (Reading Span, RSPAN, Daneman & Carpenter, 1980; Operation Span, OSPAN, Turner & Engle, 1989) or spatial WMC (Rotation Span, RotSpan, Shah & Miyake, 1996; Symmetry Span, SSPAN, Kane et al., 2004)

RSPAN, a complex span task developed by Daneman and Carpenter (1980), assesses an individual's ability to temporarily store information (remembering and recalling a word presented between sentence trials) while simultaneously performing other actions (assessing whether or not a sentence makes sense). During RSPAN, participants read sentences and make a true or false judgment regarding whether or not the sentence makes sense. At the end of each block, participants are asked to recall the last word of each sentence. Learning the last word of each sentence while simultaneously

making judgments about the sentences' semantics presumably taxes cognitive resources; however, people who have a more efficient working memory are more likely to perform well during tasks such as these, as individuals with high WMC utilize more complex strategies of storing and manipulating information compared to individuals with low WMC. RSPAN was later automated and revised, where participants read sentences and make judgments about whether or not the sentence makes sense, then learn letters in between sentence presentations for later recall, which will be described later (Oswald, McAbee, Reddick, & Hambrick, 2015).

Since the development of RSPAN, several other complex span tasks have been introduced into working memory research, such as the operation span (OSPAN; Turner & Engle, 1989), rotation span (RotSpan; Shah & Miyake, 1996), and symmetry span (SSPAN; Kane et al., 2004). Similar to RSPAN, these other tasks involve learning an item (e.g., a letter, directionality of a letter, or location of a square) while simultaneously evaluating information (e.g., arithmetic problems, directionality of an arrow, or symmetry of figures). Complex span tasks have allowed researchers to investigate how individual differences in working memory tasks predict performance in everyday activities, including reading comprehension (McVay & Kane, 2012) and attentional control (Kane, Bleckley, Conway, & Engle, 2001; Kane & McVay, 2012), and retrieval (Unsworth, 2007; Unsworth, 2009a, Unsworth 2009b; Aslan & Bauml, 2011). Furthermore, the ability of an individual to process and recall information from a story is heavily influenced by the individual's working memory capacity (Dixon, LeFevre, & Twilley, 1988; McVay & Kane, 2004).

Working Memory and Memory for Text. Dixon, LeFevre, and Twilley (1988) investigated the relationship between WMC and reading comprehension. In this study, participants' WMC was assessed via three measures, one complex span task, RSPAN (Daneman & Carpenter, 1980), and two simple span tasks, digit span and word recall. To measure reading skill, participants completed several tests measuring reading abilities. Dixon et al. (1988) found that RSPAN (Daneman & Carpenter, 1980) was the only working memory assessment which was able to predict reading comprehension, in which individuals with higher WMC showed increased performance on the reading comprehension test compared to individuals with lower WMC.

In addition, McVay and Kane (2004) investigated mind wandering and its relationship to reading comprehension and working memory. In their study, participants completed three complex span tasks (OSPAN, RSPAN, and SSPAN), read journal articles and excerpt from books with thought probes placed throughout to assess mind wandering while reading, and they completed several tasks to assess attentional control. McVay and Kane found that participants with high WMC reported being on task more while reading compared to participants with low WMC. McVay and Kane concluded that these findings support the executive attention theory of WMC, where attention is driven by WMC; therefore, people with high WMC are more efficient at controlling their attention, which allows high WMC individuals to perform better on tasks involving attention and reading comprehension.

Working Memory and Internal Context Change. Individual differences in working memory have also been shown to predict the impact of internal context change on forgetting in directed forgetting experiments (Aslan, Zellner, & Bauml, 2010; Delaney &

Sahakyan, 2007). As noted earlier, Delaney and Sahakyan found that low WMC individuals are not impacted as greatly by context change compared to high WMC individuals. Delaney and Sahakyan suggested that lower WMC individuals may not utilize contextual cues as much as high WMC individuals because they may be less effective at storing contextual information during encoding compared to individuals with high WMC. In addition, because high WMC individuals rely heavily on complex strategies during cognitive tasks, they show larger detriments in their recall during context change.

Though much research has focused on the effects of internal context change on memory for word lists, there is far less research that examines the impact of internal context change on memory for text and any individual differences in WMC that may impact the effects of context change on memory performance. Therefore, the present study investigated memory for text and retrospective time estimation following participants reading a story.

The Present Study

The current study investigated the occurrence of internal context change, memory for text, and reported retrospective time estimation, which was predicted to promote temporal contextual change among participants. The contextual instructions for reading the text were manipulated in order to facilitate mental time travel during text processing to either a *near* temporal context, *far* temporal context, or a no-context control. The contextual instructions for the near group informed participants that the story has taken place in a high school lunchroom setting, presumably because college students (the participants in this study) are temporally closer to their high school experiences. The

instructions for the far condition stated that the story has taken place in an elementary school lunchroom setting, and the control condition contained instructions that the story has taken place in a lunchroom, therefore not offering any temporal cues to participants. In addition, this study investigated working memory related to temporal context change.

According to past literature (Sahakyan & Kelley, 2002; Sahakyan & Smith, 2014), the further one removes oneself from one's current context, the more that person will engage in context change, thus affecting their memory for newly learned information. In addition, their retrospective perception of time of how long the entire experimental session has taken has been shown to provide a reliable marker for participants engaging in mental context change and, in turn, is negatively related to recall of newly learned information (Smith & Sahakyan, 2014). Therefore, the far condition was predicted to engage participants in more internal context change compared to the near condition. Furthermore, retrospective time estimations of the task duration for the far condition were hypothesized to be longer than those in the near condition.

Additionally, the proposed study investigated the occurrence of internal context change and retrospective time estimation among participants, and also assessed participants' working memory via OSPAN and RSPAN. Based on Delaney and Sahakyan's (2007) results that persons with high WMC rely on complex cognitive strategies to perform well on tasks, including associating contextual cues with information during encoding and, thus, relying on these cues for retrieval, in the current study, participants with higher WMC were predicted to have a larger detriments in recall when engaging in the far mental context change condition compared to individuals with lower WMC.

Chapter Two:

Method

Participants

A total of 115 participants were recruited from the Towson University Research Pool. However, the first 7 participants were excluded from the analyses because the final 4 inference questions were not included in the experimental procedures until the after the first seven participants completed the study. Therefore, data from 108 participants was included in the analyses. At the time of participation, all participants were enrolled in undergraduate psychology courses at Towson University. Additionally, all participants were pre-screened to ensure all students participating in this experiment were native English speakers and 18 years of age or older. Participants received either extra-credit or course credit for their participation in this experiment. All participants were tested in the Cognitive Psychology lab in room LA 1116 at Towson University. Additionally, up to six participants were tested during each session.

Materials

Materials used during this experiment consisted of a temporally ambiguous text, two sets of instructions (“near” instructions and “far” instructions, a recall test, and two shortened automated working memory assessments (OSPAN; Turner & Engle, 1979; Oswald et al., 2015; RSPAN; Daneman & Carpenter, 1980).

Text. To assess participants’ memory for text, an excerpt from *Hidden Talents* by David Lubar was modified and presented on the computer screen (see Appendix B for the

text and table of lines with accompanying duration of sentence presentation in milliseconds; see Appendix C for the original text).. The text was modified by the researcher in order to remove any cues to the location or timing of the events occurring throughout the text. After the presentation of the text, a cued recall test was presented. Participants answered 14 questions (9 factual questions, 5 inference questions) about the text (see Appendix D). These questions were created by the researcher to assess participants' memory for the content of the text (e.g., name of the school, names of characters, thoughts expressed by characters, inferences made throughout the story). The questions were presented in a random order by the E-Prime program.

Operation Span (OSPAN). To assess verbal working memory, the shortened automated Operation Span was used (Turner & Engle, 1989; Oswald, et al., 2015). During OSPAN, basic arithmetic problems were shown on the computer screen (e.g. $[7*2] + 4 =$), and participants decided if the answer provided was correct or incorrect. Once the accuracy of the problem was determined by the participant, a to-be-remembered letter was presented on the computer screen. After three to seven arithmetic-letter units were presented, participants were prompted to recall the letters in the order they were presented during the trial.

Reading Span (RSPAN). Similar to OSPAN (Turner & Engle, 1989; Oswald et al., 2015), RSPAN is an automated task used to assess verbal working memory. RSPAN has been shown to predict reading ability and comprehension (Daneman & Carpenter, 1980). During RSPAN, participants were presented with a sentence on the computer screen and were instructed to determine if the sentence makes sense or not. After making this judgment, a letter appeared briefly on the screen. Participants were instructed to

remember this letter for later recall. Then, another sentence would appear on the screen, and then another letter. After a series of sentences and letters, a screen was presented with 12 possible letters on the screen. At this time, participants selected the letters in the order they were presented. Participants were urged at the beginning of the task to try to keep their sentence judgments at least 85% accurate. This was to ensure that participants were attempting to make judgments about the sentences and were not only repeating the letters throughout the entire task. The entire duration of this task was approximately 10 minutes.

Procedure

At the beginning of the experiment, all participants were seated in front of a computer located in the group testing room. Participants were randomly assigned prior to participants entering the lab to receive either the near (10th grade high school lunchroom) instructions, far (5th grade elementary school) instructions, or control (no context/ lunchroom) instructions. All participants were instructed to turn off their cellular phones completely and to place all other belongings on the opposite side of the testing room. This was to ensure that participants were not able to refer to their phone while estimating the duration of the task and to remove any distractions which may interrupt participants' progress, which could potentially create an unwanted contextual change during the experiment. After all participants filled out the demographics questionnaire, the experimenter read brief instructions of the task aloud. All participants were informed that they would be wearing headphones, and they would be expected to listen and follow all directions presented through the headphones carefully throughout the remainder of the experiment. Participants were then informed that once the experiment began, they would

not be allowed to ask questions. Questions were not allowed during the experiment in order to maintain consistent time durations of the experiment among participants; however, participants were only informed that they would not be allowed to ask questions throughout the experiment; the mention of time was withheld throughout the experimental portion of the study. When instructed by the experimenter, all participants agreed aloud that they understood what they were being asked to do throughout the remaining period of testing. Participants then put on the headphones provided, and pressed the Enter key to begin the experiment.

Participants then received specific instructions regarding the experimental condition to which they were assigned. These instructions read, “The following excerpt takes place in a [10th grade high school /5th grade elementary school /no temporal context] lunchroom. Please think back to your past experiences in this setting and relate what you are reading to similar experiences you have had. Try to imagine sounds, sights, and smells from this location.” Instructions were prerecorded, timed, and presented through the headphones, as well as onscreen. After this screen, all participants viewed and heard the following instructions, “On the next screen, you will hear a tone which will signal the official start to the experiment.” This screen was followed by a red screen with a brief tone (3 seconds, 600 MHz), which signaled the official start of the experiment. Once the tone sounded, the experiment officially began. The timing of the experiment was a crucial part of analyzing participants’ retrospective time perception at the end of the experiment. Therefore, the total time from the sound of the starting tone to the tone signaling the end of the reading portion was 5 minutes 33 seconds. After this screen, the

text appeared on the computer screen one sentence at a time (see Appendix B for duration of sentence presentations).

According to Lewandowski, Coddling, Kleinmann, and Tucker (2003), the average oral reading rate for postsecondary students is 189 words per minute (wpm), and they estimated that the silent reading rate for postsecondary students to be somewhere in the low 200 wpm. Due to participants only being able to view one sentence at a time, the silent reading rate in this experiment was expected to be lower than the reading rates estimated by Lewandowski et al.; therefore, the word duration of each sentence presentation was the product of the number of words in each line and 317.5 milliseconds (the average reading rate per word at 189 wpm). The lines and durations ranged from 3 words (952.5 rounded up to 953 milliseconds) to 26 words (8255 milliseconds). This portion of the experiment lasted 5 minutes 33 seconds. After participants read the entire text, a red screen was shown along with a second tone (600 MHz, 3 seconds) signaling the end of this portion of the experiment. On the next screen, participants viewed and heard the following, “This signals the end of this portion of the experiment. Please think back to when the experiment officially began, signaled by the first tone, and estimate how much time you think has passed.” On the following screen, participants were instructed to use the keyboard to record how long in minutes and seconds they believed the experiment lasted beginning from the first tone. The computer screen presented one blank box, where participants typed the number of minutes, pressed the spacebar, and then the number of seconds using the keypad.

Following the reading task, participants completed a brief demographics questionnaire. These questions consisted of age, gender, and handedness. In addition,

participants were asked to rate their ability to imagine their overall lunchroom environment, the sights of their environment, the sounds of their environment, and the smells of their environment on a scale from 1 (*not at all*) to 7 (*very much*).

Once participants gave their time estimates, all participants received the cued recall test. The questions were randomized in the E-Prime program. The instructions presented on the computer screen requested participants to answer all questions to the best of their ability. Participants responded to each question by typing in the answer and pressing the ENTER key. Once participants pressed ENTER, participants advanced to the next question. After participants completed the cued recall test, the second portion of the experiment began.

Participants then performed the automated Operation Span task (OSPAN; Turner & Engle, 1989; Oswald et al., 2015). The OSPAN portion of the experiment lasted approximately 10 minutes. After all participants completed the OSPAN, they then completed the automated RSPAN (Daneman & Carpenter, 1980; Oswald et al., 2015). After all participants completed this final task, participants were debriefed by the experimenter. The duration of the entire experiment was approximately 45 minutes.

Chapter Three:

Results

The temporal context change (near [high school], far [elementary school], control [no-context]) represents the independent variable. Time estimation was calculated as difference score, that is, the difference between reported retrospective time estimations and the actual time duration of the reading task (i.e., the reported time estimate calculated into seconds minus 333 seconds). The proportion correct for recall for the text was calculated as three separate scores: (1) factual recall, or the number of correct responses out of nine; (2) inference recall, or the number of correct responses out of five; and (3) total recall, or the number of correct responses overall out of 14. A single-factor (Temporal Context: near, far, control) between-subjects Multivariate Analysis of Variance (MANOVA) was computed for all four dependent measures. Handedness, age, and reports of vividness were entered as covariates in the analysis. The data from seven participants were excluded because inference questions were not included during testing.

The covariates entered were not significant throughout the multivariate tests, p 's > .05. The analysis indicated a multivariate main effect of temporal context change, Wilk's $\lambda = .81$, $F(8, 148) = 2.02$, $p < .05$, $\eta^2_{(partial)} = .098$, power = .81. Due to the statistical significance of temporal context change, univariate analyses are described below.

Four single-factor univariate ANOVAs for each dependent measure (time estimation, factual recall, inference recall, total recall) were conducted. There was no

significant effect of temporal context for time estimate difference scores, $F(2, 77) = 1.24$, $\eta_{(partial)}^2 = .03$, $p > .05$, power = .26 (see Figure 1).

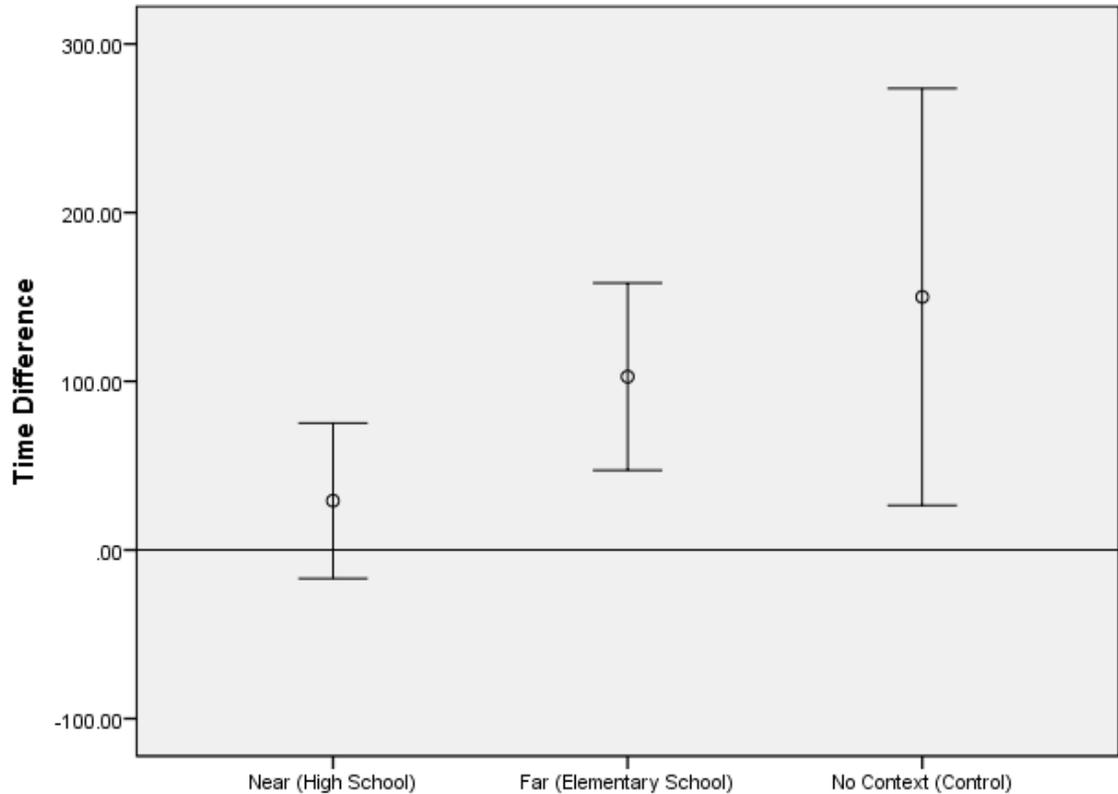


Figure 1. The line intersecting the Y axis indicates the reference line for the mean time estimate reported compared to the actual task duration

Results from analyses on the memory for text showed no significant effects for the proportion of factual recall, $F(2, 77) = 1.88$, $\eta_{(partial)}^2 = .05$, $p > .05$, power = .38, or for the proportion of total recall, $F(2, 77) = 2.23$, $\eta_{(partial)}^2 = .06$, $p > .05$, power = .44. However, results revealed a significant effect of temporal context for the proportion correct for inference questions, $F(2, 77) = 3.45$, $\eta_{(partial)}^2 = .08$, $p = .04$, power = .63 (see Figure 2). Least Squares Difference (LSD) post hoc analyses indicated that participants in the near condition ($M = .53$, $SD = .24$) correctly recalled fewer inference items than the

control condition ($M = .71, SD = .23$). There was no significant difference in inference recall between the control condition and the far condition ($M = .61, SD = .31$) or the near condition and the far condition.

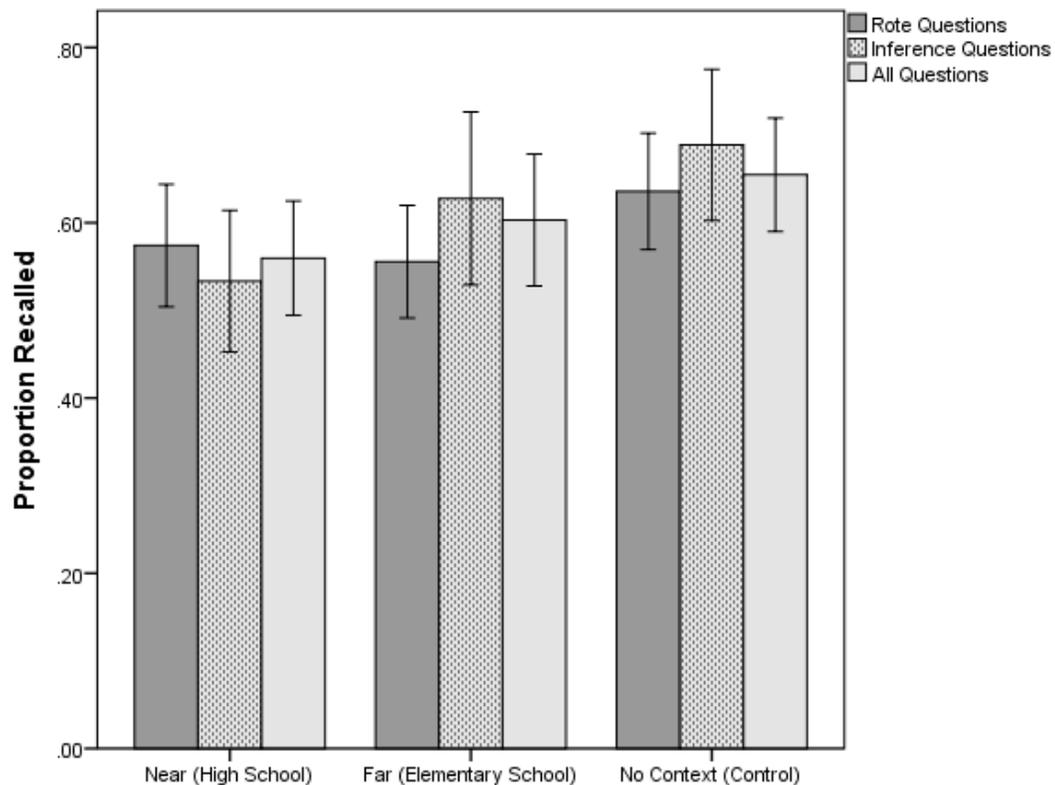


Figure 2. Mean proportion for factual, inference, and overall recall for the text.

Correlational analyses were conducted to determine relationships between OSPAN, RSPAN, and all other dependent variables for each temporal context condition. Results for the near condition (see Table 1a Appendix E) showed strong positive correlations among the recall variables, p 's $< .05$. No significant correlations were found among the variables of time estimation, recall variables, and OSPAN, p 's $> .05$. RSPAN was not significantly correlated with any variables, however, there were weak positive

correlations significant at the $p = .06$ level for total recall, and at the $p = .09$ level for factual recall (see Figure 3d & Figure 3b, Appendix F, respectively).

Similar results were shown for the far condition, in which strong positive relationships occurred among all recall measures (see Table 1b; Appendix E). There were also no significant relationships shown among time estimation, recall, and OSPAN, p 's $> .05$. RSPAN showed no significant correlations to any of the other variables, but factual recall seemed weakly, positively correlated with RSPAN, $p = .08$ (see Figure 3b; Appendix F).

Correlational analyses conducted on the no context condition indicated strong positive relationships among the recall measures (see Table 1c; Appendix E). OSPAN and RSPAN were significantly positively correlated in this condition, $p < .05$. Results also indicated significant moderate to strong positive relationships among the variable of time estimation and all measures of recall, all p 's $< .05$. This findings indicates that times that are overestimated are related to higher proportions of factual, inference, and total recall.

Chapter Four:

Discussion

Results from the current study did not support the hypotheses. The first hypothesis stated that individuals in the far context change condition would significantly overestimate the duration of the reading task compared to those in the near context change condition. Results from this analysis indicated that there were no significant differences between these two groups. Furthermore, the second hypothesis stated that recall for the text would be significantly different between these two groups, where those in the far context change condition would show detriments in recall compared to individuals in the near context change condition; however, no significant differences were shown in the analysis. The third hypothesis stated that compared to low WMC individuals, high WMC individuals would show better recall overall, but would show more detriments in the far context change condition than those in the near context change condition. Although the results were not significant, plots and graphs of the data between conditions and among high and low WMC individuals indicate that there may be interesting potential effects if given a larger sample size. Below, descriptive evaluations of the plots and graphs are presented. It should be noted that all information presented below is purely descriptive, and any differences inferred are speculative interpretations of the data at best.

A scatterplot with fit lines inserted for each condition (Figure 3a; see Appendix F) shows that individuals with low performance on RSPAN slightly underestimated the duration of the reading task in the near condition, the control condition slightly overestimated the duration of the task, and the far condition gave higher estimates of the

reading task. However, individuals performing high on RSPN gave similar estimates, both slightly above the actual duration of the reading task, in the near and far conditions, and individuals in the control condition gave the highest time estimates of the reading task. This plot may indicate that the findings from past context-dependent memory studies showing the relationship between contextual change and retrospective time estimation may affect high and low WMC individuals differently (Delaney & Sahakyan, 2007). Furthermore, individuals with high WMC may engage in more context change when given more ambiguous instructions compared to low WMC individuals. This possible difference in engagement could explain the increased differences in retrospective time estimates for high WMC individuals in the control condition. In addition, the proposed individual differences are illustrated in the scatterplot for OSPAN scores and time differences (see Figure 4a; Appendix F), where low WMC individuals slightly underestimated the duration of the reading task and high WMC individuals overestimated the task duration by several minutes. As stated previously, the overestimation of high WMC individuals in the control (no context) condition may be due to engagement in internal context change, therefore, causing increased retrospective time estimates.

A scatterplot showing fit lines for each condition for RSPAN scores and factual recall of the text (Figure 3b; see Appendix F) indicates that individuals scoring low on RSPAN recalled more information in the control condition compared to the near and far conditions, and recall between the near and far conditions were similar. Furthermore, individuals who scored high on RSPAN performed similarly between all conditions, and all conditions for individuals with high WMC appeared to perform better than all three conditions of low WMC individuals. This finding may indicate that, regardless of

engagement in temporal context change, high WMC individuals may encode and retrieve factual information equally well; however, low WMC individuals may show larger detriments in their memory for factual information after engaging in temporal context change. Furthermore, low WMC individuals may have problems with engaging in context change when given ambiguous instructions. Therefore, they may not be able to successfully engage in context change in the control condition which could explain their increased performance similar individuals with high WMC in the control condition. However, a scatterplot of OSPAN scores and factual recall (Figure 4b; see Appendix F) indicates that high WMC individuals performed slightly worse during the near and far conditions compared to individuals with low WMC. Overall, individuals in the near condition recalled slightly more information than those in the far condition. The plot also indicates obvious differences in recall for the control (no context) condition, where individuals with high WMC out-performed individuals with low WMC, and individuals with high WMC in the control condition recalled more factual information compared to individuals with high WMC in the near and far conditions.

A plot for RSPAN scores and the proportion of inference recall across all conditions (Figure 3c; see Appendix F) shows different results than the previous plot. Individuals with low WMC performed better in the control condition compared to the near and far conditions. Surprisingly, the far condition appeared to perform better regardless of WMC compared to the near condition. For individuals with high WMC, those in the far condition out-performed the control and near conditions. Moreover, individuals with low WMC performed better than individuals with high WMC in the control condition. However, it is important to note that there were only five inference

questions in the current experiment, therefore, the differences portrayed in the plot may not actually be as distinct as they seem.

Furthermore, a plot of OSPAN scores and inference recall across temporal conditions (Figure 4c, see Appendix F) indicates that individuals with high WMC performed similarly between the near and far conditions, whereas individuals with low WMC show increased recall in the far condition and decreased recall in the near condition. The control condition appeared to outperform the far condition, and high WMC individuals in the control condition appeared to outperform low WMC individuals.

A scatterplot showing fit lines for each condition for RSPAN scores and overall recall of the text (Figure 3d; see Appendix F) indicates similar recall between all conditions for high WMC individuals. Individuals with low WMC performed similarly in the control condition; however, overall recall seemed to decrease in the far condition, and individuals with low WMC showed the largest detriment in recall in the far condition. Different results were shown for OSPAN scores and overall recall. A scatterplot (Figure 4d; see Appendix F) shows similar performance for individuals with low WMC in the near and control condition, yet increased overall recall in the far condition. Similar performance was shown for individuals with high WMC in the near and far conditions which indicates equivalent recall compared to individuals with low WMC in the control and near conditions. High WMC individuals appeared to outperform all other groups in the control condition.

The findings between OSPAN and RSPAN scores and outcome variables did not indicate similar patterns. RSPAN was shown to be more correlated with the outcome measures compared to OSPAN. Overall, high WMC individuals recalled more

information from the text compared to low WMC individuals. However, high WMC participants reported longer time estimates in the control group and showed decreased recall for inference questions compared to the near and far context and all low WMC groups. This finding may be due to high WMC individuals having the ability to engage in internal context change when not given specific temporal instructions. Again, a larger sample size is needed in order to ensure that these patterns are stable. Graphs of the results may indicate similar outcomes of retrospective time estimates compared to past findings (Sahakyan & Smith, 2014), yet graphs of recall across conditions presented different findings (Godden & Baddeley, 1975; Sahakyan & Kelley, 2002; Sahakyan & Smith, 2014). Interestingly, if this pattern continues following further research, these potential results could indicate that retrospective time estimates and recall may serve as distinct functions of contextual change, which indicates that recall may, in fact, not be the best method of assessing the occurrence of context change in individuals.

Limitations and Future Directions

As noted earlier, a major limitation to this study was its sample size. According to the observed power in the analyses, no dependent variables had yet reached a satisfactory level of power = .80 (time, observed power = .263; factual recall, observed power = .380; inference recall = .631; total recall, observed power = .442).

Similar to results reported by Sahakyan and Smith (2014), the graph shown above (see Figure 2) indicates a potential difference in retrospective time estimates between temporal context change conditions, whereas the far context change group shows slightly longer time estimates compared to the near context change group. Additionally, since participants in the control condition were not instructed to think of a specific lunchroom

associated with a temporal point in time, it was expected that the reported time estimates from participants in the control group would show more variability compared to the other two groups. Further research should be done continuing this experiment to determine if, in fact, these differences of time estimates between groups do exist with a larger sample size.

Furthermore, the present findings regarding recall across temporal conditions are dissimilar to past findings in word-list context dependent memory research (Godden & Baddeley, 1975; Sahakyan & Smith, 2014). An important distinction between investigating memory for words and memory for text is the encoding phase. When assessing memory for words, the items are learned prior to the context change. In contrast, the current study involved learning information while engaging in temporal context change. These methodological dissimilarities may result in different outcomes for recall. Contrary to previous hypotheses (Sahakyan & Smith, 2014), recall and retrospective time estimates may function independently. Therefore, due to the current findings, retrospective time estimates may be a more reliable assessment of the successful engagement in mental context change.

In addition, results from the working memory span plots did not reveal similar findings compared to previous research by Delaney and Sahakyan (2007). The plots indicate no difference in recall in high working memory individuals across conditions, but variability among low working memory individuals. This potential finding may indicate that high working memory individuals are able to maintain information learned throughout the text while simultaneously engaging in internal context change. However,

low working memory individuals may struggle with these tasks, which may explain the variability across contextual change conditions.

The current study is novel, in that the investigation of the occurrence of mental context change during reading has not been investigated until now. Based on the current findings, there are many possibilities for future research on this topic. For example, how do individuals engage in temporal context change when presented with a topic that occurred prior to their knowledge of the event? Specifically, do individuals mentally time travel to when they first learned of the information, or do they reconstruct the events as if they were present during the event? Moreover, do individuals engage in context change when presented with factual content, such as historical or technical text, similar to fictional stories?

The engagement of temporal context change while reading is an interesting area of research and has many real-world applications. For instance, standardized tests are used frequently to assess reading comprehension. The potential differences in temporal context change between near and far conditions while reading may affect later recall and perceived duration of the reading. In addition, verbal comprehension is a benchmark of student performance in the education system; however, potential findings of the current study may indicate that the temporal context of the story could influence the recall and retrospective time perception of the task, and these outcomes could further be influenced by an individual's WMC.

APPENDICES

Appendix A: Instructions

Experimenter instructions:

In the following experiment, you will read an excerpt from a book.

The text will appear one sentence at a time on the computer screen, and will automatically advance to the next sentence.

After the text, you will complete questions about what you have read.

Please read each sentence carefully.

Pre-recorded instructions:

The following excerpt takes place in a [high school/elementary school/no context] lunchroom.

Please think back to your past experiences in this setting and relate what you are reading to similar experiences you have had in this setting.

Try to imagine sounds, sights, and smells from this location.

Appendix B: Modified Text

Line #	Sentence
Line 1:	I was interrupted by someone clearing their throat.
Line 2:	It was a short kid wearing glasses with thick black frames.
Line 3:	“I brought back your magazine,” he said to Torchie.
Line 4:	“Thanks,” Torchie said.
Line 5:	The kid walked over and handed a car magazine to Torchie.
Line 6:	He turned to see me and said, “Hi.”
Line 7:	“That’s Dennis Woo,” Torchie said. “But everyone calls him Cheater.”
Line 8:	Cheater glared at Torchie. “Not everyone. And it’s a lie. I never cheat. I don’t have to.”
Line 9:	He turned back toward me.
Line 10:	“Let me ask you this. Do I look like someone who needs to cheat on tests?”
Line 11:	He stood very still, as if that would help me see what a wise and honest person he was.
Line 12:	“No, you look awful smart,” I told him.

- Line 13 “In fact, you look so smart I’d probably try to copy off your tests.
- Line 14: Maybe I can sit next to you in class.”
- Line 15: He grinned. “Hey, thanks. You’re okay.”
- Line 16: I shrugged. Apparently, the subtle art of sarcasm was wasted on him.
- Line 17: I glanced over at Torchie, trying not to grin.
- Line 18: But I couldn’t help my eyes rolling toward the ceiling.
- Line 19: “Wait, I get it,” Cheater said.
- Line 20: “You’re playing with me, aren’t you? You think I didn’t know what you meant.”
- Line 21: “Relax, I was just kidding.”
- Line 22: I didn’t feel like making any more enemies—even little ones with thick glasses.
- Line 23: I held out my hand. “No hard feelings?”
- Line 24: Cheater looked at me for a moment, as if trying to decide whether I was going to play some kind of joke on him.
- Line 25: Then he reached out to shake hands.
- Line 26: As he did, I suddenly wondered whether he was going to flip me through the air.
- Line 27: I guess my expression changed enough that he could figure out what was on my mind.
- Line 28: “Relax,” he said. “You look like you think I’m going to kung fu you or something.

- Line 29: Talk about stereotypes. Just because I'm Chinese, you think I'm some kind of karate kid.
- Line 30: Let me tell you, I don't know any of that stuff. I wish I did."
- Line 31: We shook hands. "I really was just kidding," I told him.
- Line 32: "Hey, I'm used to it," Cheater said.
- Line 33: "My ancestors have been kicked around for centuries.
- Line 34: But you know what? I don't think people hate us because we look different.
- Line 35: I think they hate us because we're smart.
- Line 36: I have a cousin who gets beaten up at least once a week because he always gets one hundred on his tests.
- Line 37: You see? That's why people hate us."
- Line 38: Wow, I didn't want to get any deeper into that discussion.
- Line 39: If someone hated you, did it really matter why?
- Line 40: I didn't know. Maybe it mattered.
- Line 41: At least there didn't seem to be any prejudice about who went to Edgeview.
- Line 42: From what I'd seen, the place was about as mixed as any school I'd ever been to.
- Line 43: Trouble was color-blind.
- Line 44: "I really do know lots of stuff," Cheater said.
- Line 45: "Ask me anything. Did you know karate started out in China?"

- Line 46: Then it went to Okinawa in the sixteen hundreds.
- Line 47: Didn't get to Japan until 1910. Edgeview School was built in 1932.
- Line 48: But it started out as a factory. They rebuilt it twenty years ago.
- Line 49: But it's just been a school for the last four and a half years."
- Line 50: "He really does know just about everything," Torchie said. "It's kind of amazing
- Line 51: I was watching a kid on and off during lunch and I didn't have a clue why he was by himself.
- Line 52: Well, as my dad always said, if you don't know the answer, ask a question.
- Line 53: Of course, when I asked him a question, he usually told me to shut up and stop being such a wise ass.
- Line 54: But dad wasn't here, so I figured it was safe to ask a question.
- Line 55: "Who's the loner?" I asked Torchie, looking over toward the kid eating all by himself.
- Line 56: There was nothing I could see about his clothes or appearance that would explain his isolation.
- Line 57: "Him? That's Trash."
- Line 58: "Nice name," I said. "It's not like that," said Torchie.
- Line 59: "It's just that he trashes stuff. You know, breaks thing."
- Line 60: "Yeah," Cheater said. "I heard that at his last school, he smashed up a whole classroom -- desks, chairs, windows.

- Line 61: This kid's wacko."
- Line 62: I looked back at Trash. It was hard to imagine why someone would break stuff for fun.
- Line 63: "Hey," Torchie said to Cheater, "You shouldn't say wacko. It's not cool."
- Line 64: "Yeah, you're right," Cheater said.
- Line 65: "My mistake. He's not wacko- he's bonkers. Or maybe he's looney.
- Line 66: How about deranged? I like that one"
- Line 67: "How'd you like to be called that?" Torchie asked.
- Line 68: "I think I'd prefer insane. If you're going for technical terms," Cheater said.
- Line 69: "But flipped out has a nice ring to it.
- Line 70: And let's not forget all those wonderful phrases that can be used to indicate a mind that is somewhat less than perfect:
- Line 71: One card short of a full deck, one sandwich short of a picnic, off your rocker, out in left field- the list goes on and on.
- Line 72: Hey, do you know where the word bedlam comes from? It was a crazy house in England."
- Line 73: "Listen," Torchie told him, his voice dropping so low I had to lean forward to catch the rest of it.
- Line 74: "If enough people call you crazy, maybe you begin to believe it, even if you aren't."
- Line 75: All three of them started arguing about putting labels on people and about stuff like self-esteem.

- Line 76: Everyone was talking at once.
- Line 77: Personally, I thought they were all a bit crazy. Or wacko. Or bonkers.
- Line 78: But I kept my mouth shut.
- Line 79: I couldn't do much about kids like Bloodbath -- the school bully -- who hated me because that was how they treated everyone,
- Line 80: but I didn't want to turn the whole place against me.
- Line 81: I didn't want to end up eating all by myself every day, like that pathetic loser they called Trash.
- Line 82: So I stayed quiet and let them go at it.
- Line 83: Eventually, the argument faded out and everyone went back to eating.
- Line 84: "Well," Cheater said as we finished our meal, "welcome to Edgeview."

Line	Text	# of Words	Duration on Screen
1	I was interrupted by someone clearing their throat.	8	2540
2	It was a short kid wearing glasses with thick black frames.	11	3492.5
3	"I brought back your magazine," he said to Torchie.	9	2857.5
4	"Thanks," Torchie said.	3	952.5
5	The kid walked over and handed a car magazine to Torchie.	11	3492.5
6	He turned to see me and said, "Hi."	8	2540
7	"That's Dennis Woo," Torchie said. "But everyone calls him Cheater."	10	3175
8	Cheater glared at Torchie. "Not everyone. And it's a lie. I never cheat. I don't have to."	17	5397.5
9	He turned back toward me.	5	1587.5
10	"Let me ask you this. Do I look like someone who needs to cheat on tests?"	16	5080
11	He stood very still, as if that would help me see what a wise and honest person he was.	19	6032.5
12	"No, you look awful smart," I told him.	8	2540

13	“In fact, you look so smart I’d probably try to copy off your tests.	14	4445
14	Maybe I can sit next to you in class.”	9	2857.5
15	He grinned. “Hey, thanks. You’re okay.”	6	1905
16	I shrugged. Apparently, the subtle art of sarcasm was wasted on him.	12	3810
17	I glanced over at Torchie, trying not to grin.	9	2857.5
18	But I couldn’t help my eyes rolling toward the ceiling.	10	3175
19	“Wait, I get it,” Cheater said.	6	1905
20	“You’re playing with me, aren’t you? You think I didn’t know what you meant.”	14	4445
21	“Relax, I was just kidding.”	5	1587.5
22	I didn’t feel like making any more enemies—even little ones with thick glasses.	14	4445
23	I held out my hand. “No hard feelings?”	8	2540
24	Cheater looked at me for a moment, as if trying to decide whether I was going to play some kind of joke on him.	24	7620
25	Then he reached out to shake hands.	7	2222.5
26	As he did, I suddenly wondered whether he was going to flip me through the air.	16	5080

27	I guess my expression changed enough that he could figure out what was on my mind.	16	5080
28	“Relax,” he said. “You look like you think I’m going to kung fu you or something.	16	5080
29	Talk about stereotypes. Just because I’m Chinese, you think I’m some kind of karate kid.	15	4762.5
30	Let me tell you, I don’t know any of that stuff. I wish I did.”	15	4762.5
31	We shook hands. “I really was just kidding,” I told him.	11	3492.5
32	“Hey, I’m used to it,” Cheater said.	7	2222.5
33	“My ancestors have been kicked around for centuries.	8	2540
34	But you know what? I don’t think people hate us because we look different.	14	4445
35	I think they hate us because we’re smart.	8	2540
36	I have a cousin who gets beaten up at least once a week because he always gets one hundred on his tests.	22	6985
37	You see? That’s why people hate us.”	7	2222.5
38	Wow, I didn’t want to get any deeper into that discussion.	11	3492.5
39	If someone hated you, did it really matter why?	9	2857.5
40	I didn’t know. Maybe it mattered.	6	1905

41	At least there didn't seem to be any prejudice about who went to Edgeview.	15	4762.5
42	From what I'd seen, the place was about as mixed as any school I'd ever been to.	17	5397.5
43	Trouble was color-blind.	3	952.5
44	"I really do know lots of stuff," Cheater said.	9	2857.5
45	"Ask me anything. Did you know karate started out in China?"	11	3492.5
46	Then it went to Okinawa in the sixteen hundreds.	9	2857.5
47	Didn't get to Japan until 1910. Edgeview School was built in 1932.	13	4127.5
48	But it started out as a factory. They rebuilt it twenty years ago.	13	4127.5
49	But it's just been a school for the last four and a half years."	14	4445
50	"He really does know just about everything," Torchie said. "It's kind of amazing."	13	4127.5
51	I was watching a kid on and off during lunch and I didn't have a clue why he was by himself.	21	6667.5
52	Well, as my dad always said, if you don't know the answer, ask a question.	15	4762.5

53	Of course, when I asked him a question, he usually told me to shut up and stop being such a wise ass.	22	6985
54	But dad wasn't here, so I figured it was safe to ask a question.	14	4445
55	"Who's the loner?" I asked Torchie, looking over toward the kid eating all by himself.	15	4762.5
56	There was nothing I could see about his clothes or appearance that would explain his isolation.	16	5080
57	"Him? That's Trash."	3	952.5
58	"Nice name," I said. "It's not like that," said Torchie.	10	3175
59	"It's just that he trashes stuff. You know, breaks thing."	10	3175
60	"Yeah," Cheater said. "I heard that at his last school, he smashed up a whole classroom -- desks, chairs, windows.	20	6350
61	This kid's wacko."	3	952.5
62	I looked back at Trash. It was hard to imagine why someone would break stuff for fun.	17	5397.5
63	"Hey," Torchie said to Cheater, "You shouldn't say wacko. It's not cool."	12	3810
64	"Yeah, you're right," Cheater said.	5	1587.5
65	"My mistake. He's not wacko- he's bonkers. Or maybe	11	3492.5

	he's looney.		
66	How about deranged? I like that one"	7	2222.5
67	"How'd you like to be called that?" Torchie asked.	9	2857.5
68	"I think I'd prefer insane. If you're going for technical terms," Cheater said.	13	4127.5
69	"But flipped out has a nice ring to it.	9	2857.5
70	And let's not forget all those wonderful phrases that can be used to indicate a mind that is somewhat less than perfect:	22	6985
71	one card short of a full deck, one sandwich short of a picnic, off your rocker, out in left field- the list goes on and on.	26	8255
72	Hey, do you know where the word bedlam comes from? It was a crazy house in England."	17	5397.5
73	"Listen," Torchie told him, his voice dropping so low I had to lean forward to catch the rest of it.	20	6350
74	"If enough people call you crazy, maybe you begin to believe it, even if you aren't."	16	5080
75	All three of them started arguing about putting labels on people and about stuff like self-esteem.	16	5080
76	Everyone was talking at once.	5	1587.5

77	Personally, I thought they were all a bit crazy. Or wacko. Or bonkers.	13	4127.5
78	But I kept my mouth shut.	6	1905
79	I couldn't do much about kids like Bloodbath -- the school bully -- who hated me because that was how they treated everyone,	23	7302.5
80	but I didn't want to turn the whole place against me.	11	3492.5
81	I didn't want to end up eating all by myself every day, like that pathetic loser they called Trash.	19	6032.5
82	So I stayed quiet and let them go at it.	10	3175
83	Eventually, the argument faded out and everyone went back to eating.	11	3492.5
84	"Well," Cheater said as we finished our meal, "welcome to Edgeview."	11	3492.5

Appendix C: Original text

Hidden Talents by David Lubar

Page 26-27

I was interrupted by a knock at the door. A short kid wearing glasses with thick black frames stuck his head in. "I brought back your magazine," he said to Torchie.

"Come on in," Torchie said.

The kid walked in and handed a car a magazine to Torchie.

He turned to see me and said, "Hi."

"That's Dennis Woo," Torchie said. "But everyone calls him Cheater."

Cheater glared at Torchie. "Not everyone. And it's a lie. I never cheat. I don't have to."

He turned back toward me.

"Let me ask you this. Do I look like someone who needs to cheat on test?"

He stood very still, as if that would help me see what a wise and honest person he was.

"No, you look awful smart," I told him. "Heck, you look so smart I'd probably try to copy off your tests. Maybe I can sit next to you in class."

He grinned. "Hey, thanks. You're okay."

I shrugged. Apparently, the subtle art of sarcasm was wasted on him.

I glanced over at Torchie, trying not to grin. But I couldn't help my eyes rolling toward the ceiling.

"Wait, I get it," Cheater said. "You're playing with me, aren't you? You think I didn't know what you meant."

"Relax, I was just kidding."

I didn't feel like making any more enemies—even little ones with thick glasses.

I held out my hand.

"No hard feelings?"

Cheater looked at me for a moment, as if trying to decide whether I was going to play some kind of joke on him. Then he reached out to shake hands. As he did, I suddenly wondered whether he was going to flip me through the air.

I guess my expression changed enough that he could figure out what was on my mind.

"Relax," he said. "You look like you think I'm going to kung fu you or something. Talk about stereotypes. Just because I'm Chinese, you think I'm some kind of karate kid. Let me tell you, I don't know any of that stuff. I wish I did."

We shook hands. "I really was just kidding," I told him.

"Hey, I'm used to it," Cheater said. "My ancestors have been kicked around for centuries. But you know what? I don't think people hate us because we look different. I think they hate us because we're smart. I have a cousin who gets beaten up at least once a week because he always gets one hundred on his tests. You see? That's why people hate us." Wow, I didn't want to get any deeper into that discussion. If someone hated you, did it really matter why? I didn't know. Maybe it mattered. At least there didn't seem to be any prejudice about who went to Edgeview. From what I'd seen, the place was about as mixed as any school I'd ever been to. Trouble was color-blind.

"I really do know lots of stuff," Cheater said. "Ask me anything. Did you know karate started out in China? Then it went to Okinawa in the sixteen hundreds. Didn't get to

Japan until 1910. Edgeview Alternative School was built in 1932. But it started out as a factory. They rebuilt it twenty years ago. But it's just been a school for the last four and a half years."

"He really does know just about everything," Torchie said. "It's kind of amazing."

"Come on, ask me anything," Cheater said.

I realized he wasn't going to stop until I asked him a question. "Who invented radium?"

Page 32-33

I'd watched him on and off during the meal, and I didn't have a clue why he was by himself. Well, as my dad always said, if you don't know the answer, ask a question. Of course, when I asked him a question, he usually told me to shut up and stop being such a wise ass.

But dad wasn't here, so I figured it was safe to ask a question.

"Who's the loner?" I asked Torchie, looking over toward the kid eating all by himself at a table near the opposite wall. There was nothing I could see about his clothes or appearance that would explain his isolation.

"Him? That's Trash."

"Nice name," I said.

"It's not like that. It's just that he trashes stuff. You know, breaks thing."

"Yeah," Cheater said. "I heard that at his last school, he smashed up a whole classroom -- desks, chairs, windows. This kid's wacko."

I looked back at Trash. It was hard to imagine why someone would break stuff for fun.

"Hey," Lucky said to Cheater, "You shouldn't say wacko. It's not nice."

"Yeah, you're right," Cheater said. "My mistake. He's not wacko- he's bonkers. Or maybe he's looney. How about deranged? I like that one"

"How'd you like to be called that?" Lucky asked.

"I think I'd prefer insane. If you're going for technical terms," Cheater said. "But flipped out has a nice ring to it. And let's not forget all those wonderful phrases that can be used to indicate a mind that is somewhat less than perfect: one card short of a full deck, one sandwich short of a picnic, off your rocker, out in left field- the list goes on and on. Hey, do you know where the word bedlam comes from? It was a crazy house in England."

"Listen," Lucky told him, his voice dropping so low I had to lean forward to catch the rest of it. "If enough people call you crazy, maybe you begin to believe it, even if you aren't."

All three of them started arguing about putting labels on people and about stuff like self-esteem. Everyone was talking at once. They sounded like a bunch of miniature psychiatrists. I guess they'd gotten a lot of that in class here. Personally, I thought they were all a bit crazy. Or wacko. Or bonkers. But I kept my mouth shut. I couldn't do much about kids like Bloodbath who'd hate me because that was how they treated everyone, but I didn't want to turn the whole place against me. I didn't want to end up eating dinner all by myself every day, like that pathetic loser they called Trash.

So I stayed quiet and let them go at it. Eventually, the argument faded out and everyone went back to eating.

"Well," Cheater said as we finished our meal, "welcome to Edgeview"

Appendix D: Cued Recall Questions

1. What was the building before it was a school? **Factory**
2. What was the school bully's name? **Bloodbath**
3. Where are Cheater's ancestors from? **China**
4. What did Cheater give to Torchie? **(Car) Magazine**
5. How long ago (in years) was the school rebuilt? **20**
6. What was the name of the school? **Edgeview**
7. What does Cheater wear that stands out to the narrator? **(Thick, black-framed) Glasses**
8. Who was sitting by himself? **Trash**
9. What is the narrator afraid Cheater is going to do to him when they first meet? **Kung Fu (Flip him in the air)**
10. Why does Cheater think people hate him? **Smart**
11. Why doesn't the narrator know Cheater? **The narrator is new to the school**
12. Why does the narrator roll his eyes toward the ceiling? **Cheater doesn't understand his sarcasm**
13. Why wasn't the narrator's dad present? **Narrator was at school**
14. Why is Trash considered crazy by his peers? **He trashes things; breaks stuff—chairs and desks at his last school**

Appendix E: Correlation Tables

Table 1a

Bivariate Correlations among OSPAN, RSPAN, Time Differences, and Recall Variables for the High School (Near) Condition

Variables	1	2	3	4	5	6
1. OSPAN	--	.22	.01	-.06	.09	.00
2. RSPAN		--	.26	.29	.28	.32
3. Time Difference			--	.16	-.04	.10
4. Factual Recall				--	.54*	.93*
5. Inference Recall					--	.82*

Note: Correlations marked with an asterisk () were significant at $p < .05$*

Table 1b

Bivariate Correlations among OSPAN, RSPAN, Time Differences, and Recall Variables for the Elementary School (Far) Condition

Variables	1	2	3	4	5	6
1. OSPAN	--	.27	-.03	-.12	-.12	-.15
2. RSPAN		--	-.06	.30	.26	.16
3. Time Difference			--	.12	-.05	.24
4. Factual Recall				--	.54*	.79*
5. Inference Recall					--	.77*

Note: Correlations marked with an asterisk () were significant at $p < .05$*

Table 1c

Bivariate Correlations among OSPAN, RSPAN, Time Differences, and Recall Variables for the Control (No Context) Condition

Variables	1	2	3	4	5	6
1. OSPAN	--	.58*	.32	.33	.12	.27
2. RSPAN		--	.13	.11	-.10	.03
3. Time Difference			--	.40*	.39*	.45*
4. Factual Recall				--	.54*	.92*
5. Inference Recall					--	.83*

Note: Correlations marked with an asterisk () were significant at $p < .05$*

Appendix F: RSPAN Scatterplots

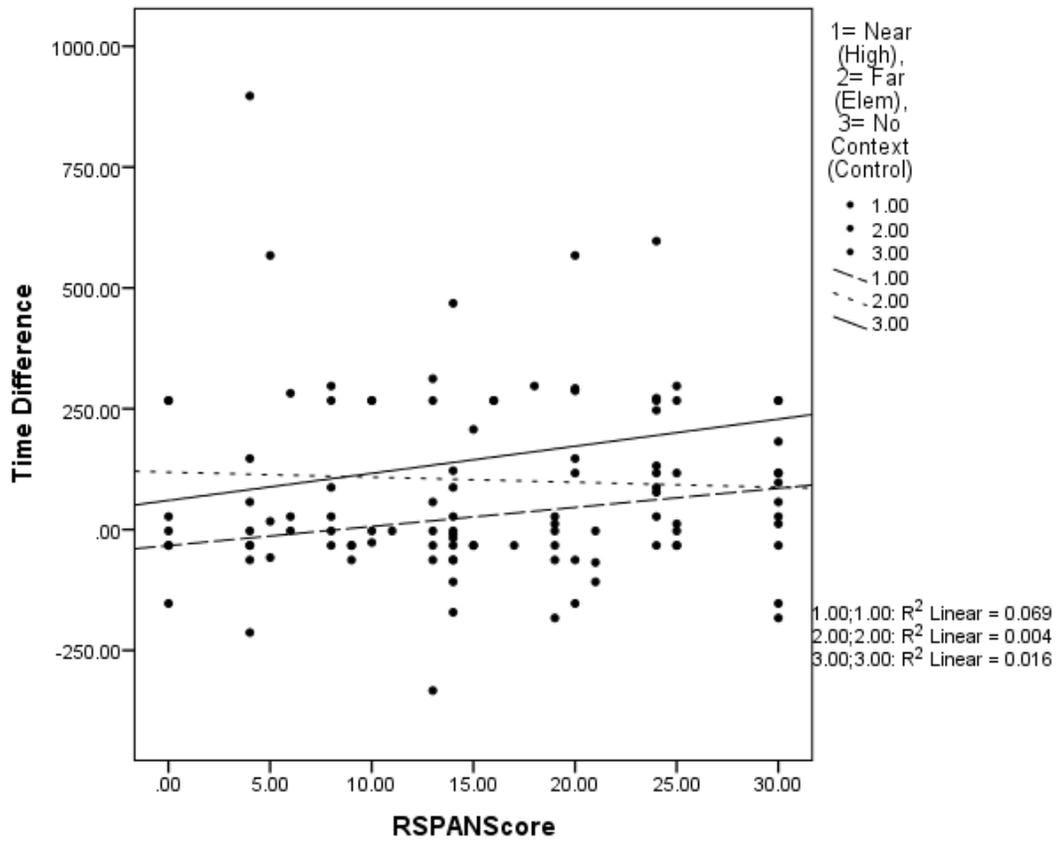


Figure 3a. Scatterplot of RSPAN scores and differences in reported time estimations compared to actual duration of the task with fit lines for each condition.

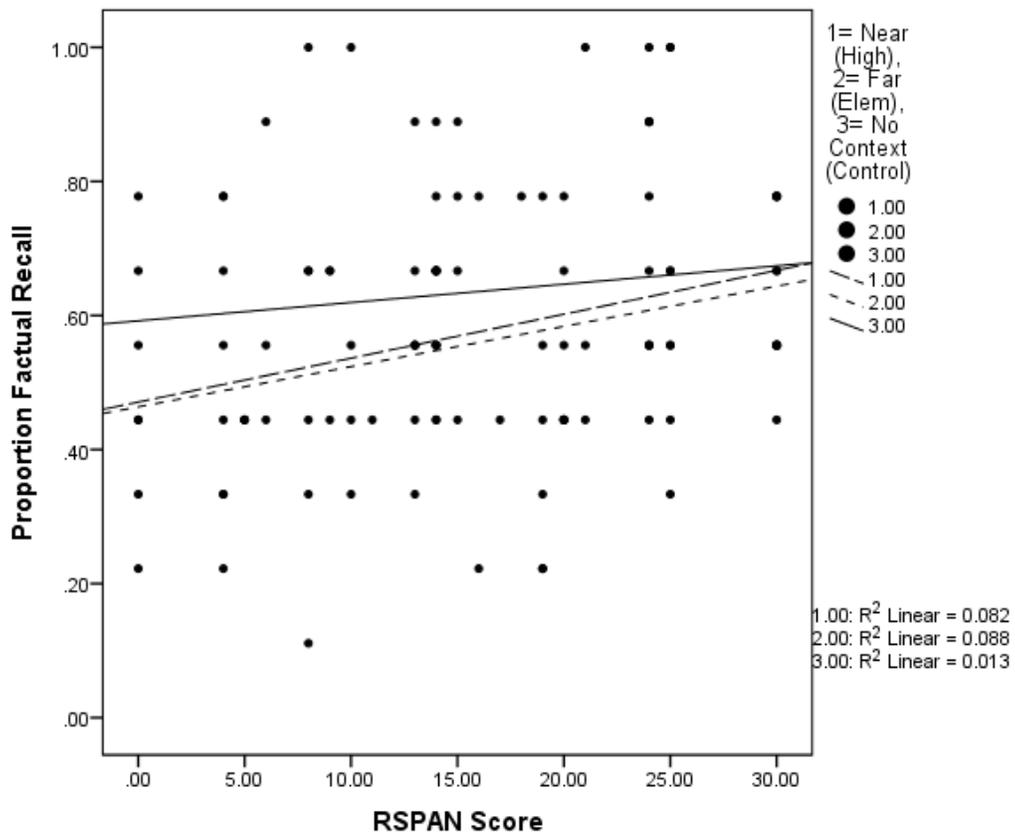


Figure 3b. Scatterplot of RSPAN scores and proportion of factual recall from the text with fit lines for each condition.

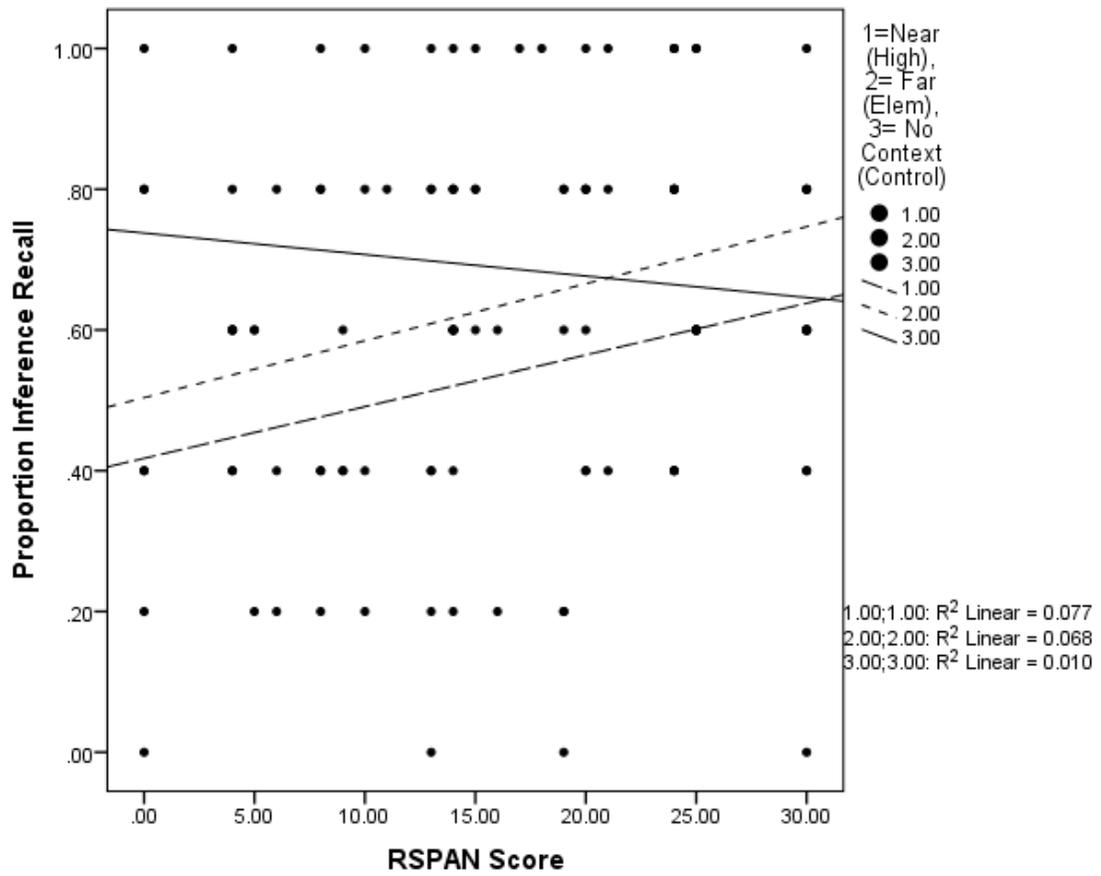


Figure 3c. Scatterplot of RSPAN scores and proportion of inference recall from the text with fit lines of each condition.

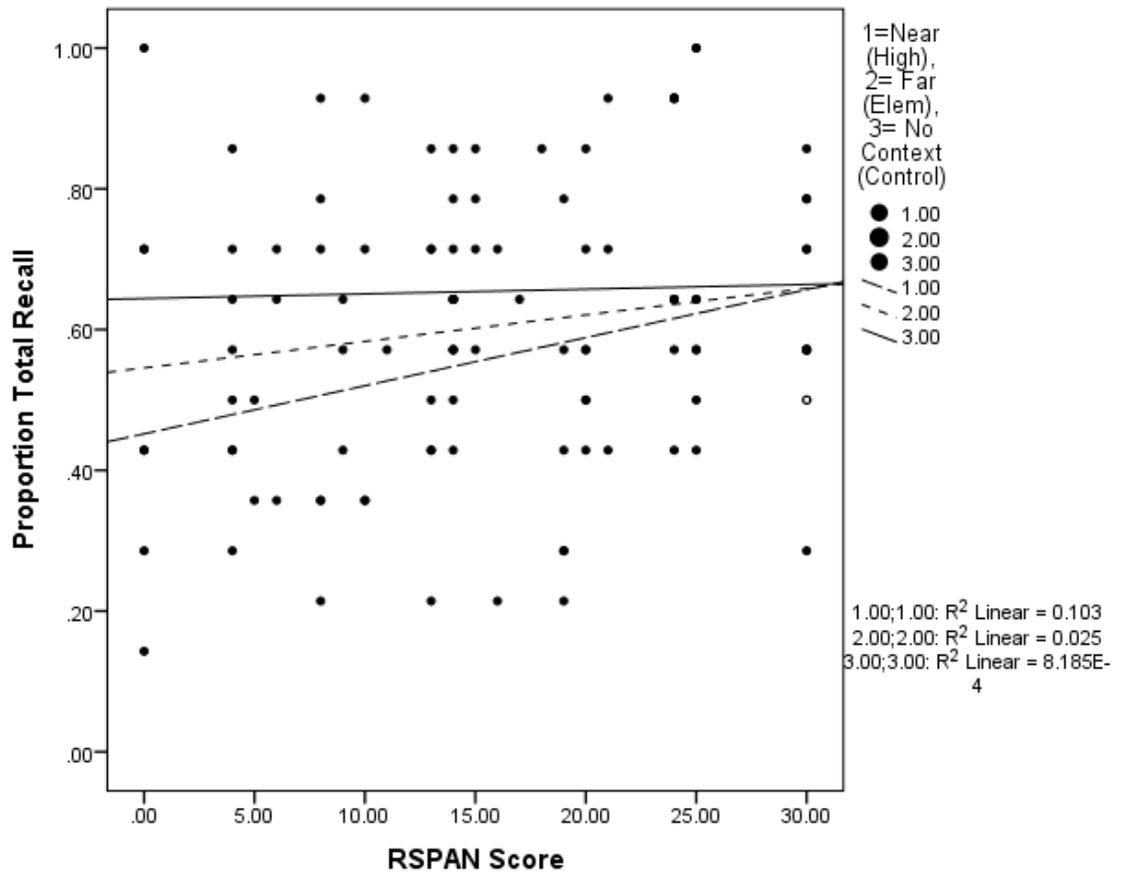


Figure 3d. Scatterplot of RSPAN scores and proportion of total recall for the text with fit lines of each condition.

Appendix G: OSPAN Scatterplots

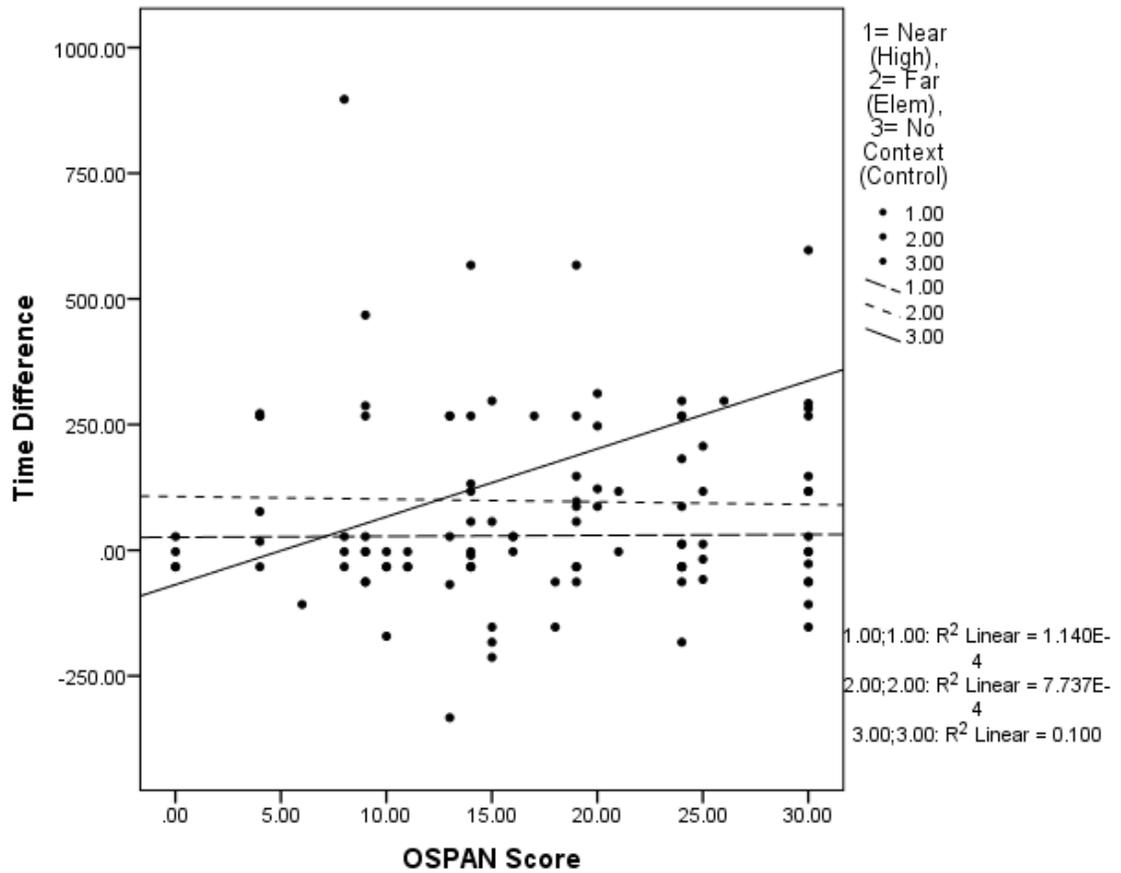


Figure 4a. Scatterplot of OSPAN scores and differences in reported time estimations compared to actual duration of the task with fit lines for each condition.

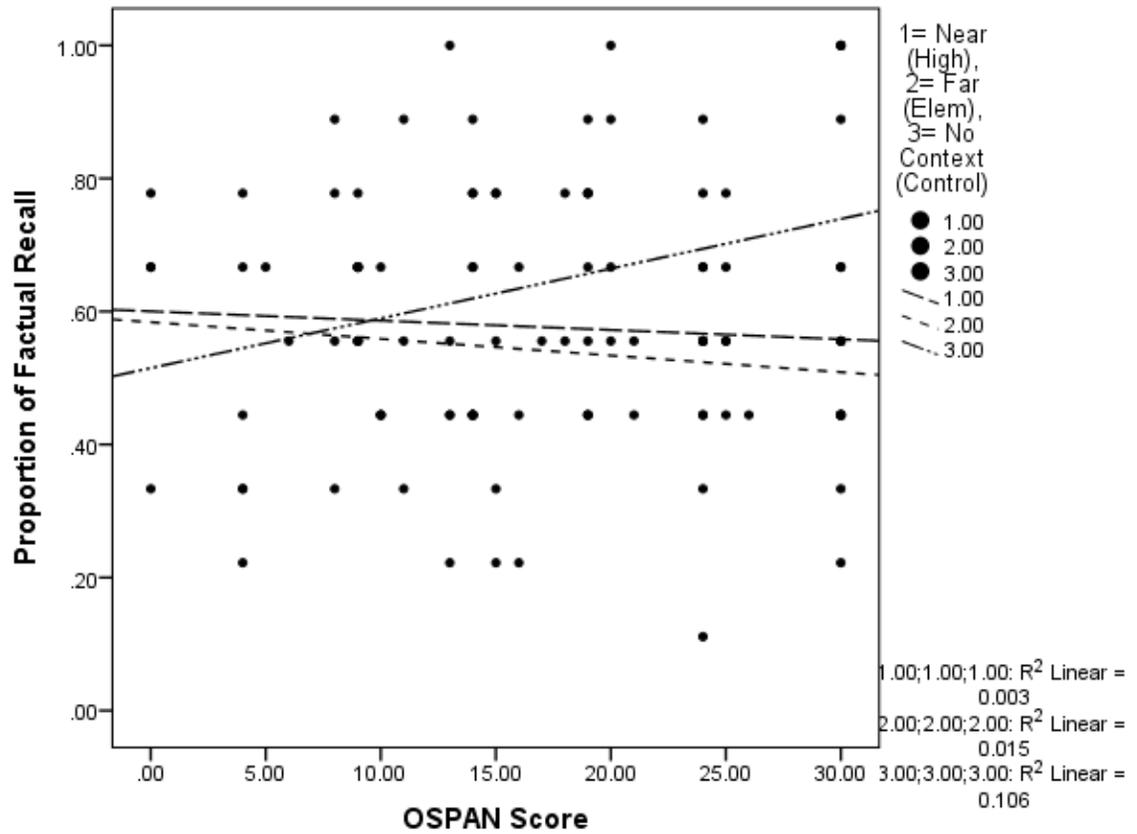


Figure 4b. Scatterplot of OSPAN scores and proportion of factual recall with fit lines of each condition.

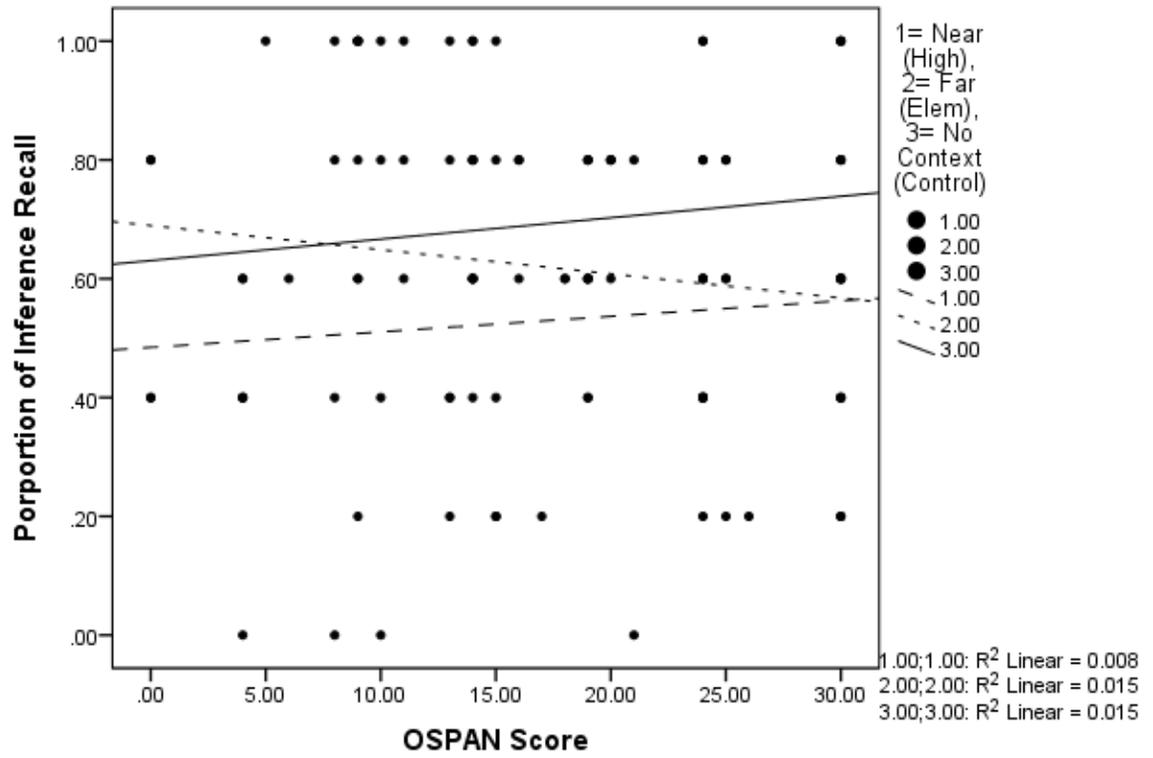


Figure 4c. Scatterplot of OSPAN scores and proportion of inference recall with fit lines of each condition.

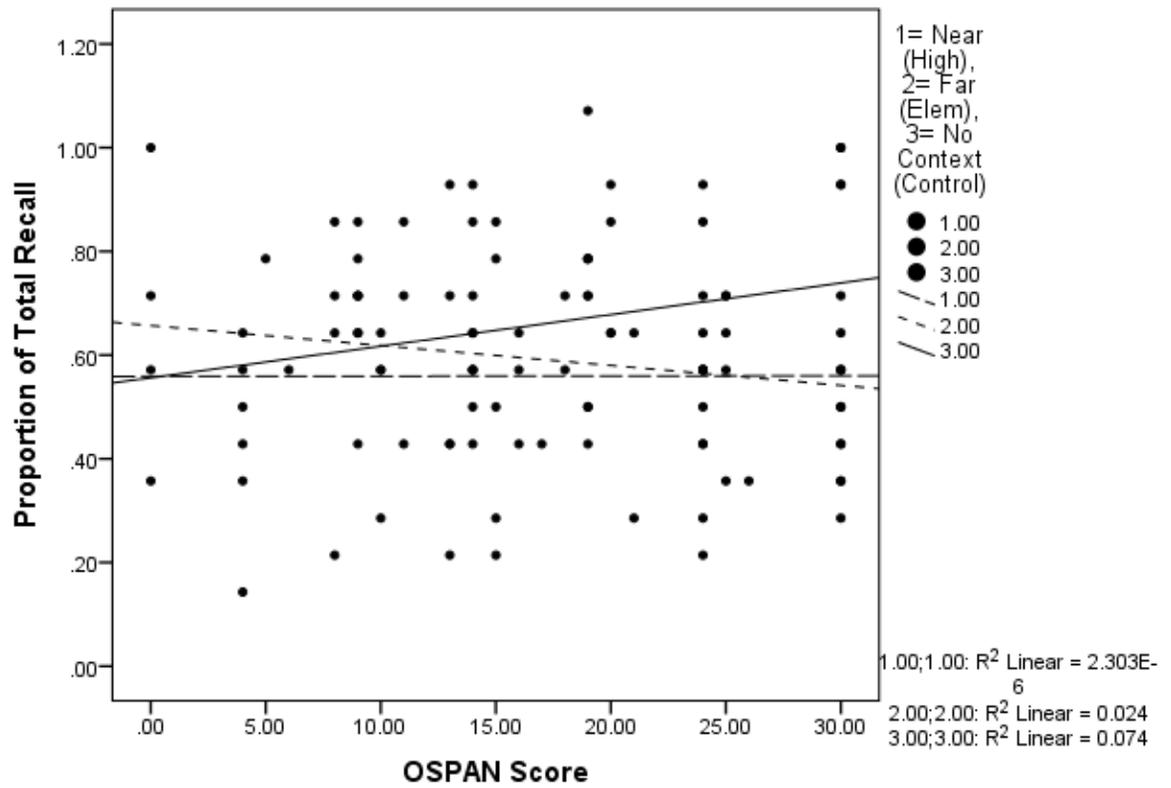


Figure 4d. Scatter plot of OSPAN scores and proportion of total recall with fit lines of each condition.

Appendix H: IRB Approval Form

**APPROVAL NUMBER: 15-A076**

To: Jacquelyn Palmer
8000 York Road
Towson MD 21252

From: Institutional Review Board for the Protection of Human
Subjects Bethany Willis-Hepp, Member

Date: Friday, April 24, 2015

RE: Application for Approval of Research Involving the Use of
Human Participants

Office of Sponsored Programs
& Research

Towson University
8000 York Road
Towson, MD 21286-0001
t. 410 704-2236
f. 410 704-4484

Thank you for submitting an Application for Approval of Research Involving the Use of Human Participants to the Institutional Review Board for the Protection of Human Participants (IRB) at Towson University. The IRB hereby approves your proposal titled:

Time Estimation and Memory for Text Following Mental Time Travel

If you should encounter any new risks, reactions, or injuries while conducting your research, please notify the IRB. Should your research extend beyond one year in duration, or should there be substantive changes in your research protocol, you will need to submit another application for approval at that time.

We wish you every success in your research project. If you have any questions, please call me at (410) 704-2236.

CC: Kerri A. Goodwin
File



Date: Friday, April 24, 2015

NOTICE OF APPROVAL

TO: Jacquelyn Palmer **DEPT:** PSYC

PROJECT TITLE: *Time Estimation and Memory for Text Following Mental Time Travel*

SPONSORING AGENCY: None

APPROVAL NUMBER: 15-A076

The Institutional Review Board for the Protection of Human Participants has approved the project described above. Approval was based on the descriptive material and procedures you submitted for review. Should any changes be made in your procedures, or if you should encounter any new risks, reactions, injuries, or deaths of persons as participants, you must notify the Board.

A consent form: is is not required of each participant

Assent: is is not required of each participant

This protocol was first approved on: 24-Apr-2015

This research will be reviewed every year from the date of first approval.


Bethany Willis-Hepp, Member
Towson University Institutional Review Board

References

- Aslan, A. & Bauml, H. (2011). Individual differences in working memory capacity predict retrieval-induced forgetting. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *37*, 264-269. doi: 10.1037/a0021324
- Aslan, A., Zellner, M., & Bauml, H. (2010). Working memory capacity predicts listwise directed forgetting in adults and children. *Memory*, *18*, 442-450. doi: 10.1080/09658211003742698
- Baddeley, A. D. (1983). Working Memory. *Philosophical Transactions of the Royal Society of London. Series B, Biological Sciences*, *302*(1110), 311-324. doi: 10.1098/rstb.1983.0057
- Balch, W. R. & Lewis, B. S. (1996). Music-dependent memory: The roles of tempo change and mood mediation. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *22*, 1354-1363. doi: 10.1037/0278-7393.22.6.1354
- Bartlett, F. C. (1932). *Remembering; A study in experimental and social psychology*. Cambridge, England: The University Press.
- Block, R. A., & Reed, M. A. (1978). Remembered duration: Evidence for a contextual-change hypothesis. *Journal of Experimental Psychology: Human Learning and Memory*, *4*, 656-665. doi:10.1037/0278-7393.4.6.656
- Bower, G., Monteiro, K., & Gilligan, S. (1978). Emotional mood as a context for learning and recall. *Journal of Verbal Learning and Verbal Behavior*, *17*, 573-585. doi: 10.1016/S0022-5371(78)90348-1

Crow, L. & Ball, C. (1975). Alcohol state-dependency and autonomic reactivity.

Psychophysiology, *12*, 702-706. <http://dx.doi.org/10.1111/j.1469->

8986.1975.tb00078.x

Daneman, M., & Carpenter, P. A. (1980). Individual differences in working memory and

reading. *Journal of Verbal Learning and Verbal Behavior*, *19*, 450-466. doi:

[http://dx.doi.org/10.1016/S0022-5371\(80\)90312-6](http://dx.doi.org/10.1016/S0022-5371(80)90312-6)

Daneman, M. & Merikle, P.M. (1996). Working memory and language comprehension:

A meta-analysis. *Psychonomic Bulletin & Review*, *3*, 422-433. doi:

10.3758/BF03214546

Delaney, P. F. & Sahakyan, L. (2007). Effects of working memory capacity on context

maintenance: Adding individual differences to the contextual-change account of

directed forgetting. *Memory & Cognition*, *35*, 1074-1082. Doi:

10.3758/BF03193479

Dixon, P., LeFevre, J., & Twilley, L. (1988). Word knowledge and working memory as

predictors of reading skill. *Journal of Educational Psychology*, *80*, 465-472. doi:

10.1037/0022-0663.80.4.465

Eich, E., Macaulay, D., & Ryan, L. (1994). Mood dependent memory for events of the

personal past. *Journal of Experimental Psychology: General*, *123*, 201-215. doi:

10.1037/0096-3445.123.2.201

Engle, R. (2002). Working memory capacity as executive attention. *Current Directions in*

Psychological Science, *11*, 19-23. doi: 10.1111/1467-8721.00160

- Engle, R. W. & Kane, M. J. (2004). Executive attention, working memory capacity, and a two-factor theory of cognitive control. *The Psychology of Learning and Motivation, 44*, 145-199. doi: 10.1016/S0079-7421(03)44005-X
- Godden, D. R. & Baddeley, A. D. (1975). Context-dependent memory in two natural environments: On land and underwater. *British Journal of Psychology, 66*, 325-331. doi: 10.1111/j.2044-8295.1975.tb01468.x
- Goodwin, D., Powell, B., Bremer, D., Hoine, H., & Stern, J. (1969). Alcohol and recall: State-dependent effects in man. *Science, 193*, 1358-1360. doi: 10.1126/science.163.3873.1358
- Jang, Y. & Huber, D. E. (2008). Context retrieval and context change in free recall: Recalling from long-term memory drives list isolation. *Journal of Experimental Psychology: Learning, Memory, and Cognition, 34*, 112-127. doi: 10.1037/0278-7393.34.1.112
- Kane, M. J., Bleckley, K., Conway, R. A., & Engle, R. W. (2001). A controlled-attention view of working memory capacity. *Journal of Experimental Psychology: General, 130*, 169-183. doi: 10.1037/0096-3445.130.2.169
- Kane, M. K. & McVay, J. C. (2012). What mind wandering reveals about executive-control abilities and failures. *Current Directions in Psychological Science, 21*, 348-354. doi: 10.1177/0963721412454875
- Kintsch, W. (1988). The use of knowledge in discourse processing: A construction-integration model. *Psychological Review, 95*, 163-182.
<http://dx.doi.org/10.1037/0033-295X.95.2.163>

Kintsch, W., Kozminsky, E., Streby, W., McKoon, G., & Keenan, J. (1975).

Comprehension and recall of text as a function of content variables. *Journal of Learning and Verbal Behavior*, *14*, 196-214. doi: 10.1016/S0022-5371(75)80065-X

Krafka, C. & Penrod, S. (1985). Reinstatement of context in a field experiment on eyewitness identification. *Journal of Personality and Social Psychology*, *49*, 58-69. doi: 10.1037/0022-3514.49.1.58

Kane, M. J., Hambrick, D. Z., Tuholski, S. W., Wilhelm, O., Payne, T. W., & Engle, R. W. (2004). The generality of working memory capacity: A latent variable approach to verbal and visuospatial memory span and reasoning. *Journal of Experimental Psychology: General*, *133*, 189-217. doi: 10.1037/0096-3445.133.2.189

Lewandowski, L., Coddling, R., Kleinmann, A., & Tucker, K. (2003). Assessment of reading rate in postsecondary students. *Journal of Psychoeducational Assessment*, *21*, 134-144. doi: 10.1177/073428290302100202

McVay, J. C. & Kane, M. J. (2012). Why does working memory predict variation in reading comprehension? On the influence of mind wandering and executive attention. *Journal of Experimental Psychology: General*, *141*, 302-320. doi: 10.1037/a0025250

Mulji, R. & Bodner, G. E. (2010). Wiping out memories: New support for a mental context change account of directed forgetting. *Memory*, *18*, 763-773. doi: 10.1080/09658211.2010.510475

- Oswald, F., McAbee, S., Redick, T., & Hambrick, D. (2015). The development of a short domain-general measure of working memory capacity. *Behavior Research Methods*. Advance online publication. doi: 10.3758/s13428-014-0543-2
- Rogers, T. B., Kuiper, N. A., & Kirker, W. S. (1977). Self-reference and the encoding of personal information. *Journal of Personality and Social Psychology*, 35, 677-688. doi: 10.1037/0022-3514.35.9.677
- Sahakyan, L. & Kelley, C. M (2002). A contextual change account of the directed forgetting effect. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 28, 1064-1072. doi: 10.1037//0278-7393.28.6.1064
- Sahakyan, L. & Smith, J. (2014). A long time ago, in a context far, far away: Retrospective time estimates in internal context change. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 40, 86-93. doi: 10.1037/a0034250
- Schab, F. (1990). Odors and remembrance of things past. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, 16, 648-655. doi: 10.1037/0278-7393.16.4.648
- Shah, P. & Miyake, A. (1996). The separability of working memory resources for spatial thinking and language processing: An individual differences approach. *Journal of Experimental Psychology: General*, 125, 4-27. doi: 10.1037/0096-3445.125.1.4
- Smith, S. M. (1979). Remembering in and out of context. *Journal of Experimental Psychology: Human Learning and Memory*, 5, 460-471. doi: 10.1037/0278-7393.5.5.460

- Smith, S. M. (1986). Environmental context-dependent recognition memory using a short-term memory task for input. *Memory & Cognition*, *14*, 347-354. doi: 10.3758/BF03202513
- Smith, S. M., Glenberg, A. & Bjork, R. A. (1978). Environmental context and human memory. *Memory & Cognition*, *6*, 342-353. doi: 10.3758/BF03197465
- Turner, M. L. & Engle, R. W. (1989). Is working memory capacity task dependent? *Journal of Memory and Language*, *28*, 127-154. doi: 10.1016/0749-596X(89)90040-5
- Unsworth, N. (2007). Individual differences in working memory capacity and episodic retrieval: Examining the dynamics of delayed and continuous distractor free recall. *Journal of Experimental Psychology: Learning, Memory, and Cognition*, *33*, 1020-1034. doi: 10.1037/0278-7393.33.6.1020
- Unsworth, N. (2009). Examining variation in working memory capacity and retrieval in cued recall. *Memory*, *17*, 386-396. doi: 10.1080/096582109002802959
- Unsworth, N. (2009). Variation in working memory capacity, fluid intelligence, and episodic recall: A latent variable examination of differences in the dynamics of free recall. *Memory & Cognition*, *37*, 837-849. doi: 10.3758/MC.37.6.837
- Unsworth, N., Spillers, G. J., & Brewer, G. A. (2012). Dynamics of context-dependent recall: An examination of internal and external context change. *Journal of Memory and Language*, *66*, 1-16. doi: 10.1016/j.jml.2011.05.001
- Wong, C. K. & Read, J. D. (2011). Positive and negative effects of physical context reinstatement on eyewitness recall and identification. *Applied Cognitive Psychology*, *25*, 2-11. doi: 10.1002/acp.1605

Jacquelyn B. Palmer | Curriculum Vitae

**Education**

Towson University, Experimental Psychology
Master of Arts, *expected* 2015
University of North Carolina at Greensboro, Psychology
Bachelor of Arts, May 2012
Central Piedmont Community College, Liberal Arts
Associate in Arts, July 2010

Publications and Poster Presentations

Fiedler, K., Brittle, C., Cotterman, C., & **Palmer, J.** (in review) Commercial motor vehicle drivers and Obstructive Sleep Apnea: A systematic review and meta-analysis of prevalence, diagnosis, treatment, and risk factors in OSA.

Goodwin, K. & **Palmer, J.** Mindfulness and individual differences in working memory, creativity, attention, and insight. Poster to be presented at: Psychonomic Society's 55th Annual Meeting; 20-23 November, 2014; Long Beach, CA.

Palmer, J. & Goodwin, K. Mindfulness and individual differences in working memory, creativity, attention, and insight (M.S. in prep).

Research Experience**Research Associate**

Acclaro Research Solutions, Inc.
Baltimore, MD, October 2013 to Present

Graduate Researcher

Cognitive Psychology Lab, Dr. Kerri Goodwin
Towson University, August 2013 to Present

Research Assistant

Memory Lab, Dr. Lili Sahakyan
University of North Carolina at Greensboro, August 2011 to May 2013

Research Assistant

Working Memory and Attention Lab, Dr. Michael Kane

University of North Carolina at Greensboro, August 2011 to May 2013

Volunteer and Professional Experience

Grant Reviewer

Association of Psychological Science Students, December 2014
Review and score grant proposals

Graduate Student Representative

Towson University, 2014-2015
Representative to the Dean of Liberal Arts
Discuss matters related to junior faculty performance measurements,
allocation of grant funds, teaching seminars
Review, score, and vote for Innovative Teaching Award

Tutor for youthful offenders in Mecklenburg County Correctional Facility

CPCC, Charlotte, NC, 2010
Provided assistance in high school level English, Mathematics, and Science
Offered guidance to at-risk youth

Mentor for at-risk youth

Communities in Schools, Charleston, SC, 2007-2008
Scheduled weekly meetings for an at-risk teen
Provided personal guidance and educational tutoring
Chaperoned multiple persons including teen and friends/family

Professional Organization

Association of Psychological Science, 2014
Psi Chi, 2014

Honors

University of North Carolina at Greensboro Dean's List, 2012
Central Piedmont Community College President's List, 2009

