CAN PERFORMANCE PREDICTIONS IMPROVE PROSPECTIVE MEMORY AND DOES TYPE OF PREDICTION MATTER?

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Abstract: The purpose of the current study was to investigate the extent to which memory beliefs (as indexed by performance predictions) affected prospective memory (PM) performance on tasks that had different retrieval processing demands. Participants were randomly assigned to a prediction condition (single-item prediction, multi-item prediction, no prediction) and a PM condition (focal or nonfocal PM task). During the experiment, participants completed a lexical decision task (LDT) that required making word judgments about letter strings. Participants then predicted their future PM performance and completed a distractor task before carrying out the PM task which was embedded in the LDT. PM performance was scored as the proportion correct out of eight possible opportunities. Given that recent research that has suggested that making predictions about one's future PM performance may serve as an effective strategy to improve actual PM performance (Meeks, Hicks, & Marsh, 2007; Rummel, Kuhlmann, & Touron, 2013), both single-item and multi-item predictions were expected to have a beneficial impact on actual PM performance. However, multi-item predictions were hypothesized to be more effective than single-item predictions for improving PM performance, especially on the nonfocal PM task. Results demonstrated that predicting performance did not significantly impact actual performance on focal or nonfocal PM tasks. On the other hand, performance was better on the focal PM task than on the nonfocal PM task indicating that cue focality did significantly impact PM performance (Einstein et al., 2005; Kliegel, Jäger, & Phillips, 2008; McDaniel & Einstein, 2000). While predicting performance was anticipated to increase monitoring processes for the PM task at a cost to performance on the ongoing LDT, the data did not demonstrate this pattern. Finally, whereas predicting performance using a multi-item scale was expected to help individuals better understand the demands of the PM tasks, the data revealed that participants were more accurate in postdicting their past PM performance than in predicting their future PM performance. These findings suggest that performance predictions may not always be useful to employ as a strategy to improve PM performance. Implications of these findings are discussed.

Keywords: Prospective memory, cue focality, metamemory, memory self-efficacy, predictions

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CHAPTER I

INTRODUCTION

In our everyday lives, remembering to fulfill future intentions in the midst of completing other actions is essential. To be productive, people must be able to remember to give a message to a co-worker at a meeting or to take medication after dinner, among many other important activities. *Prospective memory* (PM) refers to our ability to remember to carry out future intentions and it makes completing these types of tasks possible (McDaniel & Einstein, 2007). Given that prior work has demonstrated that roughly half of all reported memory complaints and memory lapses are prospective in nature (Crovitz & Daniel, 1986), research is needed to identify factors that may explain individual differences in PM performance as well as strategies that could potentially improve PM.

To better understand which factors may underlie individual differences in PM performance, it is necessary to recognize which circumstances often contribute to universal differences in PM performance. According to Craik's *environmental support hypothesis* (Craik, 1986), the amount of environmental support (i.e., retrieval cues) available during encoding and retrieval varies across memory tasks and ranges from low (e.g., no cues) to high (e.g., many cues). Naturalistic tasks often allow for more external retrieval cues (e.g., alarms, calendars, etc.) to serve as reminders than do laboratory tasks that often strictly limit the utilization of such cues. As a result, laboratory tasks tend to be more difficult than naturalistic tasks since they provide greater experimental control over the availability and use of retrieval cues to aid memory (Henry et al., 2004). Previous research has shown that free and cued recall laboratory tasks measuring *retrospective memory* (RM), or memory for past information or events (Schwartz, 2011), provide moderate levels of environmental support (Craik, 1983; 1986; Craik & McDowd, 1987) whereas PM tasks often provide less environmental support (Einstein, Smith, McDaniel & Shaw, 1997; Henry, MacLeod, & Phillips, 2004; McDaniel & Einstein, 2000). More specifically, explicit retrieval cues are given at the time of recall during free and cued recall tasks whereas more subtle PM retrieval cues are embedded in a separate laboratory task (typically referred to as an ongoing task) with no explicit prompt at the time the PM information is to be recalled. Due to providing limited environmental support, PM tasks are hypothesized to be more demanding than some other memory tasks because they often require a greater amount of self-initiated retrieval processes.

Another theoretical account that is useful for understanding differences in PM performance was put forth by McDaniel and Einstein (2000) in their *multiprocess framework*. They posited that *cue focality* may further impact the amount of self-initiated retrieval processes required to complete a PM task. This led to a distinction between focal and nonfocal PM tasks. In a *focal* PM task, individuals directly process information related to PM cues during an ongoing task. Einstein et al. (2005) exemplifies both a typical PM laboratory task and the concept of focality. In this study, participants were instructed to complete a category judgment ongoing task in which they were presented with a series of word pairs and had to decide whether the lowercase word (e.g., *tiger*) was a member of the category represented by the uppercase word (e.g., *ANIMAL*). In the focal PM condition, the PM task was to make a key press whenever a specific word (e.g., *tortoise*) appeared during the category judgment task, thus increasing the saliency of the cues. Due to adequately processing these built-in PM cues, spontaneous retrieval processes (i.e., the intention "popping" into mind; Meier, Zimmerman, & Perrig, 2006) should help participants remember to complete the PM intention (McDaniel & Einstein, 2000).

On the other hand, in a *nonfocal* PM task, the ongoing task does not require processing information directly related to PM cues (Kliegel, Jäger, & Phillips, 2008; McDaniel & Einstein, 2000). In Einstein et al., (2005), participants in the nonfocal PM condition were asked to make a key press whenever the syllable '*tor*' appeared in any of the words presented in the category judgment ongoing task. In this case, the PM cues are more subtle and should require more effortful monitoring processes to remember to complete the PM intention compared to the focal PM condition. Although spontaneous and monitoring retrieval processes may simultaneously reinforce PM, increased monitoring impacts the amount of attentional resources available for other tasks (e.g., ongoing task) and often leads to performance costs whereas spontaneous retrieval processes do not (McDaniel & Einstein, 2007; Scullin, McDaniel, & Shelton, 2013; Smith, 2003; Walter & Meier, 2014).

These findings indicate that nonfocal PM tasks should be more difficult than focal PM tasks for everyone, but especially for those who are unaware of the demands of the task. For example, if an individual does not understand the difficulty of a task ahead of time, they may not recognize that a strategy will need to be employed to successfully complete the task. However, if an individual does adequately understand the difficulty of a task beforehand, they should be able to recognize the necessity of employing a sufficient strategy, such as monitoring for the PM target items, to successfully complete the task. Based on this logic, one factor that has not been well studied that may further explain differences in PM performance and strategy implementation is metamemory.

Metacognition or "knowing about knowing" is a broad term that describes knowledge and awareness of one's cognitive functioning (Brown, 1978; Bieman-Copeland & Charness, 1994; Cavanaugh, 1982; Flavell & Wellman, 1977; Metcalfe & Shimamura, 1994; Schwartz, 2011; Tarricone, 2011). A specific component of metacognition termed *metamemory* describes one's awareness of specific cognitive processes (e.g., monitoring and regulating abilities) that are necessary for completing various memory tasks (Dunlosky & Bjork, 2008; Schwartz, 2011). Although studying metamemory in its broadest sense may be helpful for understanding what kind of information people know about their overall memory functioning and cognitive processes, it does not necessarily address the extent to which memory performance awareness impacts one's actual memory performance. As a result, some metamemory researchers study *memory self-efficacy* (MSE), or one's beliefs about one's own memory abilities in different situations, to investigate the relationship between memory beliefs and performance (Beaudoin & Desrichard, 2011; Berry, West, & Dennehy, 1989; Berry, 1999; Berry, Hastings, West, Lee, & Cavanaugh, 2010; Cavanaugh & Green 1990; Devolder, Brigham, & Pressley, 1990; Hertzog, Dixon, & Hultsch, 1990; Hess & Blanchard-Fields, 1999; Tarricone, 2011).

According to Bandura's *Social Cognitive Theory*, self-efficacy can be broadly described as beliefs about one's ability to succeed on any given task (Bandura et al., 1977; 1986; 1997; Berry, 1999; Hess & Blanchard-Fields, 1999). However, unlike the primarily cognitive approach taken today, Bandura originally proposed that individuals used self-efficacy in a social context. For example, one's level of self-efficacy stemmed from observing others and thinking about how they might be able to complete similar tasks. More important, though, was his idea about how having low or high levels of self-efficacy could influence one's approach to solving problems, meeting goals, or facing challenges. Bandura argued that individuals with high self-efficacy (i.e., high confidence in their ability to perform certain tasks) would ultimately be likely to approach their goals and challenges more readily than those with low self-efficacy (Bandura et al., 1977; 1986; 1997). This early concept is especially relevant to how people perceive their own MSE because if an individual does not feel confident in their ability to complete a memory task successfully (i.e., low MSE), the chances that they will perform poorly may be relatively high, thus potentially lowering their beliefs about their abilities to perform other tasks in the future. For this reason, Bandura's self-efficacy model can be a valuable approach (Beaudoin & Desrichard, 2011; Berry, 1999) to understand how MSE may influence individuals' actual memory performance (MP; referred to as MSE-MP relationship, hereafter).

Recently, researchers have identified four types of MSE estimates that exist on a specificity continuum ranging from general memory beliefs to specific memory beliefs about given tasks (Beaudoin & Desrichard, 2011). The broadest estimate is global MSE, which refers to one's overall memory beliefs about completing tasks that vary in type and difficulty (e.g., “I have a good memory.”; Beaudoin & Desrichard, 2011; Berry, 1999). Domain MSE refers to an individual’s beliefs about his or her ability to complete memory tasks that require processing a single type of information (e.g., “I am good at remembering past information.”). Task-specific MSE refers to one’s memory beliefs about performing a given task and this type of MSE tends to be formed over time (“I can *often* remember phone numbers.”). Finally, concurrent MSE refers to one’s memory beliefs about performing a given task in a specific “here-and-now” situation (e.g., “I can remember *this* phone number.”; Beaudoin & Desrichard, 2011). Unlike global, domain, or task-specific MSE estimates that are more stable, concurrent MSE is often temporary because one’s beliefs are more likely to change from one situation to another and previous experiences may not always be relevant (Beaudoin & Desrichard, 2011).

Considering that MSE estimates vary in terms of specificity, several different assessments are used to measure peoples’ memory beliefs depending on the aims of the research (Berry, 1999). For example, factor-analytical subscales taken from multi-item metamemory questionnaires such as the Cognitive Failures Questionnaire (CFQ: Broadbent, Cooper, FitzGerald, & Parkes, 1982), the Metamemory in Adulthood Questionnaire (MIA: Dixon, Hultsch, & Hertzog, 1988), the Memory Functioning Questionnaire (MFQ: Gilewski, Zelinski, & Schaie, 1990), and the Prospective and Retrospective Memory Questionnaire (PRMQ: Crawford, Smith, Maylor, Della Sala, & Logie, 2003; Smith, Della Sala, Logie, & Maylor, 2000) are commonly used to measure global, domain, and task-specific MSE (i.e., memory rating-based MSE) whereas single-item and multi-item performance predictions made before completing a task and single-item performance postdictions made immediately after completing a task are used to measure concurrent MSE (i.e., performance prediction-based MSE; Beaudoin & Desrichard, 2011; McDonald-Miszczak, Hunter, & Hultsch, 1994).

CHAPTER II

REVIEW OF LITERATURE

Memory Self-Efficacy-Prospective Memory Performance Relationship

On the whole, previous research examining the MSE-MP relationship has been mixed. Since most studies have been correlational rather than experimental in nature, not enough is known about the complex MSE-MP relationship (Beaudoin & Desichard, 2011). Much of the extant literature has focused exclusively on RM (especially episodic memory) and suggests that the MSE-MP relationship is moderate at best (Beaudoin & Desrichard, 2011). However, for tasks involving PM, the relationship between MSE and performance remains unclear. One important factor that makes results difficult to interpret is methodological variability in terms of how MSE and PM performance have been measured.

Global Memory Self-Efficacy and Prospective Memory Performance

Early PM studies measured the MSE-MP relationship using global MSE (Dobbs & Rule, 1987; Marsh, Hicks, & Landau, 1998; Maylor, 1990; McDonald-Miszczak, Gould, Tychynski, 1999; Reese & Cherry, 2002; Sunderland, Watts, Baddeley, & Harris, 1986), but only two demonstrated a significant link between MSE and actual PM performance. Maylor (1990) found a moderate correlation between scores on the CFQ and PM performance on a time-based PM task in which participants had to remember to carry out an action after a certain amount of time elapsed. McDonald-Miszczak et al. (1999) found a similar correlation between scores on the MIA and PM performance on a time-based PM task, but the relationship was much weaker between MIA scores and actual PM performance on an event-based PM task in which participants had to remember to carry out an action after an external retrieval cue was presented or a designated event occurred.

While these results indicate a marginal relationship between MSE and PM performance, it is important to note a few limitations. First, different global measures of MSE were administered raising the question of whether one questionnaire was better than another at evaluating the MSE-MP relationship. Given that multi-item metamemory questionnaires focus on measuring memory beliefs about general functioning and forgetting across different memory domains and tasks, they tend to provide little information about memory beliefs exclusively related to PM abilities. Therefore, the extent to which either the CFQ or the MIA adequately measured the MSE-MP relationship for PM is unknown. Second, PM performance was measured using different types of PM tasks and scoring procedures, making it difficult to clearly interpret the MSE-MP relationship.

Domain and Task-Specific Memory Self-Efficacy and Prospective Memory Performance

Since previous studies demonstrated that global MSE was not an optimal approach for examining the relationship between MSE and PM performance, some researchers have used domain and task-specific MSE. Three studies utilized the MFQ to investigate whether self-reported memory errors rated across four subscales (e.g., frequency of forgetting, seriousness of forgetting, retrospective functioning, and mnemonic usage) were related to actual PM performance, but none provided sufficient evidence supporting this relationship (Reese & Cherry, 2006; Salthouse, Berish, & Siedlecki, 2004; Zelinski, Gilewski, & Anthony-Bergstone, 1990). Despite the fact that the same MSE measure was used to assess the MSE-MP relationship across studies, certain intrinsic characteristics of the MFQ may have significantly impacted the results. For example, the MFQ is similar to other multi-item metamemory questionnaires that have been used to measure global MSE in that it has very few items specifically devoted to PM (Reese & Cherry, 2006; Smith et al., 2000), so it may have prompted individuals to predominantly evaluate their RM functioning rather than their PM functioning. As a result of being unable to adequately assess subjective PM functioning, this particular MSE measure may have artificially weakened the correlational relationship between participants' self-reported memory errors and PM performance even though each study had an adequate sample size.

Given that the MFQ was unsuccessful in detecting the MSE-MP relationship for PM, researchers used the PRMQ to determine whether self-reported memory errors rated across two multi-item subscales (e.g., problems remembering future intentions and problems remembering past information) correlated with objective PM performance. In contrast to the MFQ, the PRMQ measures the perceived occurrence of everyday PM and RM errors separately rather than together (Crawford et al., 2003). This systematic modification to the domain/task-specific MSE approach was appealing because it allowed researchers to prompt individuals to evaluate their PM and RM functioning equally. However, even with this essential improvement, only three studies found a significant correlation between scores on the PRMQ and actual PM performance (Kliegel & Jäger, 2006; Mäntyla, 2003; Zeintl, Kliegel, Rast, & Zimprich, 2006) whereas others did not find evidence of the MSE-MP relationship using either subscale by itself or combined (Meeks, Hicks, & Marsh, 2007; Rönnlund, Vestergren, Mäntyla, & Nilsson, 2011).

Although a few studies indicated that the PRMQ was successful in evaluating the MSE-MP relationship for PM, the findings were relatively inconsistent. Seeing that the PRMQ had the same objective as the MFQ, it is reasonable to expect that the overall validity of this multi-item metamemory questionnaire was influenced by similar methodological flaws. First, despite the fact that the PRMQ was able to measure individuals' self-reported memory errors on everyday PM and RM tasks separately, this improvement over the MFQ was only moderately useful for assessing one of the many influential determinants of MSE, namely domain-specific mastery experiences (Bandura, 1982; Beaudoin & Desrichard, 2011). The results demonstrated that some individuals were aware of their past PM and RM errors, but there was no way to determine whether individuals believed that these memory problems would impact their ability to complete similar tasks in the future. Second, several different PM tasks and scoring procedures were used to measure PM performance across studies, but participants may not have taken the specific characteristics of each memory task into consideration when completing the PRMQ. These are important limitations to point out because previous research has indicated that peoples' memory beliefs tend to vary from one situation to another based on the relevant characteristics of the task and situation (Bandura, 1986; 1997; Beaudoin & Desrichard, 2011; Hertzog & Hultsch, 2000).

Concurrent Memory Self-Efficacy and Prospective Memory Performance

To more fully capture the MSE-MP relationship for PM, a small but growing number of researchers have used concurrent MSE to examine how certain characteristics of PM memory tasks (e.g., the amount and type of retrieval cues available) and the situation in which the tasks are carried out (e.g., in a naturalistic or laboratory setting) may influence MSE and actual PM performance. A handful of studies have demonstrated a strong link between MSE and PM performance using single-item performance predictions and postdictions (Devolder et al., 1990; Meeks et al., 2007; Rummel, Kuhlmann, & Touron, 2013) and one study has demonstrated this relationship using multi-item performance predictions (Meier, von Wartburg, Matter, Rothen, & Reber, 2011).

Across three studies, Devolder et al. (1990) examined the extent to which younger and older adults were able to accurately predict and postdict their future RM and PM performance. Prior to completing several RM tasks (e.g., free recall, cued recall, and recognition) and one PM task (e.g., appointment keeping), participants made single-item predictions about how well they thought they would perform on each of the tasks. Participants also made single-item postdictions after completing the memory tasks indicating how well they believed they had performed. Devolder et al. (1990) found that younger adults were more accurate than older adults when predicting their RM performance and they outperformed older adults on these memory tasks. However, older adults were more accurate than younger adults when predicting their PM performance and they often outperformed younger adults on the PM task. These results indicate that younger adults were underconfident in their memory performance abilities on the RM tasks, but overconfident in their abilities on the PM task. Conversely, older adults were overconfident in their memory abilities on the RM tasks, but underconfident in their abilities on the PM task. Overall, both age groups were able to judge their past memory performance more accurately than their future memory performance on these types of tasks supporting subsequent research that has demonstrated this same pattern (Hertzog & Dixon, 1994; Kidder et al., 1997; Metcalfe & Shimamura, 1994). Given that participants' prediction and postdiction accuracy levels varied across tasks (i.e., low within-person consistency), individuals may have been more aware of their abilities to perform on some memory tasks than others.

Although finding that younger adults were more successful in predicting their future RM performance and performing the RM tasks than older adults is consistent with age-related differences supported by the environmental support hypothesis (Craik, 1986) and the multiprocess framework (McDaniel & Einstein, 2000), observing that older adults were more successful in predicting their PM performance and performing the PM task than younger adults is not consistent with previous aging research (Ihle, Hering, Mahy, Bisiacchi, & Kliegel, 2013; Kliegel et al., 2008). One explanation for this inconsistency is that the PM task used was a naturalistic one that took place outside of the laboratory and failed to consider whether participants were using compensatory strategies (i.e., external retrieval cues) to complete the task. Without being able to determine whether participants employed a strategy to improve their PM performance on this particular PM task, it is difficult to draw reliable conclusions about the MSE-MP relationship.

To better understand the MSE-MP relationship for PM and conceptually replicate Devolder et al.'s (1990) findings with proper experimental control, Meeks et al. (2007) investigated the degree to which young adults were able to accurately predict and postdict their performance on two different laboratory PM tasks. For the PM manipulation, participants in one condition were instructed to press the forward slash key as quickly as they could if they saw a word that represented an animal (e.g., *goat*; Einstein et al., 2005) during an ongoing lexical decision task (LDT) in which they were told to press 'YES' (F key) if the string of letters was a word or 'NO' (J key) if the string of letters was not a word. In the other PM condition, participants were instructed to press the forward slash key as quickly as they could if they saw the syllable 'tor' (e.g., *dormitory*) appear in any of the stimuli presented during the ongoing LDT. Since both of the PM conditions in this experiment were nonfocal, they were expected to be more difficult than focal PM tasks due to the increased self-initiated retrieval demands required (for a review, see Kliegel et al., 2008). However, it is important to note that the animal PM condition was hypothesized to be easier than the syllable PM condition because it should require fewer self-initiated retrieval processes to recognize the word '*goat*' as an animal than it does to identify the syllable '*tor*' (for a review, see Einstein & McDaniel, 2005; McDaniel & Einstein, 2007). To assess the extent to which the level of PM task difficulty influenced monitoring processes and ongoing task performance across the two conditions, Meeks et al. (2007) measured participants' reaction times (RTs) on the LDT word trials.

Before completing the PM task, participants were asked to indicate the percentage of PM target items they thought they would be able to detect out of eight opportunities using a scale from 0% to 100%. Afterwards, they were also asked to indicate the percentage of PM target items that they actually detected using an identical percentage scale. In addition to making single-item performance predictions and postdictions, all participants completed the PRMQ so that the researchers could determine whether participants' self-reported PM and RM memory errors were related to their actual PM performance. The results demonstrated that there were important differences in memory performance awareness across the two nonfocal PM conditions such that participants in the syllable PM condition were more accurate in predicting and postdicting their PM performance compared to those in the animal PM condition. Participants in the syllable PM condition also responded more slowly to the LDT items than participants in the animal PM condition indicating that they were using a compensatory strategy to increase their monitoring for the PM target items. Despite the fact that participants in the syllable PM condition used a strategy to improve their PM performance, participants in the animal PM condition likely outperformed them because the animal PM target items required fewer self-initiated retrieval processes to detect than the syllable PM target items as expected (Einstein & McDaniel, 2005; McDaniel & Einstein, 2007).

One trend that contradicted Devolder et al.'s (1990) findings with a naturalistic PM task but replicated other research using laboratory PM tasks (Knight, Harnett, & Titov, 2005; Schnitzspahn, Ihle, Henry, Rendell, & Kliegel, 2011) was that young adults were underconfident in their ability to successfully complete both of the PM tasks. As mentioned by Meeks and colleagues (2007), this finding may be partially explained by the fact that participants did not predict their future PM performance with the possibility in mind that they would employ a compensatory strategy to complete the PM task. Similar to prior work, they found that participants were less accurate when predicting their future PM performance, but slightly more accurate when postdicting their past PM performance (Devolder et al., 1990; Kidder et al., 1997). Meeks et al. (2007) did not find any evidence indicating that PRMQ scores were related to PM performance in either PM condition. Consistent with previous studies that examined the MSE-MP relationship using domain/task-specific MSE (Kliegel & Jäger, 2006; Mäntyla, 2003; Reese & Cherry, 2006; Salthouse et al., 2004; Zeintl et al., 2006; Zelinski et al., 1990), this finding was probably not significant because these types of MSE assessments do not take the specific characteristics of the task or situation into consideration. Therefore, finding that the concurrent MSE measure was related to actual PM performance but that the domain/task-specific MSE measures was not provided further evidence supporting the idea that memory performance awareness will vary depending on the type of task and situation.

Meeks et al.'s (2007) study was well-designed and highly useful for understanding the MSE-MP relationship for PM, but it failed to consider whether the act of making performance predictions about one's memory abilities may have an effect on memory performance. Prior research has shown that making performance predictions can enhance subsequent memory performance on RM tasks (Kelemen & Weaver, 1997; Spellman & Bjork, 1992), but researchers have only recently begun to measure the reactive effects of performance predictions on PM performance (Meier et al., 2011; Rummel et al., 2013). Meier et al. (2011) examined the extent to which making performance predictions versus making no performance predictions impacted PM performance and retrieval experience (e.g., *pop-up*: spontaneous remembering or *search*: effortful monitoring; for a review, see Einstein & McDaniel, 2005; McDaniel & Einstein,

2007) on focal and nonfocal PM tasks. Before completing the PM task, participants were asked to provide information about their ability to remember the PM intention and the likelihood that they would remember to carry out the PM task using a 6-item Likert scale (e.g., 1 = not sure I will remember…6 = very sure I will remember). At the end of the experiment, participants who performed the task correctly were also asked to indicate whether they remembered to complete the PM intention "because they were searching for the target" or "because the target just popped into their mind."

Meier et al. (2011) found that performance predictions improved PM performance for participants in the nonfocal PM condition, but not for participants in the focal PM condition. Since people tend to perform better on focal PM tasks than on nonfocal PM tasks, the act of making performance predictions may not have been as beneficial for participants in the focal PM condition because they were already performing near the peak level (i.e., a ceiling effect). The results also demonstrated that performance predictions and cue focality influenced retrieval experience such that those who predicted their PM performance in the nonfocal PM condition reported having more search experiences than pop-up experiences whereas participants who predicted their PM performance in the focal PM condition reported having more pop-up experiences than search experiences. These findings are consistent with both the environmental support hypothesis (Craik, 1986) and multiprocess framework (McDaniel & Einstein, 2000) because greater self-initiated retrieval and monitoring processes are required for nonfocal PM tasks whereas fewer self-initiated retrieval and monitoring processes are needed for focal PM tasks (Einstein et al., 2005). Overall, a significant interaction effect showed that performance predictions were related to PM performance such that participants in the nonfocal PM condition were more accurate in predicting their PM performance than participants in the focal PM condition. Thus, by predicting their PM performance and experiencing more search experiences, participants in the nonfocal PM condition performed nearly as well as participants in the focal PM condition indicating that performance predictions can be used as a strategy to improve PM performance, especially on more difficult tasks.

Although Meier and colleagues (2011) posited that making performance predictions improved nonfocal PM performance by increasing monitoring for the PM target items, several drawbacks limit the findings. Most importantly, methodological variability was introduced with regards to the type of PM task used as well as the type of MSE measure that was administered. For the PM task, only one PM target item was embedded in the ongoing task. Since PM performance was scored as the proportion of correct responses (i.e., the proportion of successful participants), including a single PM target item may have significantly reduced the reliability of the findings. For the MSE measure, participants were asked to indicate the likelihood that they would remember the PM intention and remember to carry out the PM task using a 6-item Likert scale, but most concurrent MSE measures have asked participants to indicate the percentage of PM target items they thought they would be able to detect using a scale from 0% to 100% (Devolder et al., 1990; Meeks et al., 2007). In addition to scale variability, it is important to note that Meier et al.'s (2011) MSE measure may have also inflated PM performance for participants who completed the multi-item MSE questionnaire in the prediction condition because they had additional opportunities to rehearse the PM target item making it easier to remember (Marsh, Hicks, Cook, Hansen, & Pallos, 2003; Einstein & McDaniel, 2005).

Rummel et al. (2013) also recently examined the extent to which making performance predictions influenced PM performance and monitoring processes on focal and nonfocal PM tasks. To reduce the amount of methodological variability between studies, they used Meeks et al.'s (2007) ongoing LDT, PM target item category, and single-item performance prediction approach to conceptually replicate Meier et al.'s (2011) novel findings of the effects of performance predictions on PM performance. To extend previous research, participants were assigned to one of three experimental prediction conditions: a PM performance prediction condition, a PM/LDT performance prediction condition, or a no performance prediction condition. Prior to completing the ongoing LDT in which the PM target items were embedded, participants in the first condition were asked to indicate the percentage of PM target items they thought they would be able to detect using a scale from 0% to 100%. Participants in the second condition were asked to indicate the percentage of PM target items they thought they would be able to detect as well as the percentage of letter strings they thought they would correctly judge as words or nonwords using a scale from 0% to 100% and how fast they thought they would be able to perform the word judgment task using a scale from 0 to 100. Finally, participants in the third condition served as a control group that made no performance predictions.

Overall, Rummel et al. (2013) found that performance predictions improved PM performance for participants in the focal and nonfocal PM conditions. Although this outcome is slightly contradictory to Meier et al.'s (2011) finding, performance predictions likely improved focal PM performance in this study because the task was more difficult and participants had to detect more PM target items than those in Meier's study did. The results demonstrated that participants were largely inaccurate when predicting their future PM performance compared to their actual PM performance. More specifically, participants were underconfident in their ability to complete the focal PM task and overconfident in their ability to complete the nonfocal PM task. Similar to Meeks et al.'s (2007) findings, participants who predicted their PM performance responded more slowly on the LDT than participants who did not predict their PM performance indicating that they did in fact employ a compensatory strategy to increase their monitoring for the PM target items compared to the non-PM target items. When participants predicted their PM performance and their LDT performance, the reactive effects of performance predictions were eliminated. As Rummel et al. (2013) hypothesized, requiring participants to make judgments about their ability to complete two memory tasks simultaneously cancels out the beneficial effects of performance predictions because neither task is perceived to be more important than the other.

Summary

Previous research has investigated the MSE-MP relationship for RM, but very few studies have examined this relationship for PM. Further, the results of the PM-focused studies have been difficult to interpret due to methodological differences in terms of how MSE and PM has been measured. Although a few studies have investigated the extent to which individuals are aware of the demands of certain PM tasks as evidenced by single-item and multi-item performance predictions, only two of them have taken the reactive effects of making performance predictions into consideration. Since people heavily rely on PM to complete everyday tasks, identifying strategies that can be used to improve PM performance is essential. To better understand the MSE-MP relationship for PM, the overarching goal of this research is to directly compare the extent to which making single-item and multi-item performance predictions are useful for improving PM performance compared to each other and making no performance predictions. Single-item performance predictions will be assessed using established methods from previous studies (Meeks et al., 2007; Rummel et al., 2013) whereas multi-item performance predictions will be assessed using the Memory Self-Efficacy Questionnaire (MSEQ; Berry et al., 1989) that was created based on Bandura's Self-Efficacy Theory (Bandura, 1977; 1982; 1997).

The MSEQ is expected to be superior to Meier et al.'s (2011) multi-item measure for assessing the MSE-MP relationship for PM for several reasons. First, it will provide valuable information about participants' beliefs regarding their ability to complete different memory tasks at various performance levels as well as their level of confidence to do so. As a brief example, an individual will first be asked to decide whether they are capable of completing a memory task at various performance levels by circling 'YES' or 'NO' (e.g., "If a target item was presented to me 8 different times, I believe I could remember to press the F6 key [1 time/4 times/…/8 times] out of the 8 times they were presented."). Individuals will then be asked to indicate how confident they are about their ability to perform at each of these levels by circling a percentage ranging from 10% to 100% (Berry et al., 1989; Beaudoin & Desrichard, 2011). Second, it will help researchers determine the extent to which individuals differ in their memory performance awareness on certain memory tasks. For example, if two participants report being able to successfully complete a memory task, but their level of confidence varies across different performance levels (e.g., 20% versus 80%), it may suggest that the person who reported having lower levels of confidence recognized the demands of the task whereas the person who reported having higher levels of confidence may not have recognized the demands of the task. Third, it will require participants to provide multiple skill-level and confidence level estimates about their ability to complete a given memory task which may then prompt them to reflect on the demands of the task more deeply than single-item performance predictions would require (Craik & Lockhart, 1972). Fourth, it has frequently been used in the cognitive aging literature on RM and employing the MSEQ here will lay the groundwork for a future study that will examine the effects of performance predictions on PM and RM among older adults. Using the MSEQ here will make it easier to connect these effects to the extant cognitive aging literature on PM.

Specific Aims

The primary aim of the proposed study was to extend previous work that assessed the MSE-MP relationship with single-item performance predictions (Devolder et al., 1990; Meeks et al., 2007; Rummel et al., 2013). Multi-item performance predictions (Meier et al., 2011) were used to determine whether they were more effective for improving PM performance than single-item performance predictions or conditions in which performance predictions were not made (e.g., a control group).

The second aim of this study was to compare the extent to which making single-item and multi-item performance predictions differentially improved PM performance on two types of tasks (focal, nonfocal) that varied in difficulty.

The third aim of this study was to compare the extent to which single-item and multi-item performance predictions led to greater performance costs on the ongoing LDT possibly reflecting increased monitoring processes for focal and nonfocal PM tasks.

The fourth aim of this study was to compare the extent to which single-item and multi-item performance predictions and single-item performance postdictions accurately reflected actual PM performance.

CHAPTER III

METHOD

Design

This experiment employed a 3 (Prediction condition: single-item prediction, multi-item prediction, no prediction) x 2 (PM condition: focal, nonfocal) x 2 (LDT block: baseline, PM) mixed factorial design. Prediction condition and PM condition were measured between subjects. LDT block was measured within subjects. The primary dependent variable was PM performance. Secondary dependent variables were task importance ratings, LDT reaction times, LDT reaction time difference scores, LDT accuracy scores, prediction difference scores and postdiction difference scores.

Participants

A total of 180 undergraduate students at Oklahoma State University who indicated English as their first language participated in the study for partial credit toward a course research requirement. Two participants who did not appropriately make word judgments during the PM block (e.g., missed 10 or more consecutive word judgment trials) as well as three participants who had absolute z scores larger than 3 on the LDT (Stevens, 2009) were excluded from the analyses. The final sample consisted of 175 participants who ranged from 18 to 32 years of age (M_{age} = 19.73 years, *SD* = 1.94).

Gender was relatively balanced with 107 women and 68 men participating. Most participants were Caucasian (82.9%), but the sample also included participants who indicated they were African American (7.4%), Native American (4.0%), Hispanic/Latino (2.9%), Pacific Islander (0.5%), or of multiple ethnicities (1.8%). Only one participant chose not to report their ethnicity (0.5%). Each participant was tested individually in a single session that lasted one hour. Participants were randomly assigned to one of three prediction conditions: single-item prediction (n = 58), multi-item prediction (n = 60), or no prediction condition (n = 57). Additionally, participants were randomly assigned to either the focal PM condition (n = 88) or the nonfocal PM condition (n = 87).

Materials

Lexical Decision and Prospective Memory Tasks. The ongoing task was a lexical decision task (LDT) similar to the one used by Meeks et al. (2007) that consisted of 420 trials (210 trials per LDT block) in which half of the trials were valid English words and the other half were pronounceable, nonwords. Items were selected from the English Lexicon Project Database (Balota et al., 2007) and were randomly assigned to a trial position within the experimental program for each participant tested. Individuals were asked to make judgments about these items and indicate whether the item was a word by pressing a key labelled 'YES' or 'NO' on the keyboard. For each trial, a fixation point (+) was presented for 500ms (Allen, Madden, & Crozier, 1991; Robert & Mathey, 2007) followed by the presentation of a single word or non-word for a maximum of 3000ms. After each word judgment was made, the screen went blank until the next trial began with another 500ms fixation point. The PM task was embedded within the LDT requiring participants to press the 'F6' key on the keyboard instead of making a word judgment whenever a target word appeared on the screen. PM target words were selected from the

English Lexicon Project Database (Balota et al., 2007) to match the ongoing LDT items in length, number of syllables, and frequency. In the focal PM condition, one target word (i.e., *goat*) was presented eight different times (Einstein & McDaniel, 1990). In the nonfocal PM condition, eight target words from one semantic category (i.e., *animal*) were each presented one time. The PM targets were*: horse, zebra, goat, sheep, moose, rabbit, giraffe, and lion* (Meeks et al., 2007; Rummel et al., 2013). Consistent with the LDT stimuli randomization, the order in which the nonfocal PM target words appeared was randomized for each participant. PM targets appeared on trials 25, 50, 75, 100, 125, 150, 175, and 200 of the PM block.

An LDT was also used to create a baseline block that was divided into two halves. The first half consisted of 105 trials and was administered before any instructions about the PM task were presented. The second half also consisted of 105 trials and was administered after the PM task was completed and the participants were informed that they no longer needed to look for or respond to the PM target items. These two halves were combined to create one baseline score that was then used to evaluate the cost that completing the PM task had on performance in the ongoing task. RTs on the LDT were expected to be faster in the baseline block than in the PM block because participants were only required to make word judgments during the baseline block (McDaniel & Einstein, 2007; Smith, 2003). On the other hand, RTs on the LDT were expected to be slower during the PM block because participants were required to complete both tasks simultaneously, which should have decreased the amount of attentional resources available for the ongoing LDT.

Other Tasks. Two other memory tasks were administered for purposes not directly related to the aims of this study. A free recall task consisted of 25 words selected from the Toglia and Battig (1978) word series (see Appendix A). Each word was presented at a 3s rate with a 200ms delay between stimuli. A cued recall task consisted of 25 unrelated word pairs selected from the online English Lexicon Project Database (Balota et al., 2007; see Appendix B). Each word pair was presented at a 5s rate with a 200ms delay between stimuli. These two tasks were counterbalanced so that some participants completed the free recall task prior to the PM task and others completed the cued recall task before the PM task. A few brief questionnaires were also administered to assess the participants' perceived importance of the LDT and PM tasks, self-reported strategy use, attentional control abilities (Derryberry & Reed, 2002; Judah, Grant, Mills, & Lechner, 2014), and demographics including age, gender, education level, and health status (adapted from the Older American Resources and Services Multidimensional Functional Assessment Questionnaire; OARS; Duke University Center for the Study of Aging and Human Development, 1975).

Metamemory Measures. For those in the single-item prediction condition, a single-item MSE questionnaire adapted from Meeks et al. (2007) was used to assess participants' memory performance predictions (see Appendix C). For the PM task, participants were instructed to indicate the total percentage of target items that they believed they would detect during the LDT task using a scale from 0% to 100%. The single-item MSE questionnaires for the free recall and cued recall memory tasks (see Appendices D, E) also consisted of one question in which participants were asked to indicate the total percentage of words that they believed they would recall from each task using a scale from 0% to 100%.

For those in the multi-item prediction condition, a multi-item MSE questionnaire adapted from Berry et al.'s (1989) Memory Self-Efficacy Questionnaire (MSEQ) was used to assess participants' memory performance predictions and confidence ratings. First, participants were instructed to circle either 'YES' or 'NO' about their ability to complete a certain memory task. If participants circled 'YES', they were then asked to indicate their level of confidence to do so by circling a percentage ranging from 10% to 100%. However, if participants circled 'NO', they were not asked to provide a confidence rating. Two different versions of the PM MSEQ consisted of eight questions each. For the focal PM condition, the questions were framed in terms of how many times participants believed they would remember to press the 'F6' key when the word *goat* appeared (e.g., "If a target item was presented to me 8 different times, I believe I could remember to press the F6 key 1 time out of the 8 times it was presented."; see Appendix F). For the nonfocal PM condition, the questions were framed in terms of how many times participants believed they would remember to press the 'F6' key when any word that represented an *animal* appeared (e.g., "If target items were presented to me 8 different times, I believe I could remember to press the F6 key 1 time out of the 8 times they were presented."; see Appendix G). The multi-item MSEQs for the free recall and cued recall memory tasks consisted of five questions about the total number of words participants believed they would recall from each word list (see Appendices H, I).

Procedure

Upon arriving at the research laboratory, participants were asked to read a consent form. After written consent was obtained, the experimenter asked all participants to read the instructions on the computer screen carefully and to ask if they had any questions throughout the session. The LDT was presented to participants as a word judgment task and each participant was instructed to press ‘YES’ on the keyboard if the string of letters shown was a word or ‘NO’ if the string of letters shown was not a word. The experimenter then told participants that they should try to make word judgments as quickly and accurately as possible. Each participant was presented with ten practice trials followed by 105 baseline trials.

Next, the experimenter introduced the PM task which was described as a secondary interest. Participants in the focal PM condition were instructed to press the ‘F6’ key on the keyboard instead of making a yes or no word judgment whenever the PM target word (e.g., *goat*) appeared on the screen as part of the LDT. Participants in the nonfocal PM condition were instructed to press the ‘F6’ key on the keyboard instead of making a yes or no word judgment whenever target words that represented an *animal* appeared on the screen as part of the LDT. The experimenter then asked all participants to restate the instructions in their own words to be certain they understood the task. Once a thorough understanding of the PM task was demonstrated, the experimenter administered participants in the prediction conditions either the single-item PM MSE questionnaire or the multi-item PM MSEQ (see Appendices D, G, H).

Afterwards, participants were instructed to complete a different memory task. The experimenter read the free recall task instructions (some participants received the cued recall task instructions here depending on counterbalancing order) out loud while participants read them on the screen. Next, the experimenter administered participants in the prediction conditions either the single-item MSE questionnaire or multi-item MSEQ depending on counterbalancing order (see Appendices E, I). Upon completing the questionnaire, participants were presented with 25 words on the computer screen. After all of the words were presented, the experimenter then asked the participants to recall out loud as many of the words as possible. Once all responses were recorded by the experimenter, participants were asked to indicate what percentage of words they felt they had successfully recalled during the memory task.

For the PM block, the experimenter reminded participants that they should press 'YES' on the keyboard if the string of letters shown was a word or 'NO' if the string of letters shown was not a word. The experimenter also reminded participants that they should try to make word judgments as quickly and accurately as possible, but they did not give any additional information about the embedded PM task. Immediately following the PM block, the experimenter administered post-test questionnaires to assess participants' memory for the PM task, self-reported importance of the LDT and PM tasks, and self-reported strategy use. Additionally, participants were asked to indicate what percentage of PM target items they felt that they had successfully detected during the LDT. After the post-test questionnaires were completed, participants were asked to complete the second half of the baseline trials.

Once the baseline testing concluded, participants were asked to complete another memory task. The experimenter read the cued recall task instructions (some participants received the free recall task instructions here depending on counterbalancing order) out loud while participants read them on the screen. Next, the experimenter administered participants in the prediction conditions either the single-item MSE questionnaire or multi-item MSEQ depending on counterbalancing order (see Appendices F, J). Upon completing the questionnaire, participants were presented with 25 word pairs on the computer screen. After all 25 word pairs were presented, participants were able to advance through the recall items at their own pace. The experimenter then asked the participants to recall out loud the missing word that completed each pair. If participants were unsure of the correct answer, they were allowed to respond with “I don’t know.” When all responses were recorded by the experimenter, participants were asked to indicate what percentage of word pairs they felt they had successfully recalled during the memory task and then filled out a 20-item attentional control scale and a short demographics questionnaire. Once completed, the session ended with a debriefing.

CHAPTER IV

RESULTS

Overview of Analyses

The general data analysis approach was to perform separate analyses of variance (ANOVAs) on all dependent measures as a function of prediction condition (single-item prediction, multi-item prediction, no prediction) and PM condition (focal, nonfocal).

Aim One and Two, Prospective Memory Performance

PM performance was scored as the proportion correct out of eight possible opportunities. PM responses were recorded as correct if participants pressed the 'F6' key on the keyboard any time a target word (i.e., *goat* or words that represented an *animal*) appeared during the ongoing LDT. Participants were expected to press the 'F6' key during the LDT trial in which the PM target word appeared (i.e., strict criterion), but if they forgot, they could press the 'F6' key up to three LDT trials (e.g., word judgments) later before a response was scored as incorrect or missed (i.e., lenient criterion). In the whole sample (N = 175), only four participants pressed the 'F6' key during the three LDT trials following each PM target item resulting in no significant difference in PM performance when applying the strict versus the lenient criterion. Thus, the strict criterion was applied to the following analyses for consistency (Rummel et al., 2013).

A 3 (Prediction condition: single-item prediction, multi-item prediction, no prediction) x 2 (PM condition: focal, nonfocal) between-subjects factorial ANOVA was conducted to statistically determine the effect of performance predictions on PM performance. No main effect of prediction condition was found when collapsed across PM condition, $F(2, 169) = .189$, $p = .828$, $\eta_p^2 = .002$. A main effect of PM condition was observed such that PM performance in the focal PM condition was significantly better than PM performance in the nonfocal PM condition, $F(1, 169) = 46.26$, $p < .001$, $\eta_p^2 = .215$, but no significant interaction between prediction condition and PM condition was found, $F(2, 169) = 1.17$, $p = .313$, $\eta_p^2 = .014$. Mean PM performance (as proportion correct) by prediction condition and PM condition can be found in Table 1.

Aim One and Two, Task Importance Ratings

A brief questionnaire was administered to assess how important participants thought the PM task and the LDT were on a 7-item Likert scale (e.g., 1 = little importance to 7 = great importance). Collapsing across all conditions, bivariate correlations calculated using Spearman's Rho (ρ) revealed three important relationships. First, a positive relationship between perceived PM task importance and PM performance indicated that as PM task importance ratings increased, PM performance also increased, $\rho = .64$, $p < .001$. Second, a negative relationship between perceived LDT importance and PM task performance demonstrated that as LDT importance ratings increased, PM performance decreased, $\rho = -.29$, $p < .001$. Third, a negative relationship between perceived PM task importance and perceived LDT importance indicated that as PM task importance ratings increased, LDT importance ratings decreased, $\rho = -.19$, $p < .05$, replicating prior research on task importance ratings and performance (Walter & Meier, 2014).

To further investigate these correlational relationships, a 3 (Prediction condition: single-item prediction, multi-item prediction, no prediction) x 2 (PM condition: focal, nonfocal) x 2 (Task type: PM, LDT) mixed factorial ANOVA was conducted on the task importance ratings to statistically determine the extent to which prediction condition and PM condition influenced the perceived importance of the PM task and the LDT. No main effect of prediction condition was found, $F(2, 169) = .819$, $p = .442$, $\eta_p^2 = .010$. However, a main effect of PM condition was observed such that participants in the focal PM condition perceived the PM task and the LDT to be more important than participants in the nonfocal PM condition perceived them to be, $F(1, 169) = 18.52$, $p = <.001$, $\eta_p^2 = .099$. A main effect of task type was also found such that participants generally perceived the LDT to be more important than the PM task, $F(1, 169) = 5.21$, $p = .024$, $\eta_p^2 = .030$. Finally, a significant interaction between PM condition and task type was found, $F(1, 169) = 11.20$, $p < .001$, $\eta_p^2 = .062$.

Follow-up tests of simple effects were conducted to further explore the interaction. These tests revealed that there were significant differences in perceived task importance between the PM conditions for the PM task ($M_F = 5.84$, $SD = 1.78$; $M_{NF} = 4.47$, $SD = 2.19$), $t(173) = 4.55$, $p < .001$, but not for the LDT ($M_F = 5.63$, $SD = 1.28$; $M_{NF} = 5.63$, $SD = 1.42$), $t(173) = .035$, $p = .972$. These results suggest that this interaction was driven by the magnitude of the difference in participants' perceived PM task importance across the PM conditions. Mean task importance ratings by prediction condition, PM condition, and task type can be found in Table 2.

Aim Three, Lexical Decision Task Cost as Measured by Reaction Times

All RTs for the LDT were recorded as the length of time it took for participants to make a judgment about whether the item presented on the screen was a word or not by pressing the keys labeled ‘YES’ or ‘NO’ on the keyboard. Consistent with previous PM research (Einstein et al., 2005; Knight et al., 2011; Lourenço, & Maylor, 2014; Meeks et al., 2007; Rummel et al., 2013), analyses were confined to RTs on trials in which words were presented and correctly identified as words. Word trials with RTs of less than 300ms or more than 2.5 standard deviations from an individual’s mean RT were trimmed. This resulted in the exclusion of less than 1% of trials. All PM target trials as well as the three trials following each PM target item were also excluded from the RT analyses to control for task switching costs on these trials (Rummel et al., 2013; Smith & Bayen, 2004).

A 3 (Prediction condition: single-item prediction, multi-item prediction, no prediction) x 2 (PM condition: focal, nonfocal) x 2 (LDT block: baseline, PM) mixed factorial ANOVA was conducted on the trimmed RT data to statistically determine the extent to which prediction condition and PM condition impacted RT responses on the LDT across the baseline and PM blocks. No main effect of prediction condition, $F(2, 169) = .112$, $p = .894$, $\eta_p^2 = .001$ or PM condition was found, $F(1, 169) = .829$, $p = .364$, $\eta_p^2 = .005$. However, a main effect of LDT block was observed such that participants responded more slowly to LDT items in the PM block than in the baseline block, $F(1,$

169) = 97.49, $p < .001$, $\eta_p^2 = .366$. A significant interaction between PM condition and LDT block was also found, $F(1, 169) = 14.40$, $p < .001$, $\eta_p^2 = .079$.

To further explore the interaction, follow-up tests of simple effects were conducted. These tests indicated that there were significant differences in RT responses on the LDT between the PM conditions in the baseline block (M_F = 680ms, $SD = 87$; M_{NF} = 650ms, $SD = 76$), $t(173) = 2.36$, $p < .05$, but not in the PM block (M_F = 708ms, SD = 94; M_{NF} = 714ms, $SD = 96$), $t(173) = .433$, $p = .665$. In addition, a 2 (PM condition: focal, nonfocal) x 3 (Prediction condition: single-item prediction, multi-item prediction, no prediction) between-subjects factorial ANOVA on the RT difference scores (e.g., each participant's mean RT for the PM block subtracted from their mean RT for the baseline block; Smith, Rogers, McVay, Lopez, & Loft, 2014) revealed a main effect of PM condition such that participants in the focal PM condition had an average RT increase (e.g., slowing) of 28ms ($SD = 45$) from the baseline block to the PM block whereas participants in the nonfocal PM condition had an average RT increase (e.g., slowing) of 64ms ($SD = 75$) from the baseline block to the PM block, $F(1, 169) = 14.401$, $p = .001$, $\eta_p^2 = .079$. These results suggest that this interaction was driven by the magnitude of the difference in RT responses (i.e., slowing) on the LDT across the PM conditions from the baseline block to the PM block. Mean RTs (in milliseconds) by prediction condition, PM condition, and LDT block can be found in Table 3.

Aim Three, Lexical Decision Task Cost as Measured by Accuracy

LDT accuracy was scored as the proportion of trials in which words and non-words were correctly identified out of the total number of possible trials in each LDT block (Scullin, McDaniel, & Einstein, 2010; Smith, & Loft, 2014). LDT responses were recorded as correct if participants pressed the 'YES' key on the keyboard whenever words were presented on the screen and the 'NO' key on the keyboard whenever non-words were presented on the screen. All trials presented during the LDT counted towards the total number of possible trials except for the eight PM target items. There were 210 trials presented in the baseline block and 202 trials presented in the PM block.

A 3 (Prediction condition: single-item prediction, multi-item prediction, no prediction) x 2 (PM condition: focal, nonfocal) x 2 (LDT block: baseline, PM) mixed factorial ANOVA was conducted on the LDT accuracy scores to statistically determine the extent to which completing the PM task influenced the ability to accurately complete the LDT. No main effect of prediction condition, $F(2, 169) = 2.17$, $p = .118$, $\eta_p^2 = .025$ or PM condition, $F(1, 169) = 1.07$, $p = .303$, $\eta_p^2 = .006$ was found. However, a main effect of LDT block was observed such that participants correctly responded to more of the LDT trials in the PM block ($M = .95$, $SD = .04$) than in the baseline block ($M = .94$, $SD = .05$), $F(1, 169) = 27.11$, $p < .001$, $\eta_p^2 = .138$. No significant interactions were found, Fs < 1.

Aim Four, Prediction Accuracy

Performance predictions were assessed using the single-item MSE and the multi-item MSEQ. Given that the number of items (e.g., one item versus eight items) and scales (e.g., prediction percentage versus prediction percentage and confidence ratings) varied across these measures, the accuracy of single-item and multi-item performance predictions were evaluated independently of each other. For the single-item MSE, predictions were converted from percentages to proportions so that each participant's predicted PM performance could be subtracted from their actual PM performance which was scored as a proportion (Devolder et al., 1990; Meeks et al., 2007; Rummel et al., 2013). This resulted in a prediction difference score for each participant. For the multi-item MSEQ, self-efficacy level (SEL) scores (i.e., predictions) were obtained by summing the number of 'YES' responses made with at least 10% confidence (Berry et al., 1989; Berry, Williams, Usubalieva, & Kilb, 2013). SEL scores were then converted to percentages by dividing the number of 'YES' responses made by the total number of target items (e.g., 1/8 = 12.5%...8/8 = 100%). Finally, the percentages were converted to proportions so that each participant's predicted PM performance could be subtracted from their actual PM performance which was scored as a proportion. Self-efficacy strength (SEST) scores (i.e., average of all eight confidence ratings) were also examined to determine the extent to which participants in the multi-item prediction condition may have differed in their ability to recognize the demands of the PM tasks. This resulted in a prediction difference score and a confidence score for each participant.

Aim Four, Single-Item Prediction Accuracy

An independent samples t-test was conducted on the prediction difference scores to statistically determine the extent to which single-item performance predictions accurately reflected actual PM performance. The results indicated that there was a significant difference between the prediction difference scores across the PM conditions such that participants in the focal PM condition were more accurate when predicting their actual PM performance than participants in the nonfocal PM condition, $t(56) = 3.02$, $p = .004$. Further, the prediction score means revealed that those in the focal PM condition were highly accurate in predicting their ability to successfully complete the PM task ($M_{Diff} = -.08$, $SD = .05$) whereas those in the nonfocal PM condition were overconfident in predicting their ability to successfully complete the PM task (M_{Diff} = .19, SD = .07). Note that two participants who met the previous outlier criteria for absolute z scores larger than 3 on the LDT (Stevens, 2009) were excluded from the analysis (n = 58).

Aim Four, Multi-Item Prediction Accuracy

An independent samples t-test was conducted on the prediction difference scores to statistically determine the extent to which multi-item performance predictions accurately reflected actual PM performance. The results indicated that there was a significant difference between the prediction difference scores across the PM conditions such that participants in the focal PM condition were more accurate when predicting their actual PM performance than participants in the nonfocal PM condition, $t(54) = 3.77$, $p < .001$. Further, the prediction score means revealed that those in the focal PM condition were highly accurate in predicting their ability to successfully complete the PM task (M_{Diff} = .07, SD = .03) whereas those in the nonfocal PM condition were overconfident in predicting their ability to successfully complete the PM task (M_{Diff} = .40, SD = .08). When SEST scores (i.e., confidence ratings) were taken into account, the means revealed that participants in both PM conditions were highly confident in their ability to successfully complete the PM task (M_F = .79, SD = .17; M_{NF} = .75, SD = .16). Note that four participants who filled out the MSEQ incorrectly (e.g., interpreted the scale in reverse) were excluded from the analysis (n = 56).

Aim Four, Postdiction Accuracy

Performance postdictions were assessed using the single-item MSE only (Devolder et al., 1990; Meeks et al., 2007). Since this measure was consistent across the single-item and multi-item prediction conditions, the accuracy of performance postdictions were evaluated together. Postdictions were converted from percentages to proportions so that each participant's postdicted PM performance could be subtracted from their actual PM performance which was scored as a proportion. This resulted in a postdiction difference score for each participant.

A 2 (Prediction type: single-item prediction, multi-item prediction) x 2 (PM condition: focal, nonfocal) factorial ANOVA was conducted on the postdiction difference scores to statistically determine the extent to which performance postdictions accurately reflected actual PM performance. No main effect of prediction condition was found, $F(1, 110) = .155$, $p = .694$, $\eta_p^2 = .001$. A main effect of PM condition was observed such that participants in the focal PM condition were more accurate when postdicting their actual PM performance than participants in the nonfocal PM condition, $F(1, 110) = 8.22$, $p = .005$, $\eta_p^2 = .070$, but no significant interaction between prediction condition and PM condition was found, $F(1, 110) = .018$, $p = .893$, $\eta_p^2 = .000$. Mean performance predictions and postdictions (as proportions) by prediction condition and PM condition can be found in Table 4.

CHAPTER V

DISCUSSION

Overview of Findings

The current research yielded five primary findings. First, this study was unable to conceptually replicate previous work using single-item performance predictions (Devolder et al., 1990; Meeks et al., 2007; Rummel et al., 2013). Second, although this study extended prior work on single-item performance predictions with multi-item performance predictions, it was unable to demonstrate that multi-item performance predictions were beneficial for improving PM performance (Meier et al., 2011). Third, while no effect of performance predictions on PM performance was found, this study was able to replicate past PM research on focality such that PM performance was better on the focal PM task than on the nonfocal PM task (Einstein et al., 2005; Kliegel et al., 2008; McDaniel & Einstein, 2000). Fourth, this study was able to demonstrate that the addition of the PM task led to greater performance costs on the LDT replicating past PM research (McDaniel & Einstein, 2007; Smith, 2003; Walter & Meier, 2014), but the act of making performance predictions was not found to increase monitoring processes for the PM tasks. Fifth, this study demonstrated that performance predictions and postdictions more accurately reflected focal PM performance than nonfocal PM performance. These findings and their implications are described more fully in the sections that follow.

Aim One and Two, Prediction Effects on Prospective Memory Performance

Overall, having participants predict their future PM performance did not have the anticipated beneficial effect on actual PM performance. While a few other studies have shown that making single-item and multi-item PM performance predictions enhanced PM performance compared to making no PM performance predictions, our data did not replicate these findings (Meier et al., 2011; Rummel et al., 2013). Despite the fact that the single-item and multi-item MSE questionnaires used to assess PM performance predictions were adapted from previously established measures (Berry et al., 1989; Meeks et al., 2007), the results suggest that PM performance predictions may not have been measured reliably. One factor that may have reduced the reliability and effectiveness of PM performance predictions is the number of times that participants were required to predict their future memory performance during the experiment.

Similar to prior studies that investigated the MSE-MP relationship for PM (Devolder et al., 1990; Meeks et al., 2007; Meier et al., 2011; Rummel et al., 2013), participants were asked to predict their PM performance before completing the PM task (e.g., to press F6 for *goat* or *animal words*). Then, to make sure that there was a delay between the initial formation of the PM intention and the opportunity to carry out the PM task, participants were also asked to predict their RM performance on a different memory task (e.g., to recall 25 words or 25 word pairs) and complete it before returning to the PM task (McDaniel & Einstein, 2007). Finally, once participants completed the PM task, they were asked to predict their RM performance on another memory task (e.g., to recall 25 words or 25 word pairs). In total, this particular design required participants to predict their future memory performance on three separate memory tasks during one experimental session.

Based on Devolder at al.'s (1990) findings, requiring participants to predict their future memory performance on several unrelated tasks was not expected to influence their perceptions of the PM task. However, more recent research has suggested that this may have cancelled out the beneficial effects of performance predictions by way of decreasing the perceived importance of the PM task relative to the other tasks (Meeks et al., 2007; Meier et al., 2011; Rummel et al., 2013). According to Walter and Meier (2014), greater levels of perceived PM task importance often lead to an increase in PM performance. Consistent with what some researchers have posited (Meeks et al., 2007; Meier et al., 2011; Rummel et al., 2013), having participants make performance predictions about their future PM performance was expected to increase their perceived importance of the PM task and in turn increase their actual PM performance. Given that the current study demonstrated that there were no differences in participants' perceptions of the PM task across the single-item and multi-item prediction conditions, it is plausible that having participants predict their future memory performance on two additional RM tasks may have decreased their perceived importance of the PM task and in turn their actual PM performance. Although the exact mechanism that may underlie the beneficial act of making performance predictions is unknown, these findings in addition to previous research (Meeks et al., 2007; Meier et al., 2011; Rummel et al., 2013) provide evidence to suggest that making multiple performance predictions may serve to reduce the importance of a PM task whereas only making PM performance predictions may serve to increase the importance of a PM task.

Aim One and Two, Focality Effects on Prospective Memory Performance

Whereas making PM performance predictions did not impact participants' actual PM performance, a reliable effect of focality on PM performance was found replicating past PM research (Einstein et al., 2005; Kliegel et al., 2008; McDaniel & Einstein, 2000). As anticipated, participants who completed the focal PM task (e.g., pressing F6 when *goat* was presented eight times) significantly outperformed participants who completed the nonfocal PM task (e.g., pressing F6 when *animal words* were presented eight times) resulting in a ceiling effect. Due to the fact that focal PM tasks tend to require fewer self-initiated retrieval processes to complete than nonfocal PM tasks (Einstein et al., 2005; Kliegel et al., 2008; McDaniel & Einstein, 2000), this result was expected. Further, given that participants in the focal PM condition perceived the PM task to be more important than participants in the nonfocal PM condition, these differences in perceived PM task importance were expected to consistently reflect actual PM performance (Walter & Meier, 2014). These findings suggest that PM performance was measured reliably.

Aim Three, Lexical Decision Task Cost

By means of increasing the perceived importance of a PM task, researchers have postulated that making PM performance predictions may also increase the amount of attentional resources that participants will allocate to the PM task to help monitor for and successfully detect PM target items while simultaneously completing another task (Meeks et al., 2007; Meier et al., 2011; Rummel et al., 2013; Walter & Meier, 2014). This shift in attentional resources should improve PM performance at a cost to the competing ongoing task (McDaniel & Einstein, 2007; Smith, 2003; Smith, Hunt, McVay, & McConnell, 2007; Walter & Meier, 2014). To date, only three studies including this one have examined the extent to which making PM performance predictions may influence the allocation of attentional resources to the PM task and ongoing LDT above and beyond general dual-task processing (Meeks et al., 2007; Rummel et al., 2013). Consistent with the previously proposed mechanism, both Meeks et al. (2007) and Rummel et al. (2013) found that when participants were asked to predict their PM performance, they responded more slowly to the LDT items in the PM block than in the baseline block and detected more of the PM target items indicating that they were allocating a greater amount of attentional resources to the PM task than the LDT. Thus, as a result of prioritizing the PM task over the LDT, those participants increased their monitoring processes for the PM target items relative to the LDT items and in turn enhanced their PM performance compared to participants who were not asked to predict their PM performance.

Despite employing a LDT that was nearly identical to the one that Meeks et al. (2007) used, this experiment yielded LDT reaction times that were somewhat inconsistent with former studies (Meeks et al., 2007; Rummel et al., 2013). The key explanation for these conflicting findings is that pre-experimental group non-equivalence biased our ability to objectively measure of participants' RTs on the LDT. On the one hand, participants were expected to have similar mean RTs in the baseline LDT block regardless of the PM or prediction condition they were in because neither the PM task instructions nor the PM performance prediction instructions were administered before this task. However, the mean baseline block RTs revealed that participants in the focal PM condition responded more slowly to the LDT items than participants in the nonfocal PM condition. Further, those in the single-item prediction and no prediction conditions responded more slowly to the LDT items than those who were in the multi-item prediction condition. These findings suggest that random assignment may not have fully accounted for individual differences in speed of processing (Schwartz, 2011).

On the other hand, participants were expected to have different mean RTs in the PM LDT block as a function of PM and prediction condition. Specifically, participants in the nonfocal PM and multi-item prediction conditions were expected to respond the slowest to the LDT items in the PM block relative to the baseline block. Though the mean RT data did not demonstrate this hypothesized relationship, they did reveal that participants generally responded more slowly to the LDT items in the PM block than in the baseline block replicating prior PM research using a speeded LDT (Einstein et al., 2005; Hicks et al., 2005; Meeks et al., 2007; Rummel et al., 2013). The results also indicated that PM condition and LDT block interacted with each other to produce reliable differences in RT responses across the baseline and PM blocks. Thus, on average, participants in the nonfocal PM condition responded 64ms slower to the LDT items in the PM block than in the baseline block whereas participants in the focal PM condition responded 28ms slower to the LDT items in the PM block than in the baseline block.

While pre-experimental group differences at baseline may have greatly reduced the degree to which these findings can be meaningfully interpreted, it is important to note a few theoretical implications. Specifically, these findings are consistent with the multiprocess framework (McDaniel & Einstein, 2000) because they suggest that those in the nonfocal PM condition allocated more attentional resources to the PM task at a cost of responding more slowly to the ongoing LDT, but not at a cost to responding less accurately. However, they do not provide any evidence to suggest that the act of making

PM performance predictions increased the amount of attentional resources that participants allocated to the PM task as some researchers would expect (Meeks et al., 2007; Rummel et al., 2013).

Aim Four, Prediction Accuracy

One of the primary goals of this study was to better understand the extent to which participants' PM performance predictions would accurately reflect their actual PM performance. For those who made single-item performance predictions, the results revealed that participants in the focal PM condition were more accurate when predicting their future PM performance than participants in the nonfocal PM condition indicating that they better understood the demands of the PM task. Although participants in the focal PM condition were highly accurate in judging their ability to successfully complete the PM task, those in the nonfocal PM condition were somewhat overconfident in judging their ability to successfully complete the PM task. That is, individuals who were asked to press the F6 key on the keyboard whenever they saw the word *goat* appear during the LDT expected their PM performance to be relatively close to what it actually was whereas individuals who were asked to press the F6 key on the keyboard whenever they saw *animal words* appear during the LDT expected their PM performance to be moderately better than it actually was. While this pattern is generally consistent with Rummel et al.'s (2013) findings using focal and nonfocal PM tasks, it is inconsistent with other studies that have shown that young adults tend to be underconfident (i.e., exhibit low MSE) in their ability to complete different laboratory PM tasks (Meeks et al., 2007; Knight et al., 2005; Schnitzspahn et al., 2011).

For those who made multi-item performance predictions about their future PM performance, a similar pattern of accuracy emerged such that participants in the focal PM condition were more accurate when predicting their future PM performance than participants in the nonfocal PM condition indicating that they better understood the demands of the PM task. While those in the focal PM condition were highly accurate in judging their ability to successfully complete the PM task, those in the nonfocal PM condition were markedly overconfident in judging their ability to successfully complete the PM task. That is, individuals who were asked to press the F6 key on the keyboard whenever they saw the word *goat* appear during the LDT expected their PM performance to be fairly close to what it actually was whereas individuals who were asked to press the F6 key on the keyboard whenever they saw *animal words* appear during the LDT expected their PM performance to be substantially better than it actually was. Although this pattern is inconsistent with Meier et al.'s (2011) findings, it may have been observed because the PM tasks used in this study were different from Meier's in that they were from a separate semantic category (i.e., *animals* versus *musical instruments*) and more PM target items were presented (e.g., eight PM target items in the present study and one PM target item in Meier's study) potentially making it more difficult for participants to understand the PM task demands. An additional examination of the SEST scores indicated that participants exhibited a high amount of confidence (i.e., high MSE) in their ability to successfully complete the PM tasks. Despite the fact that this pattern does not replicate similar laboratory research on the MSE-MP relationship for PM (Meeks et al., 2007; Knight et al., 2005; Schnitzspahn et al., 2011), it does coincide with Devolder et al.'s (1990) findings that demonstrated that young adults tend to be overconfident (i.e., exhibit high MSE) in their ability to complete PM tasks.

Altogether, these findings demonstrate that single-item performance predictions more accurately reflected actual PM performance than multi-item performance predictions. However, it is important to note that the type of PM task (e.g., focal or nonfocal) played a large role in whether participants were able to accurately predict their future PM performance. While participants who made single-item and multi-item performance predictions about their future focal PM performance were remarkably accurate at predicting their actual PM performance, there were very few individuals who were able to perfectly predict their PM performance indicating that not everyone was aware of the demands of the PM task. Moreover, participants who made single-item and multi-item performance predictions about their future nonfocal PM performance were largely inaccurate at predicting their actual PM performance indicating that most individuals were unaware of the demands of the PM task. As such, this study provides further evidence to suggest that memory performance awareness may depend on the type of PM task that individuals must complete (Devolder et al., 1990; Meeks et al., 2007; Meier et al., 2011; Rummel et al., 2013) as well as the type of performance prediction that they make about their future PM performance.

Contrary to the original hypotheses of this study, it may be the case that having participants make single-item performance predictions about their future PM performance rather than multi-item performance predictions results in a better understanding of the PM task demands. One potential explanation for this assertion was discovered during subject testing. Specifically, participants who were asked to make single-item performance predictions about their future PM performance frequently asked questions about how many PM target items (i.e., *goat* or *animal words*) were going to be presented during the LDT before giving a final MSE judgment. In order to avoid influencing participants' MSE judgments, this information was intentionally withheld. However, concealing additional information about the PM task could have made the PM task seem more difficult than it actually was and in turn may have made participants think more deeply than anticipated about the demands of the PM task. In contrast, participants who were asked to make multi-item performance predictions about their future PM performance were explicitly told how many PM target items (i.e., *goat* or *animal words*) were going to be presented during the LDT which eliminated more specific questions about the PM task. Given that participants who made multi-item performance predictions tended to be overconfident in their ability to complete the PM tasks compared to those who made single-item performance predictions, providing too much information about the PM task could have made the PM task seem easier than it actually was and in turn may have made participants think less deeply than anticipated about the demands of the PM task.

Aim Four, Postdiction Accuracy

In addition to examining how accurately PM performance predictions reflected actual PM performance, another goal of this study was to better understand the extent to which participants' PM performance postdictions would accurately reflect their actual PM performance. Similar to the PM performance prediction findings, the results of this study revealed that participants in the focal PM condition were more accurate when postdicting their actual PM performance than participants in the nonfocal PM condition indicating that they better understood how well they completed the PM task. Since prior PM research has shown that young adults tend to be slightly more accurate when postdicting their past PM performance than when predicting their future PM performance (Devolder et al., 1990; Kidder et al., 1997; Meeks et al., 2007), PM condition (e.g., focality) was not expected to result in a meaningful difference. Thus, regardless of the difference in postdiction accuracy across PM condition, participants were generally more accurate in judging their past PM performance than their future PM performance as anticipated.

Implications

While a majority of the expected results were not obtained, it is important to note some of the theoretical implications of the present research. First, this study contributed to both the metamemory and the PM literature in a replicatory fashion by examining the influence of memory beliefs (as indexed by performance predictions and postdictions) on PM performance. Although having individuals predict their ability to successfully complete an upcoming PM task did not improve their PM performance, focality had a consistent effect on PM performance replicating past PM research (Einstein et al., 2005; Kliegel et al., 2008; McDaniel & Einstein, 2000). Second, this study provided additional empirical evidence to suggest that the beneficial effect of making performance predictions may be influenced by the perceived importance of the PM task relative to the ongoing task (Meeks et al., 2007; Meier et al., 2011; Rummel et al., 2013) though more research is needed to determine the exact underlying mechanism. For example, the act of making performance predictions did not impact monitoring processes on the PM tasks. However, it may be that having individuals predict their future memory performance several times led them to perceive the PM task to be less important than the LDT which may have in turn decreased the amount of attentional resources that participants allocated to monitoring for the PM task possibly leading to fewer performance costs on the LDT (for a similar argument, see Rummel et al., 2013). Finally, to my knowledge, this study was the first to demonstrate that the type of performance prediction that individuals make may differentially impact the extent to which they understand the demands of different PM tasks. Specifically, individuals who made single-item performance predictions appeared to understand the demands of the PM task better than those who made multi-item performance predictions although the postdictions indicated that most people were generally better able to understand the demands of the PM tasks after completing it. From a practical perspective, these findings are valuable because they suggest that performance predictions (namely, multi-item performance predictions) may not always be useful to employ as a strategy to improve PM performance, especially on more difficult tasks.

Limitations

The current study has a few limitations. First and foremost, unanticipated pre-experimental group non-equivalence may have biased our ability to objectively measure participants' memory performance in the laboratory despite employing a completely randomized design. Given that participants varied in their speed of processing abilities, it is possible that they may have also differed on other basic cognitive abilities. Second, the MSE questionnaires used to assess performance predictions were sometimes perceived as ambiguous. Consequently, participants may have needed to ask one or more questions to clarify the instructions before making a final decision, resulting in a longer time delay between the receipt of the PM instructions and commencement of the PM task. In turn, greater variability in the length of this delay may have differentially influenced PM performance across the single-item and multi-item performance prediction conditions. Since PM intentions tend to be more difficult to recall after longer delays (McDaniel & Einstein, 2007), it is possible that participants who were unable to remember to complete the PM task forgot to do so because of an extended time delay rather than poor encoding of the PM task. Post-test questioning provided some support for this explanation since all participants remembered forming the PM intention, but not everyone remembered to actually carry out the PM task. Third, a total of six laboratory research assistants (RAs) were involved in the data collection phase of this experiment. To reduce the likelihood of increasing experimenter error, each RA was thoroughly trained one-on-one to administer the study script and protocol. Follow-up practice observations and weekly laboratory meetings were also held to encourage RAs to ask questions they had about the administration of the experiment or discuss problems they had while running participants. Although numerous steps were taken to insure experimental control, the possibility that participants run by one particular experimenter may have had a different experience than those who were run by another experimenter cannot be ruled out.

Future Directions

Given that very few studies (five including this one) have examined the MSE-MP relationship for PM to date, additional research is needed to better understand the extent to which memory beliefs may influence PM performance. One direction for future research is to investigate the extent to which single-item and multi-item performance predictions may impact individuals' PM performance when only one judgment about their future PM performance is made. This research would be advantageous for at least two reasons. First, it would allow researchers to further compare the effectiveness of single-item and multi-item performance predictions. If multi-item performance predictions are found to be useful when only future PM performance is predicted, researchers would be able to link the well-established, metamemory literature on RM to the newly established, metamemory literature on PM. Second, it would also allow researchers to determine whether the previously documented beneficial effect of performance predictions on PM performance exists more broadly or only within contextualized constraints.

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APPENDICES

APPENDIX A

FREE RECALL MEMORY TASK WORD LIST

Experimental Trials (25 total)

Simple
Method
Wither
Place
Wisdom
View
Duty
Earn
Wealth
Import
Joke
Raise
Trend
Near
Open
Agile
Private
Laid
Unite
Charm
Fashion
Build
Motion
Culture
Rest

APPENDIX B

CUED RECALL MEMORY TASK WORD PAIR LIST

Experimental Trials (25 total)

License-Fiber
Thunder-Relish
Mansion-Feather
Carriage-Flashlight
Engine-Forest
Body-Novel
Station-Fragment
Ballet-Charcoal
Summit-Tourist
Transit-Rainbow
Bucket-People
Pistol-Dancer
Infant-Jury
Bouquet-Ceiling
Public-Algae
Lecture-Harvest
Blanket-Figure
Traffic-Sewage
Union-Doorway
Wardrobe-Ocean
Elbow-Debate
Garage-Baker
Cracker-Gesture
Evening-Mailbox
Pattern-Laundry

APPENDIX C

SINGLE-ITEM MEMORY SELF-EFFICACY QUESTIONNAIRE FOR FOCAL AND NONFOCAL PROSPECTIVE MEMORY TASKS

1. What percentage of the target items do you think you will detect during the word judgment task?

0% 10 20 30 40 50 60 70 80 90 100%

APPENDIX D

SINGLE-ITEM MEMORY SELF-EFFICACY QUESTIONNAIRE FOR FREE RECALL MEMORY TASK

1. What percentage of the words do you think you will recall during the memory task?

0% 10 20 30 40 50 60 70 80 90 100%

APPENDIX E

SINGLE-ITEM MEMORY SELF-EFFICACY QUESTIONNAIRE FOR CUED RECALL MEMORY TASK

1. What percentage of the word pairs do you think you will recall during the memory task?

0% 10 20 30 40 50 60 70 80 90 100%

APPENDIX F

MULTI-ITEM MEMORY SELF-EFFICACY QUESTIONNAIRE FOR FOCAL PROSPECTIVE MEMORY TASK

For each statement, answer Yes or No to indicate whether or not you can perform the task described in that statement. If you answer Yes, then also answer how sure or certain you are about performing that task. You can state your certainty by giving a percentage ranging from 10%, which is completely uncertain, to 100%, which is completely certain. An answer of No does not require a "percent certainty" statement.

1. If a target item was presented to me 8 different times, I believe I could remember to press the F6 key **1** time out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

2. If a target item was presented to me 8 different times, I believe I could remember to press the F6 key **2** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

3. If a target item was presented to me 8 different times, I believe I could remember to press the F6 key **3** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

4. If a target item was presented to me 8 different times, I believe I could remember to press the F6 key **4** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

5. If a target item was presented to me 8 different times, I believe I could remember to press the F6 key **5** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

6. If a target item was presented to me 8 different times, I believe I could remember to press the F6 key **6** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

7. If a target item was presented to me 8 different times, I believe I could remember to press the F6 key **7** time out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

8. If a target item was presented to me 8 different times, I believe I could remember to press the F6 key **8** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

APPENDIX G

MULTI-ITEM MEMORY SELF-EFFICACY QUESTIONNAIRE FOR NONFOCAL PROSPECTIVE MEMORY TASK

For each statement, answer Yes or No to indicate whether or not you can perform the task described in that statement. If you answer Yes, then also answer how sure or certain you are about performing that task. You can state your certainty by giving a percentage ranging from 10%, which is completely uncertain, to 100%, which is completely certain. An answer of No does not require a "percent certainty" statement.

1. If target items were presented to me 8 different times, I believe I could remember to press the F6 key **1** time out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

2. If target items were presented to me 8 different times, I believe I could remember to press the F6 key **2** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

3. If target items were presented to me 8 different times, I believe I could remember to press the F6 key **3** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

4. If target items were presented to me 8 different times, I believe I could remember to press the F6 key **4** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

5. If target items were presented to me 8 different times, I believe I could remember to press the F6 key **5** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

6. If target items were presented to me 8 different times, I believe I could remember to press the F6 key **6** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

7. If target items were presented to me 8 different times, I believe I could remember to press the F6 key **7** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

8. If target items were presented to me 8 different times, I believe I could remember to press the F6 key **8** times out of the **8** times they were presented.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

APPENDIX H

MULTI-ITEM MEMORY SELF-EFFICACY QUESTIONNAIRE FOR FREE RECALL MEMORY TASK

For each statement, answer Yes or No to indicate whether or not you can perform the task described in that statement. If you answer Yes, then also answer how sure or certain you are about performing that task. You can state your certainty by giving a percentage ranging from 10%, which is completely uncertain, to 100%, which is completely certain. An answer of No does not require a "percent certainty" statement.

1. On a test of 25 words, I believe I could recall between **1** and **5** of the words correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

2. On a test of 25 words, I believe I could recall between **6** and **10** of the words correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

3. On a test of 25 words, I believe I could recall between **11** and **15** of the words correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

4. On a test of 25 words, I believe I could recall between **16** and **20** of the words correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

5. On a test of 25 words, I believe I could recall between **21** and **25** of the words correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

APPENDIX I

MULTI-ITEM MEMORY SELF-EFFICACY QUESTIONNAIRE FOR CUED RECALL MEMORY TASK

For each statement, answer Yes or No to indicate whether or not you can perform the task described in that statement. If you answer Yes, then also answer how sure or certain you are about performing that task. You can state your certainty by giving a percentage ranging from 10%, which is completely uncertain, to 100%, which is completely certain. An answer of No does not require a "percent certainty" statement.

1. On a test of 25 word pairs, I believe I could recall between **1** and **5** of the word pairs correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

2. On a test of 25 word pairs, I believe I could recall between **6** and **10** of the word pairs correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

3. On a test of 25 word pairs, I believe I could recall between **11** and **15** of the word pairs correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

4. On a test of 25 word pairs, I believe I could recall between **16** and **20** of the word pairs correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

5. On a test of 25 word pairs, I believe I could recall between **21** and **25** of the word pairs correctly.

   No Yes 10% 20 30 40 50 60 70 80 90 100%

Table 1

Mean Prospective Memory Performance (as proportion correct) by Prediction Condition and PM Condition

		Prediction Condition		
PM Condition	n	No Prediction	Single-Item Prediction	Multi-Item Prediction
Focal	87	.96 (.05)	.85 (.26)	.87 (.24)
Nonfocal	88	.51 (.54)	.58 (.39)	.57 (.39)
Total	175	.74 (.36)	.72 (.35)	.72 (.35)

Note. Standard deviations are in parentheses.

Table 2

Mean Task Importance Ratings (on a 1 to 7 scale) by Prediction Condition, PM Condition, and Task Type

PM Condition		
Focal	Task Type	
Prediction Condition	PM Task	LDT
No Prediction	6.07 (1.51)	5.76 (1.63)
Single-Item Prediction	5.76 (1.96)	5.34 (115)
Multi-Item Prediction	5.70 (1.88)	5.66 (1.01)
Nonfocal		
No Prediction	4.68 (2.18)	5.64 (1.45)
Single-Item Prediction	4.41 (2.06)	5.76 (1.33)
Multi-Item Prediction	4.33 (2.37)	5.50 (1.50)

Note. Standard deviations are in parentheses.

Table 3

Mean Reaction Times (in milliseconds) by Prediction Condition, PM Condition, and LDT Block

PM Condition		
Focal	LDT Block	
Prediction Condition	Baseline Block	PM Block
No Prediction	672 (65)	708 (68)
Single-Item Prediction	670 (96)	698 (115)
Multi-Item Prediction	696 (98)	719 (96)
Nonfocal		
No Prediction	655 (94)	712 (106)
Single-Item Prediction	649 (61)	724 (102)
Multi-Item Prediction	647 (72)	707 (82)

Note. Standard deviations are in parentheses.

Table 4

Mean Performance Predictions and Postdictions (as proportions) by Prediction Condition and PM Condition

Prediction Condition		
Single-item		
PM Condition	Prediction	Postdiction
Focal	.77 (.17)	.82 (.28)
Nonfocal	.77 (.12)	.67 (.28)
Multi-item		
Focal	.97 (.07)	.84 (.16)
Nonfocal	.97 (.09)	.65 (.28)

Note. Standard deviations are in parentheses.

VITA

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