ABSTRACT

KIM, PAUL YOUNGHOON. Exploring Age-Related Differences in Prospective Memory Inside and Outside of the Lab. (Under the direction of Christopher B. Mayhorn.)

In this study, the characteristics of the two prospective memory tasks (activity-based and event-based) were investigated both in the laboratory and a naturalistic setting with the addition of the age component. Forty young and 40 older adults participated. First, the participants came to the lab and answered ninety trivia questions embedded were the prospective memory tasks. Second, they were required to come to Crabtree Valley Mall (the naturalistic setting) a couple of days later (i.e. one particular Saturday) to complete various prospective memory tasks (i.e. finding 4 different men's shirts as well as filling out a naturalistic questionnaire and picking up debriefing statement). Results found that both age groups performed the event-based task followed by activity-based task better in the lab than in the naturalistic setting. The young participants performed the tasks better than their older counterparts in both contexts, though the effects were nonsignificant. An interesting finding was that older participants performed the naturalistic event-based task better than the young participants. To conclude, the study suggests converting activity-based tasks into event-based tasks to help people accomplish their tasks successfully.

Exploring Age-Related Differences in Prospective Memory Inside and Outside of the Lab

by
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DEDICATION

To my parents, Tong Hui and Sun Hae Kim

and to my brother, Peter Kim

BIOGRAPHY

Paul Younghoon Kim was born on September 20, 1981 in Raleigh, North Carolina at 6:00pm. He looked almost exactly like his older brother as a baby that his mother asked why is Peter here. In 1986, Paul entered Stough Elementary School. He was apprehensive at first, but got used to school life quickly. However in the summer of 1989, his mother, brother Peter, he, and a friend of the family were involved in a car accident. He sustained the most injuries, having lost the left dominant side of his brain. He lay in a coma for four and a half months in a bed at Lenox Baker Children's Hospital. Miraculously, he opened his eyes.

The next several months were hard on the family. Paul, his mother, and a nurse aide would travel to Lenox Baker every morning, so Paul could have his dose of rehabilitation while his father went to work and Peter went to school. After a time, Paul went back to school, only losing one year.

He could not speak for two years, though he passed every grade. He climbed and entered Martin Middle School in 1993 and entered Athens Drive High School in 1996. Finally reaching the status of college student in Fall 2000 at North Carolina State University and majored in psychology. He graduated at the top of his class and the top of the whole university in Spring 2005 with honors (summa cum laude).

A break interspersed his eventual acceptance into graduate school at North Carolina State University in the program of human factors and ergonomics in Fall 2007.

What he did during the break was revise and submit his senior honors thesis, working with Dr. Mayhorn, into a manuscript and submitted it to American Journal of Psychology,

attended and presented a poster of the so-called manuscript at 2007 North Carolina Cognition Conference, as well as submitted his first collection of poems.

The manuscript was accepted after one revision and was published in the American Journal of Psychology in the summer of 2008. As of his first poetry book, it was published but the sale of the book seemed to be low. So the publisher recalled it.

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I would also like to thank Lassiter Speller and Jennifer Smith for helping me collect the needed data during the Summer of 2008. I appreciate my brother for helping me during that summer, if only for one lab day before leaving for Utah. I would like to thank Jordan Joyner, my father and mother for helping me collect the rest of the data during Fall of 2008.

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Chapter 1

Introduction

Much of the memory literature has investigated the topic of retrospective memory which refers to remembering past information such as telephone numbers or addresses. By contrast, the focus of the present research is on prospective memory. Prospective memory is essential because it refers to one's ability to remember and execute intentions in the future. If a young adult forgets an intention such as picking up milk at the grocery store on the way home from school, then he or she might be considered irresponsible. However, if an older individual forgets an intention such as remembering the appointment of going to the internal medicine doctor at 3 pm, the social attribution is much different. For instance, the older adult might simply be considered forgetful due to a "senior moment" or he or she might face a much more uncharitable judgment of senility (cf. Meacham, 1982; Sinnott, 1986).

In contrast with the backward-looking perspective of retrospective memory, prospective memory is forward-looking (Marsh, Hancock, & Hicks, 2002). While the former differs from the latter, prospective memory contains both retrospective as well as prospective components. The retrospective component includes remembering the content of the intention such as remembering a message and the specific friend who should receive it. The prospective component, in turn, is to notice the opportune time to act upon the intention in the right context or situation as well as retrieving the necessary cue, whether salient or not, for that action. For example, recognizing the cues that indicate that class is over, then seeing

the friend, and then giving the content of the message to him or her (Einstein & McDaniel, 1996; Glisky, 1996; Uttl, 2006).

In the next few paragraphs, the relationship between prospective memory and other cognitive abilities such as attention, planning, and working memory will be explored. As the previous example illustrates, prospective memory is related to attention because "attention can be likened to a spotlight that enhances the efficiency of detection of events within its beam" (Posner, Snyder, & Davidson, 1980, pp. 172). Detecting a target stimulus is a task that is necessary in recognizing and identifying salient cues within a sea of potential distracters. Once the prospective cue is identified, it triggers an impulse to perform the prospective intention.

In a related study, Hicks, Cook, and Marsh (2005) found in two experiments that the size of the letter strings (i.e. focal attention) did not add any salience in cue detection. However, when the periphery of the attention manipulation (i.e. nonfocal attention) changed from a small border to a large border around the letter string, cue detection increased significantly.

The finding that intentionality can be delayed until it is needed suggests that the planning is also associated with prospective memory performance. Planning might be conceptualized as the effortful work of being prepared for some task or intention in the future. Two planning methods that have been investigated in this context are time-keeping (Rabbitt, 1996) and means-end analysis (Kreutzer, Leonard, & Flavell, 1975). Time-keeping mostly requires the use of a clock or timer to schedule planned activities. However when someone becomes an expert at time-keeping, he or she uses environmental support (e.g.,

cues) for “time-cued prospective memory” such as an expert cook “observing the critical changes in the ingredients as they are simmering, thus using the cooking process itself as a reliable clock” (Rabbitt, 1996, pp. 242). The other method which is often associated with problem solving, means-end analysis, requires seeing the initial state and the eventual outcome, and systematically planning how to accomplish the task. One example of such a task involved requiring groups of children in kindergarten, first, third, and fifth grades to remember to bring skates to school on the following day (Kreutzer, Leonard, & Flavell, 1975). Results suggested that the older kids were more likely to use means-end analysis than younger children such that they reported a variety of mnemonic efforts such as placing the skates at the door to remind them or writing a note about the upcoming task and placing it on the child’s dresser (Kreutzer, Leonard, & Flavell, 1975).

Because prospective memory tasks often occur in complex situations where multiple tasks are ongoing, working memory is also related to the completion of the prospective memory task. For example, when the primary task involves a low working memory load, then prospective memory is not affected. However previous research by Kidder, Park, Hertzog, and Morrell (1997) suggests that high working memory load associated with a complex primary task will decrease the likelihood of successful prospective memory performance. In their study, Kidder et al. (1997) recruited adult participants (both young and older) to participate in an experiment where they had to view words on a computer screen and recall the last two or three words (different working memory load conditions). The prospective memory task was to identify when the background changed (manipulated by one or three target backgrounds). The results showed that when the condition had low (two

words) working memory load and low prospective memory load (one target background), both age groups' performances were at or near ceiling level. However, when the condition involved high (three words) working memory load and high prospective memory load (three target backgrounds), age differences appeared. The young age group performed the task near ceiling level (but had a lower overall score than the low load condition); the older age group was differentially affected by the load manipulations. Interestingly, these results seem to conflict with the previous hypotheses of Einstein and McDaniel (1990; 1996) that suggest that there should be minimal age effects in prospective memory tasks reliant on external cues (Kidder, Park, Hertzog, & Morrell, 1997).

Marsh and Hicks (1998) also conducted a series of experiments, varying the type of working memory through the use of high vs. low vs. no load conditions. They concluded that prospective memory performance suffered when working memory tasks emphasized the involvement of the executive control and/or the visuospatial sketchpad. However when manipulating the articulatory loop component of working memory, it seemed that it did not involve the executive control, allowing prospective memory to have no adverse effect. For the experiments, performance on the prospective memory task was worst in the high load condition whereas prospective performance during the low load condition was similar to that of no load condition.

From these studies, it is apparent that the situational context where a prospective intention is formed is very important because various combinations of cognitive processes are being engaged during different tasks. For this reason, the nature of prospective memory testing methodology might greatly influence the findings of any given study. To

conceptualize how performance might vary, the following sections will address the different types of prospective memory tasks that have been studied in the past. Topics to be addressed include: performance differences between time- and event-based intentions, task interruption, age effects, and finally the different methodologies utilized to study prospective memory.

Different Types of Prospective Memory Tasks

One early classification of prospective memory tasks categorized intentions as either pulses or steps (Ellis, 1987). Pulses have a high personal importance factor requiring frequent monitoring, a narrow window of opportunity, specificity of time, and less flexibility such as remembering the doctor's appointment at 3:00 pm. However, steps have a wider window of opportunity, more flexibility, and less frequent monitoring such as booking a holiday resort. In turn, steps are less likely to involve the use of memory aids to remember intentions, and are fulfilled when appropriate within a wide time period; pulses are externally remembered because of the personal importance of the intention and must be executed within a narrow time frame. Writing intentions down in a diary is good and beneficial for remembering pulses (Ellis, 1987).

Harris (1984) uses the terms "simple" and "compound" activities as steps and pulses, respectively. "Simple" activities occur when one thing is done before or after another activity and requires monitoring of the activity to be interrupted. On the other hand, "compound" activities or appointments require monitoring of a process external to the interrupted activity. He proposes a test-wait-test-exit (TWTE) model to describe how people approach "compound" activities (pulses) because it stresses the duration and shape of the critical

period for an appropriate response to be issued in which the information of a test provides (Harris & Wilkins, 1982).

Another way to distinguish intentions is to classify them as “habitual remembering” and “episodic remembering” (Meacham, & Leiman, 1975). “Habitual remembering” refers to routine activities performed daily such as brushing your teeth before bed. “Episodic remembering” refers to more infrequent activities that occur on an irregular basis. These effects require reminding to remember such as stopping at the grocery store to buy milk on the way home (Meacham, & Leiman, 1975).

More recently, Einstein and colleagues have theorized that prospective memory can be divided into two different types of intentions: event- and time-based intentions (Craik, 1986; Einstein, Holland, McDaniel, & Guynn, 1992; Einstein & McDaniel, 1990; 1996; Einstein, McDaniel, Richardson, Guynn, & Cunfer, 1995). An additional third type, activity-based intentions, is a much more recent theoretical contribution to the literature (Kim & Mayhorn, 2008; Kvavilashvili & Ellis, 1996). Activity- and event-based intentions have an external cue that signals the participant to remember and complete the intention that the participant has such as remembering to give a message to a friend when seeing him or her. Time-based intentions, however, rely on the specificity of time or within a specified time period, and use self-initiated retrieval processes where remembering is accomplished without the use of external cues (Craik, 1986; Einstein et al., 1992; Einstein & McDaniel, 1996; Marsh & Hicks, 1998).

Another difference between time- and event-based intentions is their reliance on several frontal lobe-based processes that account for age-related differences across tasks. It

has been shown that time-based intentions require memory for temporal information, time estimation, strategic planning, environmental monitoring, and divided attention. However, event-based intentions lack a temporal memory component or time estimation, may require minimal strategic planning, and involve less divided attention because the cue is embedded within a primary task (Glisky, 1996).

Task Interruption

One notable distinction among the three types of intentions is whether or not there is task interruption. Task interruption occurs when people are busily engaged in an activity and unexpectedly or purposely (dealing with laboratory studies) they are interrupted with the activity they are working on (Mäntylä & Sgaramella, 1997; Schiffman & Greist-Bousquet, 1992). When they recollect their thoughts and remember their intention; most of the time, they remember uncompleted intentions (Marsh, Hicks, & Bink, 1998; Speier, Vessey, & Valacich, 2003). The earliest account of this was the 1927 article, "Das Behalten erledigter und unerledigter Handlungen" (On Completed and Uncompleted Tasks). Bluma Zeigarnik, the author of this article, found that tasks that were interrupted were more likely to be remembered by adults (90% of the time) than completed ones. Children, in general, only remembered interrupted tasks. This is now called the Zeigarnik effect (Reeve, Cole, & Olson, 1986; Zeigarnik, 2007; Zeigarnik, 1967). However, these results appear to contradict findings from a later study conducted by Kvavilashvili, Messer, and Ebdon (2001) where task interruption during an ongoing task had an adverse effect upon children's prospective memory. The recommendation they propose is to allow children to complete a task fully before beginning another task. On a side note, Altmann and Trafton (2004) found in a series

of four experiments that when participants were interrupted while engaged in a task simulation scenario, their resumption lags took longer when the interruption lasted 6 and 8 seconds rather than the 2 and 4 seconds they used in the first two experiments during which time there was no activity going on.

While event- and time-based intentions include an interruption during remembering and execution of a planned intention such as stopping on the way home to grab milk at the grocery store (event-based) or an appointment at 3:00 pm (time-based), activity-based intentions show no sign of interruption. They (activity-based) are intentions that follow after finishing an ongoing activity and before beginning another activity (Kvavilashvili & Ellis, 1996).

Activity-based intentions are said to be less demanding than either time- or event-based [intentions] because the external cue is the end of an ongoing activity and does not require an interruption of the activity (Kvavilashvili & Ellis, 1996; Shum, Ungvari, Tang, & Leung, 2004). However, the research is scarce about utilizing activity-based intentions alone or in conjunction with the other types of prospective memory tasks. It seems that the only research studies that have investigated activity-based intentions published to date have been conducted to evaluate special populations such as traumatic brain injury participants (Shum, Valentine, & Cutmore, 1999), schizophrenic patients (Shum, Ungvari, Tang, & Leung, 2004), or stroke patients (Brooks, Rose, Potter, Jayawardena, & Morling, 2004) against control participants for clinical and rehabilitative purposes. Of the three studies, two (Shum, Valentine, & Cutmore, 1999) and (Shum, Ungvari, Tang, & Leung, 2004) concluded that activity-based intentions were performed more successfully than either event- and time-based

intentions. The performance of event-based task followed after the performance of activity-based task and lastly, the performance of time-based task. However, the special groups did worse than the control groups as predicted by the researchers. The study by Shum, Valentine, and Cutmore (1999) yielded data that made the direct comparison of the activity-based tasks with the event- and time-based tasks inappropriate. In a 2 x 2 mixed model design, time- and event-based tasks were systematically manipulated in an effort to compare the two groups of traumatic brain injury and controls. Unfortunately, the activity-based tasks involved a separate dependent variable requiring the participants to make three separate responses: (1) remember to write their cumulative percentage on the whiteboard using a pen at the end of testing session, (2) turn off the computer monitor, and (3) turn off the testing in progress light before leaving the room. The event- and time-based tasks required participants to telephone the second author, who was in an adjacent room, whenever the target word, “prime minister” came on the screen as well as every five minutes, respectively. There were 5 times to telephone the experimenter for each of the two prospective memory tasks. Qualitatively, the performance of activity-based tasks was better than the performances of event- and time-based tasks. The study by Shum et al. (2004) systematically differentiated the capabilities of schizophrenic patients and controls on prospective memory. For the time-based task, the participant had to contact the research assistant using an intercom to inform him or her of the participant’s correct cumulative score on the general-knowledge task every five minutes. For the event-based task, participants had to contact the research assistant via the intercom whenever the participants saw the word, “police” during the ongoing, general-knowledge, task. Lastly, the participants saw a blank computer screen every five minutes (subsections)

and the activity-based task was for them to press the spacebar to contact the research assistant to reactivate the computer. There were five times to respond for the three prospective memory tasks and the ongoing task was for 25 min. The other study by Brooks, Rose, Potter, Jayawardena, and Morling (2004) used a virtual environment to examine the prospective memory capabilities of stroke patients and controls. They discovered an unusual finding. The stroke patients' group performed better on the time-based task than on the event- and activity-based tasks. A possible explanation for this trend may be that stroke patients' inability to perform tasks in the future is attributable to an inability to multitask. Or, it may be that the time-based task was relatively short (instructing the experimenter to press a button on the clock in the hall at exactly 5 minute intervals) and was not realistic during the ongoing virtual environment activity because they continually rehearsed the prospective task. However, the control group performed the best on event-based tasks, followed by activity-based tasks, and lastly time-based tasks (Brooks, Rose, Potter, Jayawardena, & Morling, 2004).

Related to the Zeigarnik effect and task interruption is the concept of cue distinctiveness. Cue distinctiveness and unfamiliarity are attributes that make a target cue more effective than another target cue that utilizes familiar attributes because the unfamiliar cue is separable from a mass of background objects such that people are reminded to remember their intentions and execute them. Several studies have shown that when cues are unfamiliar and distinctive, participants remember the intention longer and for longer periods of time than they do when cues are familiar and indistinctive (Einstein & McDaniel, 1990,

Experiment 2; Li, Ding, & Zhang, 2005; Mäntylä & Nilsson, 1988; McDaniel & Einstein, 1993, Experiment 2).

To explain these differences in how people process distinctive and indistinctive cues, it might be informative to consider the intention superiority effect. The intention superiority effect states that planned intentions yet to be performed have a higher level of activation and accessibility than other intentions (Goschke & Kuhl, 1993; Marsh, Hicks, & Bink, 1998; Marsh, Hicks, & Watson, 2002; Penningroth, 2005). Previous research suggests that intentions that are about to be performed in the future persist at a heightened level of activation than those associated with more neutral information (Marsh, Hicks, & Bink, 1998). However, when the prospective intention was completed, the response was slower when the contents of the intention were recalled than when neutral information was recalled. It seems that after the to-be-performed intention is completed, the intention is displaced by more pressing intentions yet to be performed or for neutral information. Goschke and Kuhl (1996) found similar results in a series of experiments on implicit memory. Here, participants were asked to read words in neutral and prospective scripts and remember them for a later recall test. The participants unexpectedly received a word-fragment test. Their task was to fill in the blanks with the first word that came to mind. The results showed that when the participants had to perform the task later on, they remembered the prospective memory words exceedingly better than the neutral words. Similar trends were observed when the researchers used blocking (having distracter task, preventing rehearsal of the neutral and prospective words) and imagery (visualizing the neutral and prospective words in the mind) conditions, favoring the prospective script over the neutral script.

Another related factor that might influence the heightened activation of intentions or the Zeigarnik-like effects of prospective memory is intrinsic motivation. Research by Reeve, Cole, and Olson (1986) has shown that when participants are interrupted prior to completing a puzzle, the salience of the Zeigarnik effect is evident. However when participants are complemented with competent, self-efficacious performance feedback opposed to incompetent, self-efficacious performance feedback, they will reengage in a puzzle even though the puzzle has been completed before which suggests that the performance feedback overpowered the heightened activation attributed to the Zeigarnik effect (Reeve, Cole, & Olson, 1986).

Age-Related Performance Differences

Children. Because many of the cognitive processes related to the execution of prospective memory tasks are subject to individual differences such as chronological age, it seems imperative that age differences in prospective memory be considered. A study by Ceci and Bronfenbrenner (1985) showed that young children have the capability to perform strategic time-monitoring by checking a clock more frequently as the time of the intended action approaches. Specifically, children's time monitoring takes on a U-shaped pattern such that initial clock-checking is frequent as children synchronize their internal clocks. Once synchronized, children display a slower rate of clock checking in the middle phase of the study. Lastly, as the target time approaches, children display an increased rate of clock–checking. In this particular study, the prospective task was time-based in that children were required to remove cupcakes from an oven after 30 minutes of baking. During the waiting period, the children could play Pac Man (a popular video game) in the adjacent room. The

time-monitoring strategy was shown to be more prevalent in a familiar setting such as at home than in an unfamiliar setting such as in a university laboratory. Although the U-shaped pattern of clock checking was clearly defined, the majority of the children failed to effectively complete the prospective task because they did not take the cupcakes out of the oven on time due to lapses in temporal judgment (Ceci & Bronfenbrenner, 1985).

Older Adults. While prospective memory is important at all stages of development. It might be argued that prospective memory is particularly important at the other end of the age spectrum: older adulthood. Consider that preserved prospective memory skills are necessary to maintain a successful and independent lifestyle in old age (Kvavilashvili, & Fisher, 2007).

In the following paragraphs, a review of the research will show differences in time- and event-based prospective memory between young and older adults. It will also show discrepancies in the findings relating to event-based prospective memory. From previous research with children that investigated time monitoring as a component of prospective remembering, a U-shaped curve was found to be associated with accurate monitoring (Ceci et al., 1985). Interestingly, time monitoring investigations of younger adults and older adults (Einstein et al., 1995, Experiment 1) have revealed that young adults monitor time efficiently (a J-shaped curve) as the target time approaches yet older adults displayed weak or detrimental patterns of time-monitoring (a low backward L-shaped curve). While this previous study identifies a number of factors that contribute to age-related decrements in time-based tasks, results from Einstein et al. (1995, Experiment 2) showed that young adults and older adults performed the event-based task equally well. Einstein and colleagues

postulate that these event-based results illustrate a Noticing + Search procedure where the first phase is to notice the target cue because of familiarity or perceptual fluency (automatic processing) and then have directed search (controlled processing) to find the meaning and context of the target cue (Einstein & McDaniel, 1996).

Contrary to the findings that performance on event-based tasks are age-invariant, Uttl (2006) did find age-related differences in visual and auditory event-based prospective memory. The results showed that the younger participants (age range: 18-22 years old) performed better on both tasks than the older participants (age range: 49-95 years old). Uttl (2006) proposed that the age-related difference is attributable to cognitive and processing declines in the older participants. However, it might be argued that the difference in the age range of the older participants compared to that of the young participants might have biased the results.

Given these disparate findings, the mixed nature of the relationship between chronological age and prospective memory performance are apparent (Kvavilashvili, & Fisher, 2007). Some laboratory studies (e.g. Einstein & McDaniel, 1990; Einstein, McDaniel, Richardson, Guynn, & Cunfer, 1995; Rendell & Thomson, 1999, Experiment 3; Uttl, 2006) have shown that there are age-related differences in prospective memory between young and older participants, with younger participants performing better than older ones on time- and event-based prospective memory tasks. However, this pattern of age-related decrements across task type are contradicted by other findings which indicate that there are age-related differences in the event-based task (e.g. Rendell & Thomson, 1999; Uttl, 2006), or minimal or no age-related differences in the event-based task (e.g. Einstein & McDaniel, 1990;

Einstein et al., 1995). These different patterns of results are further complicated when testing venue varies. When studies are taken out of the laboratory into the naturalistic setting, researchers often find that older participants consistently outperform younger participants in both event- and time-based prospective memory tasks that are embedded in the course of everyday activities (Harris, 1984; Kvavilashvili, & Fisher, 2007; Maylor, 1993b).

For example, Kvavilashvili and Fisher (2007, Study 2) found that both younger and older participants monitored the time efficiently (J-shaped curve) for the naturalistic time-based task during a one-week period. Participants were to call the experimenter at an appointed time on the designated Sunday. There were no significant age differences, but still a higher percentage of older than younger individuals called in on time.

Possible explanations for these naturalistic findings might be that older adults perform better because of higher intrinsic motivation (i.e., a vested interest in completing the task) and task characteristics such as familiar efforts to increase cognitive support by older participants when they are faced with performing routine tasks. However, there was no evidence that older participants were more motivated than their younger counterparts in this study (Kvavilashvili, & Fisher, 2007). In a related study, Rendell and Thomson (1999, Experiments 1 & 2), discount motivation as a likely explanation because they used the same young and older participants (both were motivated) in both experiments and showed that older participants had superior performance compared to that of their younger counterparts on the time-based naturalistic prospective memory tasks. The demand of the task also may not be a factor because the researchers (Rendell & Thomson, 1999, Experiments 1 & 2) manipulated the intensity of the demand of the naturalistic task and still found older

participants' superior performance compared to that of the younger participants. It seems that the most plausible explanation is the familiarity of the setting.

Laboratory vs. Naturalistic Methods

Most of the studies that have investigated prospective memory have been conducted in the relatively sterile environment of the laboratory (e.g. Einstein et al., 1992; Einstein, McDaniel, Richardson, Guynn, & Cunfer, 1995). The required task is to perform a future action that is embedded within another laboratory task, preferably a retrospective memory task (Rendell & Thomson, 1999) such as remembering to ask for a red pen to draw a circle (Dobbs & Rule, 1987), remembering to ask for a hidden belonging, remembering to give a message (Zelinski, Gilewski, & Anthony-Bergstone, 1990), pressing a particular key on a computer keyboard when a target word appears (Einstein et al., 1992; Einstein & McDaniel, 1990; Park, Hertzog, Kidder, Morrell, & Mayhorn, 1997), or circling the trial number whenever a face having a beard or wearing glasses appears during a "famous people naming task" (Maylor, 1993a; Maylor, 1996; Rendell & Thomson, 1999). The strength of this approach is that researchers can impose experimental control in an effort to isolate variables of interest and minimize the effects of extraneous or confounding variables. Indeed, it has been argued that "the laboratory tradition is strong in method and rich in theory" (Winograd, 1988, pp. 19). With these benefits of laboratory investigation come related limitations that leave the research open to criticism. For instance, the ecological validity of lab-based prospective memory tasks is often questioned because the intentions being measured belong to the experimenter (not the participants) and the distracting task is often superfluous or unrelated to the primary prospective memory task. Also, the performance of intentions in the

lab seems not to be congruent to everyday intentions because the prospective tasks in the lab are repetitions of the same task (Marsh, Hicks, & Landau, 1998) and the lab environment is still lacking because of the ecological validity of the setting. Efforts to study prospective memory outside the confines of the laboratory have been termed the ecological approach. Such efforts promise to add to the richness of the prospective memory literature (Winograd, 1988) by exploring how people remember to accomplish their own intentions even though a portion of experimental control is sacrificed (Marsh, Hicks, & Landau, 1998).

There have been several studies that have been conducted outside of the laboratory to investigate people's naturalistic prospective memory performance (e.g., Devolder, Brigham, & Pressley, 1990; Harris, 1980; Intons-Peterson, & Fournier, 1986; Marsh, Hicks, & Landau, 1998; Meacham, & Leiman, 1975; Park, & Kidder, 1996; Park, Morrell, Frieske, & Kincaid, 1992; Poon, 1985; Schaffer, & Poon, 1982; West, 1988). Most of these studies utilize self-reports, measures of medication adherence, mailing postcards on certain days, telephoning on specified days, or diary methods (Cohen, 1989). One of the earliest accounts is that of Meacham and Leiman (1975) where participants were asked to mail postcards on specific dates ranging from 16 or 32 days later. At the end, the researchers asked how the participants remembered to mail the postcards. The majority of the participants reported using external retrieval cues such as checking calendars or leaving cards in a conspicuous location. Very few used purely cognitive abilities (internal cues).

A more recent study using the ecological approach was Marsh, Hicks, and Landau (1998) who conducted three experiments outside the laboratory using diary data collected from undergraduate students. Based on self-report data about how intentions are generally

remembered, students were classified as either recorders or non-recorders. Recorders used external cues such as calendars and planners to remember intentions whereas non-recorders did not use any type of external cue, but they reported rehearsing their intentions mentally several times a day. In general, students described six categories of intentions: a) commitments and appointments (e.g., a dentist appointment), b) intentions to commit (e.g., calling to establish an appointment), c) intentions to complete (e.g., having to return something or to borrow something from a friend), d) intentions to study (e.g., doing homework), e) intentions to communicate (e.g., writing, telephoning, e-mailing, or sending a letter), and f) miscellaneous intentions (e.g., taking medicine or feeding a friend's pet). Results from the first experiment revealed a number of reasons why planned intentions were not completed. Participants reported that prospective intentions were often forgotten, reprioritized, canceled, or were impossible for the six categories of plans. The most frequently reported reason for not completing an intention was termed "reprioritization" whereby intentions were organized according to subjective importance such that some intentions were placed "on hold" while other more important intentions were completed.

The second and third experiments focused on students' use of external cues to prompt the retrieval of intentions. In the second experiment, the researchers provided a green neon wristband such that half of the recorders and half of the non-recorders' had access to a retrieval cue to remind them to review their intentions daily. The four conditions were recorders without band, recorders with band, non-recorders without band, and non-recorders with band. Results indicated that wearing a wristband enhanced participants' efforts to review intentions; however, the effect was not statistically significant. In the third

experiment, the experimenters manipulated access to the participants' own use of external cues such that half of the recorders did not have access to their daily planners and half of the non-recorders were required to use planners. Findings indicated that giving planners to non-recorders lessened the number of intentions forgotten because of the added assistance of writing intentions down.

A more recent investigation (Kim & Mayhorn, 2008) investigated the three types of intentions (time-, event-, and activity-based) in the lab and naturalistic settings. In the lab, the participants were required to answer ninety trivia questions, embedded were the three types of prospective memory tasks: time-based, write initials every 3 minutes; event-based, circle answer whenever question about telephone comes up; and activity-based, write name after finishing a block of 15 questions. The results showed a statistically significant difference in performance between the time-based task and the event-based task as well as between the time-based task and the activity-based task in the lab. However, performance on the activity- and event-based tasks did not vary significantly from one another in the lab. In the naturalistic setting, participants were required to write their daily intentions down in a diary and whether they completed the intentions. The results showed no significant difference among the three types of naturalistic intentions. However, this study illustrated that time-based tasks seemed to be reliant on the context whereas event- and activity-based tasks did not. In the lab context, the performance of the activity-based task was the best and in the naturalistic context, the performance of event-based intentions was the best. These context-specific discrepancies in prospective memory performance suggest that further research is

needed to determine how performances on event-based and activity-based tasks vary under different experimental circumstances.

To this end, another goal of the current research is to investigate how patterns of prospective memory performance vary between the naturalistic and laboratory setting. One difficulty with making this type of direct comparison between the task types, the age variable, and contexts is that a number of extraneous factors are not equated between task types, the age variable, or across context. For instance, non-cognitive factors such as the perceived importance of the task (Kvavilashvili, 1987) or the incentive or motivation to perform the task (Meacham & Singer, 1977) might influence naturalistic performance but not lab performance. Given these potential theoretical shortcomings, the current research will utilize an exploratory examination of the relationships between the various types of tasks, young versus older individuals, and contexts for expository purposes. Should different patterns of performance emerge by task type, by the age variable, or by context, this information should be informative to other researchers interested in memory research.

Purpose of this Study

Because there is a clear distinction between event- and time-based intentions, the investigator has excluded time-based intentions. It is on the basis that previous research (Kim & Mayhorn, 2008) suggests that time-based intentions rely heavily on context between laboratory and real world settings while event- and activity-based intentions do not. What is much less well understood is the distinction between event-based and activity-based tasks. Thus, the current study focused on investigating the characteristics of event- and activity-based intentions.

Furthermore, the current work supplemented what was known about the performance of laboratory tasks by including a naturalistic testing component. This naturalistic component might be conceptualized as including an ecologically valid setting where participants had to complete prospective memory tasks (a more thorough description is detailed in the *Procedure* of the Method Section).

Given inconsistent results from previous research that investigated age differences in prospective memory, it was unclear whether participants (both young and older) performed better on activity-based intentions than event-based intentions in both settings because of the lack of an interruption (Kvavilashvili & Ellis, 1996). For this reason, special emphasis was placed on examining the patterns of performance across the age variable with task type for the two distinct contexts of lab versus naturalistic environment.

Empirical Questions

Overall there is a difference between young and older individuals in prospective memory, but how much and how different are the two types of tasks, really? And if demand of the tasks is not a factor, as Rendell and Thomson (1999) reported, is familiarity the primary explanation? Likewise, how do the Zeigarnik effect and cue distinctiveness influence execution of intentions (Li, Ding, & Zhang, 2005; Einstein & McDaniel, 1990, Experiment 2; Mäntylä & Nilsson, 1988; McDaniel & Einstein, 1993, Experiment 2)?

Research Hypotheses

H_1 - The first hypothesis predicted that performance of the activity-based task will outperform the event-based task in the laboratory and naturalistic environments (Kvavilashvili & Ellis, 1996) for both young and older adults.

H_2 - The second hypothesis was that the young adult group outperformed the older adult group in both activity- and event-based tasks in the lab (Kvavilashvili & Ellis, 1996).

H_3 – The third hypothesis was that the performance in the naturalistic setting should exceed the performance in the lab (Kim & Mayhorn, 2008).

H_4 – The fourth hypothesis was that the older age group outperformed the young age group in the naturalistic (mall) setting, consistent with the results of Rendell and Thomson (1999).

Chapter 2

Method

Participants

Eighty people participated in this experiment. Forty (14 young males, 26 young females, *M* = 19.35, *SD* = 2.55, range = 18 – 32) came from the student participant pool at N.C. State University. They were enrolled in introductory psychology classes and were recruited to fulfill their class research requirement. The rest came from an established list of older individuals (22 older males, 18 older females, *M* = 70.20, *SD* = 7.07, range = 60 – 85), who have participated in research at the NCSU Psychology Department. Young adults received course credit for completing the experiment (3 credits for the lab section and 3 credits for the field section) along with $5 to compensate them for travel to the naturalistic portion of the study. However, 11 young adults did not come and participate in the field section. Older adults received $10.00 each for participating in the lab segment of the experiment, plus $10.00 each for the field segment of the study. Five older adults did not participate in the field section.

Experiment Design

The design was a 2 (age group: young and older) x 2 (context: laboratory and ecologically valid setting) x 2 (intention type: activity- and event-based) mixed model. The between-participant variable was age groups: young and older adults. The second was a within-participant variable consisting of two different contexts: one being a controlled laboratory setting and the other being an ecologically valid naturalistic setting. The third was a within-participant variable that consisted of two tasks designed to measure different

intention types: activity- and event-based. The dependent variable of interest was the task performance as measured by the number of completed intentions for each combination of age, context, and task type converted later into percentage correct.

Materials / Apparatus

A laptop computer (Dell Inspiron 2600) and a projector were used to present experimental stimuli via PowerPoint slides. Ninety trivia questions chosen from various popular press books and specialty websites were presented, one question per slide, to the participants. An example is illustrated in Appendix A.

Trivia questions were organized into six blocks of 15 items. Each block of questions was answered on a separate page of the answer sheet provided to the participants. To assess event-based intentions, participants were asked to circle an answer that was associated with the topic of telephones. The telephone-related questions were #11, #23, #44, and #67 of the ninety-question presentation slideshow. To assess activity-based intentions, participants were instructed to write “yes” or “no” as to whether there was a question related to telephone following the completion of each block of questions. If participants incorrectly marked a “non-telephone” question during the event-based task or incorrectly marked “yes or “no” for the activity-based task, then their scores were counted as incorrect. Also participants were instructed to remove their wristwatches at the beginning of the lab section.

Procedure

Participants were tested in small groups (n = 2-4) in experimental sessions that lasted approximately 90 minutes for the portion completed in the laboratory (see Appendix B for procedure and instructions for the lab). The group was mixed such that equal numbers of

young and older participants were present. After the participants signed the consent forms (Appendix C), they filled out a demographics questionnaire which asked about gender, age, ethnicity, and years of education (Appendix D). Then they were tested for perceptual speed (digit symbol substitution test), working memory (forward/backward digit span test), verbal comprehension (vocabulary) and measure of inhibition (Stroop test) using Wechsler Adult Intelligence Scale III, Shipley Institute of Living Scale, and Stroop Color and Word Test: A manual for Clinical and Experimental Uses (Golden, 1978; Shipley, 1986; Wechsler, 1997). All participants were seated at tables, spaced out so that the likelihood of observing the work of others was reduced, and were facing the experimenter and the projector screen. Prior to answering the ninety trivia questions, the participants were provided with written task instructions that describe how to complete each of the two types of intention (see Appendix E). After answering any questions posed by participants and taking away the instruction sheets, the experimenter instructed the participants to begin answering the ninety trivia questions which were projected on the screen (see Appendix F for the ninety questions and answers). Each question was projected for 20 seconds. Each block of questions lasted 5 minutes, and there were no stoppages between blocks. Participants were instructed not to flip back or revisit previous pages once a block had been completed. While working on the questions, participants had to remember to draw a circle around the answer when a question about “telephone” came up (event-based) and write “yes” or “no” as to whether there had been a telephone question present after completing each block of questions at the bottom of the page (activity-based). The total density of prospective target times/cues was 4 and 6, respectively.

At the end of the laboratory session, the participants were instructed to remember to come to a mall on one particular Saturday (range: 2 to 23 days later). Once they came to Crabtree Valley Mall on that particular Saturday beginning at 10:30 am, the participants were instructed to act like "secret shoppers" and to go to four different stores, checking men's shirts. They had to look at the displayed mannequin or part (i.e. torso) of a mannequin wearing the shirt and write down on a piece of paper the store and the price of the displayed shirt, one shirt at each of the four different locations. Each shirt was distinguished by a specific color and type (see Appendix H). The retail display rotation of the men's shirt stimulus occurred weekly, so updating required weekly trips around the mall prior to the participants' arrival to accomplish the task. This was the naturalistic event-based task because the participants were cued by the sight of the mannequin displaying a male shirt. The instructions for this task and the activity-based task in the mall were stated in Appendix G. Following that and after returning the pieces of paper to the experimenter, they were to complete a short questionnaire (distracter task) designed to assess each person's prior shopping experience at Crabtree Valley Mall and familiarity with the floor plan (Appendix I). On the back of the completed questionnaire, the participants were to write down the store that had the shirt of the best value and price among the four shirts they investigated. The participants had to return the completed questionnaires to a box labeled "RETURN HERE" (boldface) and pick up a debriefing statement (see Appendix L) before leaving the mall. This was the naturalistic activity-based task because these actions are to occur following the completion of the questionnaire. The instructions regarding the completion of the activity-based task were given at the beginning of the naturalistic session before participants were

dispersed to accomplish the naturalistic event-based task. There were one to eight participants at the mall at a time, 80 participants for a total of 19 times. The investigator was located in the same spot in the mall, for all the conditions. It was at a rectangular table on the second level of the mall in the Pavilion (Food Court) next to the NC Sports & Gifts on the southwest from the origin (rectangular table), the GameStop next to that store, Robek's Juice southeast from the origin, and the toy horse/toy automobiles next to that. A confederate (undergraduate assistant) was assigned a similar location on the lower mall level such that four participants were run on both mall levels simultaneously where one participant was sent in each direction away from the experimenter and confederate. A starting strategy was implemented to control for the likelihood that participants would follow one another during the naturalistic tasks, one participant was sent in each direction with a five-minute head start before the next participant was allowed to begin.

The pilot study that the researcher ran had been very insightful as well as discussion with one confederate student afterwards. Revisions to the naturalistic setting instructions (included in Appendix G) explicitly referred to two stores that were located on the first level and two that were located on the second level.

Chapter 3

Results

The experiment measured the completion of intentions by younger and older participants inside and outside of the laboratory. A 2 x 2 x 2 mixed model analysis of variance was used to analyze the age factor with the different contexts across the different types of intentions (activity-based vs. event-based). Alpha levels for all statistical analyses were set at .05. Descriptive statistics for both young and older adults are presented in Table 1 and Table 2. Table 6 shows how many participants completed either one or both of the naturalistic activity-based tasks. For the older individuals, there were 12 who only picked the debriefing statement up, 1 who wrote the best shirt, and 8 who completed both tasks.

Results revealed a main effect of task type; $F(1, 78) = 13.70$, $p < .001$, $\eta^2 = .15$ (Power = 0.10) (Faul, Erdfelder, Lang, & Buchner, 2007) rejecting H_1, and in turn, refuting the claim by Kvavilashvili and Ellis (1996). The event-based tasks performed better than the activity-based tasks (mean difference = 0.48) in both contexts.

Analysis did not reveal a main effect of age such that H_2 was not supported. Young participants did perform better than their older counterparts across task type in the lab setting but not significantly; $F(1, 78) = 0.09$, *ns*, $\eta^2 = .001$ (Power = 0.05) (Faul, Erdfelder, Lang, & Buchner, 2007).

There was a main effect of context but it did not support H_3. All the participants regardless of age performed better in the lab than in the naturalistic setting; $F(1, 78) = 89.80$, $p < .001$, $\eta^2 = .54$ (Power = 0.90) (Faul, Erdfelder, Lang, & Buchner, 2007). The mean

difference was 1.88. This finding was different from the results reported by Kim and Mayhorn (2008).

The 2-way interaction between age and experimental context was not significant; thus, results failed to support H_4. The older age group did perform better on the event- but not the activity-based tasks than their younger counterparts in the naturalistic setting (Kim & Mayhorn, 2008).

Figure 1 shows the percentage correct for the number of completed intentions across experimental conditions for the two different groups (younger and older participants) and Table 8 shows the means of the different task type and context combinations in percentage.

Post Hoc Tests

The investigator then conducted several post hoc tests to determine whether there were any significant simple effects among the young and older adults, task types, and contexts.

Paired-samples *t*-tests were utilized to test the simple effects of task type and age within each context. There was no statistical difference between young adults' performance of the activity-based task and the event-based task performed in the laboratory. However, there was a marginally significant effect for the older adults such that they were more likely to successfully complete the event-based task rather than the activity-based task in the lab: $t(39) = -7.03$, $p = .067$. Examination of the pattern of task performance in the naturalistic setting showed significant effects for both young and older adults such that both age groups were more successful at performing event-based than activity-based tasks; $t(39) = -6.21$, $p < .001$ and $t(39) = -7.03$, $p < .001$, respectively.

A second set of follow-up tests were conducted for the task type and age components across context. A significant effect was found for the activity-based tasks such that young adults were more successful at performing these tasks in the lab rather than the naturalistic setting; $t(39) = 7.66$, $p < .001$. A similar result indicated that young adults were also more likely to successfully complete event-based tasks in the lab rather than in the naturalistic setting, $t(39) = 4.46$, $p < .001$. The data from the older adults also displayed significant effects such that their performance was better in the lab for both activity- and event-based tasks; $t(39) = 7.16$, $p < .001$ and $t(39) = 2.22$, $p < .05$, respectively.

Regression Analyses

Based on zero-order correlations, multiple regression analyses were conducted to determine how age, perceptual speed, working memory, vocabulary, and the measure of inhibition scores influence performance on the various task type and experimental context combinations. As this set of analyses was largely exploratory, it was inappropriate to formulate directional hypotheses.

Almost all predictor variables were inter-correlated with the exception of the Stroop test score and working memory (Forward Digit Span) task. Given these correlation results, every variable was included in the backward elimination multiple regression analyses except the Forward Digit Span task and the Stroop test score. However, there was a significant correlation between the Forward Digit Span task and the Backward Digit Span task in working memory.

The only predictor variable that showed statistical significance for the activity-based task in the laboratory setting was the Backward Digit Span task (Step 5: $\beta = .29$, $p < .01$). Table 3 illustrates the backward elimination multiple regression analysis.

There were no statistically significant predictors for the event-based task in the laboratory setting. The R^2 values were .050 for Step 1, .049 for Step 2, .048 for Step 3, .045 for Step 4, and .039 for Step 5.

The predictor variable (recall of the symbols of the Digit Symbol Substitution Test) was significant for the naturalistic activity-based task only from Step 5 (Step 5: $\beta = .29$, $p = .01$). Table 4 illustrates the backward elimination multiple regression analysis.

There were no statistically significant predictor variables for the naturalistic event-based task. The R^2 values were .029 for Step 1, .029 for Step 2, .027 for Step 3, .026 for Step 4, and .025 for Step 5.

A second set of multiple regression analyses was conducted on the two distinct age groups for the various task type and experimental context combinations. As this set of analyses was also largely exploratory, it was again inappropriate to formulate directional hypotheses.

For the young group, Forward Digit Span task and vocabulary were significantly correlated with young age. Forward Digit Span task was the only significant predictor of young adults' performance on the lab activity-based task in Step 3. Table 5 shows the backward elimination multiple regression analysis.

There were no statistically significant predictor variables (i.e. young age, Forward Digit Span task, and vocabulary) to report for the lab event-based task. The R^2 values were .083 for Step 1; .078 for Step 2; and .072 for Step 3.

There were no statistically significant predictor variables (i.e. young age, Forward Digit Span task, and vocabulary) to report for the naturalistic activity-based task. The R^2 values were .022 for Step 1; .021 for Step 2; and .014 for Step 3.

There were no statistically significant predictor variables (i.e. young age, Forward Digit Span task, and vocabulary) to report for the naturalistic event-based task. The R^2 values were .018 for Step 1; .017 for Step 2; and .012 for Step 3.

For the older group, there were no statistically significant correlations with older age. Still, the investigator did a regression analysis for the laboratory activity-based task with the only predictor variable, older age. Older age was a significant predictor of the older adults' performance on the lab activity-based task ($B = -0.113$, $SE\ B = 0.048$, $\beta = -.355$, $p < .05$). The R^2 value was .126.

Older age was a marginally significant predictor variable of older adults' performance on the lab event-based task ($B = -0.058$, $SE\ B = .029$, $\beta = -.312$, $p = .05$). The R^2 value was .097.

The older age variable was a significant predictor for older adults' performance on the naturalistic activity-based task ($B = -0.039$, $SE\ B = 0.017$, $\beta = -.355$, $p < .05$). The R^2 value was .126.

There was no statistically significant predictor variable (i.e. older age) to report for the naturalistic event-based task performed by older adults. The R^2 value was .059.

Summary of Results

In sum, there were two significant main effects (i.e. task type and context) in this experiment, though both showed the opposite pattern from what had been hypothesized. The other main effect (i.e. age: young and older) was not present nor was the 2-way interaction between task type and context. Post hoc tests (follow-up paired samples *t*–tests for task type and age within context) did not show any statistically significant effect for the lab activity- and event-based tasks for young adults. A marginally significant effect ($p < .07$) was found for older adults such that completing the event-based task was easier than completing the activity-based task in the laboratory. There were significant effects for both age groups in the naturalistic setting such that participants completed event-based tasks more often than the activity-based tasks. Another set of follow-up tests was conducted to examine simple effects of task type and age across context. There were more significant effects favoring the completion of the event- and activity-based tasks in the laboratory condition than in the naturalistic condition for both young and older adults, respectively. The predictor variables utilized for the regression analyses for the performances of activity- and event based tasks were age (as a continuous variable), Digit Symbol Substitution Test, recall of the symbols of the Digit Symbol Substitution Test, Backward Digit Span task, and vocabulary in both laboratory and naturalistic settings. When analyses were done separately for the young and older groups, the predictor variables were different. For the young group, the predictor variables were young age, Forward Digit Span task, and vocabulary in the lab and naturalistic settings. For the older group, no predictor variables significantly correlated with one another. However, linear regression analyses were conducted using older age as the only predictor

variable in the lab and naturalistic settings. Older age was found to be significant in both laboratory and naturalistic activity-based tasks but not for event-based tasks.

Chapter 4

Discussion

None of the four hypotheses were supported. As stated the first hypothesis was the prediction that the performance of activity-based tasks would outperform the performance of event-based tasks (Kvavilashvili & Ellis, 1996) for both groups in both settings. However, event-based intentions were generally performed better than activity-based ones, overall, rejecting H_1. The second hypothesis predicted that young adults would outperform their older counterparts in both lab activity- and event-based tasks (Kvavilashvili & Ellis, 1996). There was no significant difference between the two age groups, not rejecting H_2. It seems that both groups were motivated enough to do well on the tasks. The third hypothesis predicted that the performance in the naturalistic setting would exceed that of the performance in the lab (Kim & Mayhorn, 2008). The performance in the laboratory setting of the experiment was found to be better than the performance in the naturalistic setting, not supporting H_3. The fourth hypothesis predicted that the older adults would outperform their younger counterparts in the naturalistic setting (Rendell & Thomson 1999).The young participants performed better on both tasks than their older counterparts in both contexts, except for the naturalistic event-based task which the older adults performed better (discussed later).

Activity-based intentions did not show a superior performance over event-based intentions. Looking at *Figure 1*, the performance of activity-based tasks was below that of the performance of event-based tasks in both conditions (60.0% for young participants and 57.5% for older participants in lab activity-based tasks; 81.9% and 73.8% in lab event-based tasks; 40.0% and 36.3% in naturalistic activity-based tasks; and 49.4% and 56.9% in

naturalistic event-based tasks, respectively). Results from a previous study (Kim & Mayhorn, 2008) showed a contradiction; they found activity-based tasks to be performed the best in the laboratory and event-based tasks best in the naturalistic setting. Discrepancy is evident because in this experiment, event-based tasks were best in both laboratory and naturalistic settings. It is, perhaps, unusual because the time interval for the lab distracter task (90 trivia question slides) was 20 seconds long, enough time to do the activity-based task after finishing the block of questions. Perhaps, as Altmann and Trafton (2007) suggest, participants had slower reengagement times when there was no activity going on for 6 and 8 seconds (i.e. staring at a blank screen) in the tank simulation scenario, possibly due to lack of cue availability, alertness, or arousal and this made the activity-based task more difficult. Further research needs to be done to explain this discrepancy in the literature. An alternate explanation might be the dimensions of the tasks selected. The event-based tasks in both laboratory and naturalistic settings had a more active role (i.e. circling answer when telephone question came up in lab and searching for men's shirts in naturalistic setting) and could be remembered more than the more passive activity-based tasks (i.e. writing "yes" or "no" whether there was telephone question in lab and putting completed questionnaire in box as well as picking debriefing statement up in naturalistic setting).

Contrary to the findings by Rendell and Thomson (1999) that older adults have superior prospective memory performance in the real world than young adults and that demand of the task is not a factor, this experiment showed that older adults fared well in the naturalistic setting's event-based task compared with the young participants but did not in the activity-based tasks. A possibility as to why older people performed better in the naturalistic

event-based task than their younger counterparts was that in this experiment, participants could write down the descriptions of the men's clothes on a piece of paper and go around the mall to look for them. They always had the piece of paper to remind them of what to look for. In this way, having a short or long delay did not matter. In the same way, pilots use note-taking (as prospective cues) after listening to air traffic control (ATC) messages and repeating them back again (Morrow et al., 2003; Morrow et al., 2005). Also, it could be argued that the event-based task in the mall was less artificial than the activity-based task because it was a familiar shopping task. Thus, older adults may have been able to compensate for any cognitive shortcomings by utilizing their experience using the "shopping list" as a cue. However for the naturalistic activity-based task, a delay from doing the event-based task might have had an adverse effect in remembering and completing the activity-based task (cf. Johansson, Andersson, & Rönnberg, 2000 in which they found performance on time-based tasks to be superior than to the event-based tasks in a naturalistic setting). It also signaled that the demand of the prospective memory tasks was a factor in the mall setting, familiarity with the area not so much. The reason is that the majority of the participants were not familiar with the floor plan of Crabtree Valley Mall and that they visited Crabtree Valley Mall rarely (see Table 2; Appendix K shows results from a few participants familiar with the floor plan). Other extraneous factors that may have contributed to these results include the variability of time, noise level, distraction, and level of crowd. For the laboratory setting, as predicted, the young participants did better than their older counterparts but not significantly.

In this study, participants showed the Zeigarnik effect (Reeve, Cole, & Olson, 1986; Zeigarnik, 2007; Zeigarnik, 1967) or the intention superiority effect (Goschke & Kuhl, 1993; Marsh, Hicks, & Bink, 1998; Marsh, Hicks, & Watson, 2002; Penningroth, 2005) in completing the event-based tasks in both laboratory and naturalistic contexts. However because of no activity between answering the blocks of questions (Altmann & Trafton, 2004) or the delay before completing the naturalistic activity-based tasks, there was forgetfulness or blocking on the part of the participants.

The context issue is problematic because the prediction was not supported. It predicted that performance on the naturalistic setting's tasks would be better (i.e. % completion rate) than on the laboratory setting's tasks. In reality, both activity- and event-based tasks in the lab were higher. This pattern displayed by the current data contradicts Kim and Mayhorn's (2008) results which were the basis for the current prediction. It might be because in the lab, minimal or no noise was present and concentration could be focused on the tasks at hand while there was ambient noise and distraction in the naturalistic setting. The investigator got that impression from the feedback of participants when filling out the naturalistic questionnaire (See Appendix J).

An observation that the investigator saw (i.e. purely observational), was that participants utilized the multi-process framework (McDaniel & Einstein, 2000) while working on the attention grabbing and difficult questions used as the main ongoing task in the lab. It seemed that some of the participants disregarded the intentions until the cues were presented prompting them to act, illustrating the automatic, retrieval process. Others might have used the strategic monitoring method to do the tasks. The strategic monitoring method

is in sync with the preparatory attentional memory (PAM) theory as proposed by Smith and her colleagues (Smith, 2003; Smith & Bayen, 2004). It details that participants mentally prepare for the upcoming prospective memory task and continuously scan the surrounding (i.e. the 90-question ongoing task). When the target (cue) occurs, they complete the memory task.

An additional observation concerning older participants was that 9 out of the 40 who had some college education, bachelor's degree, master's degree, or possibly a doctoral degree did not listen to the instructions and marked the activity-based task or event-based task with a check mark, line, question number, or inappropriate marking in the lab portion of the experiment (see Table 7). More cooperation and following the instructions verbatim were shown by the other older participants possibly because they listen more carefully and are familiar with testing procedures. Because the educational range of participants was from high school graduate to Ph. D.'s and age also varied considerably given the design of this experiment, it is difficult to parse out the effects of age and education.

The multiple regression analysis found that for lab activity-based tasks, Backward Digit Span task was the only statistically significant predictor variable. The recall of symbols of the Digit Symbol Substitution Test (DSSrec) was the significant predictor for the naturalistic activity-based task. Overall, there cannot be any direct comparisons from the lab tasks to the naturalistic tasks because different predictor variables go into each different context. For both lab and naturalistic event-based tasks, none of the cognitive predictor variables measured in this study was significant. Questions arise as to why there were not. Are lab and naturalistic event-based tasks immune from all cognitive predictor variables that

were tested here or would other tests demonstrate an effect? Further research should explore these avenues (For these analyses, age was grouped as a continuous variable).

The second set of multiple regression analyses for the two distinct age groups found no similarities among the different tasks and different contexts. Forward Digit Span task was the only significant predictor variable of young adults' performance on the lab activity-based task. There were no significant predictor variables for any of the other tasks and contexts. For the older group, no predictor variables were significant. Linear regression analyses were conducted using the older age predictor as a continuous variable on the various tasks and contexts. The analyses found that for older participants, age was a significant predictor of performance on both the lab and naturalistic activity-based tasks. No significant predictor variables were found for the performances of both lab and naturalistic event-based tasks. There seems to be no significance for the predictor variables used in this experiment concerning the lab and naturalistic event-based tasks for the young group. On the other hand, there was statistical significance in performing the lab and naturalistic activity-based tasks for the young adults. For the older group, there appears to be significance for the lab activity- and naturalistic activity-based tasks. However, there seems not to be significance for the lab and naturalistic event-based task of older adults. There might not be any significance for the young group concerning the factors used for the lab event- and naturalistic event-based tasks but statistical significance for the lab and naturalistic activity-based tasks. For the older group, no significance is present for any of the different tasks and contexts. Other factors may influence the older group as well as the young group that have not been delineated.

Limitations

The present study had some limitations. First, because the participants were predominantly Caucasian and only five African-Americans and five Asians participated as well as two other participants having mixed heritage, generalization was hard concerning the scope of the wider population. Second, there might have been inadvertent nonverbal or verbal cues given by the investigator during the laboratory trivia questionnaire that might have elevated or reduced percentage correct of either or both of activity- and event-based tasks. One such incident occurred when the investigator mumbled "you are doing the wrong thing" to an older participant, allowing other older participants in the room to listen and might have corrected their misstep in the respective tasks. However, the mishap was not big and the investigator believes the results really represented the outcome. No young participant(s) heard the mumble or any peep from the confederates or from the investigator.

Future research should include a middle-aged group (Zeintl, Kliegel, & Hofer, 2007) along with a young and older age group because the transition from young to middle to older ages might demonstrate different completion rates for activity and event-based tasks, especially for time-based tasks possibly due to age-related changes in cognitive factors. However a better way is the conceptualization of age as a continuous variable (i.e. lifespan) to examine the changes that people go through from young age onward. A demarcation line could be from every 10 years such as 20 to 29 years old, 30 to 39 years old, etc (Hess, 2006).

Goals, motivations, expectations and a number of other social cognitive factors may play a part in handling various tasks and obligations. Different strategies could be utilized dealing with reduced cognitive resources when people age. Processing speed may be

different for the lifespan groups as well in processing prospective memory tasks (Hess, 2006; Zeintl, Kliegel, & Hofer, 2007).

Conclusion

The patterns of results from the present study and from (Kim & Mayhorn, 2008), show that activity-based tasks are as elusive as ever. Some studies (e.g. Shum, Valentine, & Cutmore, 1999) find higher performance of activity-based tasks than other types of prospective memory tasks. Other studies (e.g. Brooks, Rose, Potter, Jayawardena, & Morling, 2004) show the opposite. More research is needed to distinguish the characteristics of activity- and event-based tasks and to exhaust the different avenues of activity-based intentions. Concerning this case, in the naturalistic setting, the division line between activity- and event-based tasks is not clear. As Altmann and Trafton (2007) have pointed out, participants had slower reengagement times when there was no activity going on for 6 and 8 seconds (i.e. staring at a blank screen) in the tank simulation scenario, possibly due to lack of cue availability, alertness, or arousal (in their experiments, at least) and this made the activity-based task more difficult. There may also be an abundant number of external cues that can be used in completing prospective memory tasks in the naturalistic setting (Kim & Mayhorn, 2008). However the distinction between the two prospective memory tasks can be clearly defined in the sterile environment of the laboratory.

The utility of using naturalistic tests is useful and beneficial because these tests compare and contrast to their respective laboratory conditions. Again, it is stated that, “the laboratory tradition is strong in method and rich in theory” (Winograd, 1988, pp. 19). However without a strong backing from ecological research to support or refute the claims

made by laboratory tests, the laboratory tradition is fraught with problems. Also, utilizing naturalistic tests enables researchers and investigators to generalize to a wider population.

From the results of this experiment, they demonstrated that the completion of event-based prospective memory tasks was superior to the completion of activity-based tasks implying that people should use environmental support in the real world in order to improve their naturalistic prospective memory (Craik, 1986; Herrmann, 1996; Mayhorn, Lanzolla, Wogalter, & Watson, 2005). In effect, people should strive to convert activity-based tasks into event-based tasks to improve the likelihood of successful task completion.

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Table 1

Descriptive Statistics for Young Adults and Older Adults

	M	*SD*	*Range/(Maximum Score)*	*t*-test (df = 39)
Young Adults				
Age	19.35	2.55	18 – 32	
DSS	67%	14%	7% – 92% (100)	-46.47***
DSSrec	80%	24%	22% – 100% (9)	-45.63***
FwdDig	71%	14%	38% – 100% (16)	-45.14***
BackDig	71%	18%	29% – 100% (14)	-46.51***
Vocab	72%	10%	43% – 95% (40)	47.14***
Education	14.06	1.40	12 – 19	-15.09***
Lab AB	60.00%	36%	0% – 100% (6)	
Lab EB	81.88%	18%	0% – 100% (4)	
Nat AB	40.00%	12%	0% – 100% (2)	
Nat EB	49.38%	23%	0% – 100% (4)	
Older Adults				
Age	70.20	7.07	60 - 85	
DSS	52%	8%	32% – 70% (100)	-62.16***
DSSrec	53%	28%	0% – 100% (9)	-62.16***
FwdDig	70%	17%	0% – 94% (16)	-61.68***
BackDig	61%	19%	21% – 100% (14)	-62.23***
Vocab	90%	6%	73% – 98% (40)	62.08***
Education	16.50	2.89	12 – 22	-44.18***
Lab AB	57.50%	36%		
Lab EB	73.75%	18%		
Nat AB	36.25%	12%		
Nat EB	56.88%	12%		

Note: DSS = Digit Substitution Test, DSSrec = Digit Substitution Test recall, FwdDig = Forward Digit Span task, BackDig = Backward Digit Span task, Vocab = Vocabulary, Lab AB = Lab activity-based task, Lab EB = Lab event-based task, Nat AB = Naturalistic activity-based task, Nat EB = Naturalistic event-based task; *$p < .05$, **$p < .01$, ***$p < .001$

Table 2

Familiarity of Floor Plan of Crabtree Valley Mall (n = 80)

	Number of Participants
Young Adults	9
Older Adults	7
Total	16

Table 3

Backward Elimination Multiple Regression Analysis for Predictor Variables on Laboratory Activity-Based Task

Variable	*B*	*SE B*	β
Step 1			
Constant (Intercept)	-1.897	2.416	
Age	6.46E-005	0.018	.001
DSS	3.031	2.418	.181
DSSrec	0.243	1.059	.031
BackDig	2.740	1.431	.232
Vocab	2.026	3.311	.108
Step 2			
Constant (Intercept)	-1.898	2.384	
DSS	3.028	2.251	.181
DSSrec	2.42	1.023	.031
BackDig	2.738	1.364	.232*
Vocab	2.035	2.169	.109
Step 3			
Constant (Intercept)	-1.894	2.370	
DSS	3.272	1.988	.195
BackDig	2.797	1.333	.236*
Vocab	2.001	2.151	.107
Step 4			
Constant (Intercept)	-0.021	1.249	
DSS	2.639	1.867	.157
BackDig	2.987	1.316	.253*
Step 5			
Constant (Intersept)	1.242	0.879	
BackDig	3.465	1.280	.293**

Note. R^2 = .120 for Step 1, ΔR^2 = .120 for Step 2, ΔR^2 = .119 for Step 3, ΔR^2 = .109 for Step 4, ΔR^2 = .086 for Step 5; *p < .05, **p < .01
DSS = Digit Substitution Test, DSSrec = Digit Substitution Test recall, BackDig = Backward Digit Span task, Vocab = Vocabulary

Table 4

Backward Elimination Multiple Regression Analysis for Predictor Variables on Naturalistic Activity-Based Task

Variable	*B*	*SE B*	β
Step 1			
Constant (Intercept)	-0.013	0.811	
Age	0.008	0.006	.266
DSS	1.035	0.812	.184
DSSrec	0.663	0.356	.252
BackDig	0.356	0.481	.090
Vocab	-1.073	1.112	-.171
Step 2			
Constant (Intercept)	0.030	0.807	
Age	0.007	0.006	.223
DSS	1.069	0.808	.190
DSSrec	0.691	0.353	.262
Vocab	-0.814	1.052	-.130
Step 3			
Constant (Intercept)	-0.407	0.574	
Age	0.003	0.004	.112
DSS	0.996	0.800	.177
DSSrec	0.643	0.346	.244
Step 4			
Constant (Intercept)	-0/049	0.374	
DSS	0.710	0.720	.126
DSSrec	0.581	0.337	.221
Step 5			
Constant (Intercept)	0.258	0.207	
DSSrec	0.759	0.286	.288*

Note. R^2 = .116 for Step 1, ΔR^2 = .110 for Step 2, ΔR^2 = .102 for Step 3, ΔR^2 = .094 for Step 4, ΔR^2 = .083 for Step 5; *p < .05
DSS = Digit Substitution Test, DSSrec = Digit Substitution Test recall, BackDig = Backward Digit Span task, Vocab = Vocabulary

Table 5

Backward Elimination Multiple Regression Analysis (young age) for Predictor Variables on Lab Activity-Based Task

Variable	*B*	*SE B*	β
Step 1			
Constant (Intercept)	1.557	4.384	
Young	-0.135	0.193	-.147
FwdDig	4.232	3.000	.257
Vocab	2.273	4.393	.098
Step 2			
Constant (Intercept)	1.758	4.323	
Young	-0.079	0.158	-.086
FwdDig	4.727	2.815	.287
Step 3			
Constant (Intercept)	-0.201	1.839	
FwdDig	5.324	2.526	.323*

Note. R^2 = .117 for Step 1, ΔR^2 = .111 for Step 2, ΔR^2 = .105 for Step 3; *p < .05
Young = Young Age Group, FwdDig = Forward Digit Span Task, Vocab = Vocabulary

Table 6

Completion of either One or Both of the Naturalistic Activity-Based Tasks (2 tasks)

	Number of Participants
Wrote Best (i.e. cheapest priced) Shirt	3
Picked Debriefing Statement Up	25
Completed Both Tasks	16
Total	44

Table 7

Failure to Follow Laboratory Instructions (Years of Education)

	Years of Education
Participant #1	17
Participant #2	18
Participant #3	18
Participant #4	16
Participant #5	17
Participant #6	17
Participant #7	19
Participant #8	14
Participant #9	17

Table 8

Means of the Different Task Type and Context Combinations (%)

	Laboratory		Naturalistic	
	Activity-based	Event-based	Activity-based	Event-based
Young Adults	60.00	81.88	40.00	49.38
Older Adults	57.50	73.75	36.25	56.88

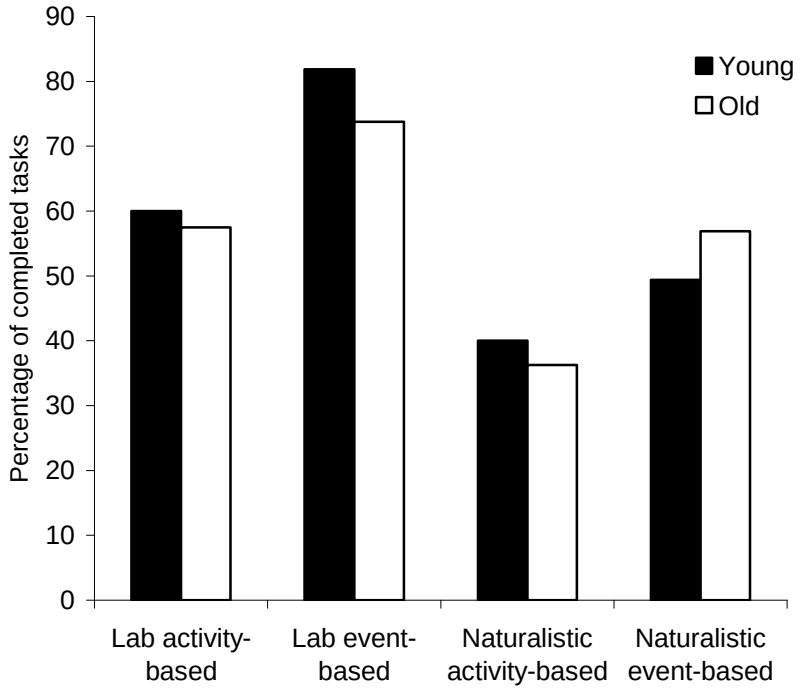

Figure 1. Completion rates (%) at the laboratory and naturalistic settings for young and old

APPENDICES

Appendix A

An Example of the Multiple-Choice Questionnaire

1. When was the Bolshevik Revolution?
    A) 1918
    B) 1916
    C) 1915
    D) 1917

Answer: D) 1917

Appendix B

Procedure and Instructions for the Lab

Materials Needed:

1. Laptop & Projector - LRL
2. MS PowerPoint version of General-knowledge questions
    a. MS Office 2000 or XP? – LRL
    b. CD ROM or stick (Flash memory)?
3. 80 copies of answer sheets
4. 160 copies of consent form (80 for young adults and 80 for older adults)
5. Lab Procedure
6. Instructions for Lab

Lab Procedure:

1. Distribute two (2) copies of the Informed Consent Form for Research.
2. Distribute demographics questionnaire.
3. Administer individual differences tests.
4. Distribute written task instruction to participants. (Any questions?)
5. Ask to remove wristwatches and put them away.
6. Project multiple choice questions.
7. Collect the answer sheet.
8. Inform participants to come to Crabtree Valley Mall.

Lab Instructions:

1. Read and complete the Consent Form. One copy is to sign and return to me and the other you keep.
2. Fill out the demographics questionnaire, querying gender, age, ethnicity, and years of education.
3. I will administer several individual differences tests.
4. Main task: You will answer 90 general-knowledge questions. Answer them to your best ability. There will be six blocks. The multiple choice questions will be projected on the screen.
5. While you are answering the questions, do the following;
    a. <u>Circle</u> the answer when the question is related to telephone.
    b. Write <u>yes or no</u> whether there was a telephone question after <u>completing</u> each block of questions at the bottom of the page.
6. There will be no looking back at previous blocks during this session.
7. After the lab session is completed, stay in your seat. I will explain what you will do in the next few days (Remember to come to Crabtree Valley Mall with a piece of paper and writing utensil after the lab session on Saturday at 10:30 am).

Appendix C

Informed Consent Form for Young (presented first) and Older Adults

North Carolina State University
INFORMED CONSENT FORM for RESEARCH

Exploring Age-Related Differences in Prospective Memory Inside and Outside of the Lab

Principal Investigator: P. Y. Kim

What are some general things you should know about research studies?
You are being asked to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time. The purpose of research studies is to gain a better understanding of a certain topic or issue. You are not guaranteed any personal benefits from being in a study. Research studies also may pose risks to those that participate. In this consent form you will find specific details about the research in which you being asked to participate in. If you do not understand something in this form it is your right to ask the researcher for clarification or more information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher(s) named above.

What is the purpose of this study?
The purpose of this study is to investigate your ability to handle and remember actions while engaged in answering trivia questions. Following the laboratory task, you will be asked to come to Crabtree Valley Mall after a few days to complete naturalistic tasks.

What will happen if you take part in the study?
If you agree to participate in this study, first you will be asked to fill out a demographics questionnaire, querying gender, age, ethnicity, and years of education. Second, you will be tested on perceptual speed (digit symbol substitution test), working memory (forward/backward digit span task), verbal comprehension (vocabulary), and measure of inhibition (Stroop test) using Wechsler Adult Intelligence Scale III, Shipley Institute of Living Scale, and Stroop Color and Word Test (Golden, 1978; Shipley, 1986; Wechsler, 1997). Third, you will be asked to answer some trivia questions. While working on the questions, a second task is to remember to do something else. The second part of the study will ask you to come to Crabtree Valley Mall, one week after the lab portion of the study, to complete naturalistic tasks. I will provide you with the information at that time. The first part will be for 90 minutes, and the second part will be for 1 hour. The total duration will be 90 minutes for lab and 1 hour in the mall setting. It should not exceed 3 hours.

Risks
I do not see any risks involved with this study.

Benefits
No direct benefit is expected to the participants. However, our findings may be beneficial to the general public.

Confidentiality
The information in the study records will be kept strictly confidential. Data will be stored securely by a code number (e.g. 101) that is linked to your I.D. Data will be stored securely and will be made available only to persons conducting the study unless you specifically give permission in writing to do otherwise. No reference will be made in oral or written reports which could link you to the study.

Compensation
For participating in this study you will receive 6 research credits plus $5.00 in the mall. If you withdraw from the study prior to its completion, you will receive 1 research credit per 30 min interval. Other ways to earn the same amount of credits is writing a 3-page paper relevant to psychology.

Emergency Medical Treatment (if applicable)-
N/A

What if you have questions about this study?
If you have questions at any time about the study or the procedures, you may contact the researcher, Paul Kim, at 4009 City of Oaks Wynd, (919-781-3645) or pykim@ncsu.edu.

What if you have questions about your rights as a research participant?
If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Dr. David Kaber, Chair of the NCSU IRB for the Use of Human Subjects in Research Committee, Box 7514, NCSU Campus (919/515-3086) or Mr. Matthew Ronning, Assistant Vice Chancellor, Research Administration, Box 7514, NCSU Campus (919/513-2148)

Consent To Participate
"I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may withdraw at any time."

Subject's signature_____ **Date** _____
Investigator's signature_____ **Date** _____

North Carolina State University
INFORMED CONSENT FORM for RESEARCH

Exploring Age-Related Differences in Prospective Memory Inside and Outside of the Lab

Principal Investigator: P. Y. Kim

What are some general things you should know about research studies?

You are being asked to take part in a research study. Your participation in this study is voluntary. You have the right to be a part of this study, to choose not to participate or to stop participating at any time. The purpose of research studies is to gain a better understanding of a certain topic or issue. You are not guaranteed any personal benefits from being in a study. Research studies also may pose risks to those that participate. In this consent form you will find specific details about the research in which you being asked to participate in. If you do not understand something in this form it is your right to ask the researcher for clarification or more information. A copy of this consent form will be provided to you. If at any time you have questions about your participation, do not hesitate to contact the researcher(s) named above.

What is the purpose of this study?

The purpose of this study is to investigate your ability to handle and remember actions while engaged in answering trivia questions. Following the laboratory task, you will be asked to come to Crabtree Valley Mall after a few days to complete naturalistic tasks.

What will happen if you take part in the study?

If you agree to participate in this study, first you will be asked to fill out a demographics questionnaire, querying gender, age, ethnicity, and years of education. Second, you will be tested on perceptual speed (digit symbol substitution test), working memory (forward/backward digit span task), verbal comprehension (vocabulary), and measure of inhibition (Stroop test) using Wechsler Adult Intelligence Scale III, Shipley Institute of Living Scale, and Stroop Color and Word Test (Golden, 1978; Shipley, 1986; Wechsler, 1997). Third, you will be asked to answer some trivia questions. While working on the questions, a second task is to remember to do something else. The second part of the study will ask you to come to Crabtree Valley Mall, one week after the lab portion of the study, to complete naturalistic tasks. I will provide you with the information at that time. The first part will be for 90 minutes, and the second part will be for 1 hours. The total duration will be 90 minutes for lab and 1 hours in the mall setting. It should not exceed 3 hours.

Risks

There are no more risks beyond those associated with light office work.

Benefits

No direct benefit is expected to the participants. However, our findings may be beneficial to the general public.

Confidentiality

The information in the study records will be kept strictly confidential. Data will be stored securely by a code number (e.g. 102) that is linked to your I.D. Data will be stored securely and will be made available only to persons conducting the study unless you specifically give permission in writing to do otherwise. No reference will be made in oral or written reports which could link you to the study.

Compensation

For participating in this study you will receive $10.00 in the lab and another $10.00 in the mall. If you withdraw from the study prior to its completion, you will receive $10.00. There are no other ways of earning the money.

Emergency Medical Treatment (if applicable)-

N/A

What if you have questions about this study?
If you have questions at any time about the study or the procedures, you may contact the researcher, Paul Kim, at 4009 City of Oaks Wynd, (919-781-3645) or pykim@ncsu.edu.

What if you have questions about your rights as a research participant?
If you feel you have not been treated according to the descriptions in this form, or your rights as a participant in research have been violated during the course of this project, you may contact Dr. David Kaber, Chair of the NCSU IRB for the Use of Human Subjects in Research Committee, Box 7514, NCSU Campus (919/515-3086) or Mr. Matthew Ronning, Assistant Vice Chancellor, Research Administration, Box 7514, NCSU Campus (919/513-2148)

Consent To Participate
"I have read and understand the above information. I have received a copy of this form. I agree to participate in this study with the understanding that I may withdraw at any time."

Subject's signature_____ **Date** _____
Investigator's signature_____ **Date** _____

Appendix D

Demographics Questionnaire

Demographics Questionnaire

Gender: M F Age: _____

Ethnicity: _____ Years of Education _____

Appendix E

Written Task Instruction

INSTRUCTION:

- You will answer 90 general-knowledge multiple choice questions.
- Answer them to your best ability and guess the answer if you are unsure.
- There will be six blocks of questions. The questions will be projected on the screen.
- While you are answering the questions, also do the following;

  (1) Circle the answer when the question is related to telephone.

  (2) Write yes or no whether there was a telephone question after completing each block of questions at the bottom of the page.

Appendix F

General-knowledge Questions and Answers

General-knowledge Questions

1. Prague is located in which country?
   A) Slovakia
   B) Czech Republic
   C) Slovenia
   D) Croatia

2. Who was the 11th President of the United States?
   A) John Tyler
   B) Zachary Taylor
   C) James K. Polk
   D) Millard Fillmore

3. Which island contains Japan's capital, Tokyo
   A) Honshu
   B) Kyushu
   C) Shikoku
   D) Hokkaido

4. What country claims to be the oldest republic in the world?
   A) San Marino
   B) Monaco
   C) Vatican City
   D) Iraq

5. What is our state beverage?
   A) Milk
   B) Water
   C) Orange Juice
   D) Ginger Ale

6. When was the Bolshevik Revolution?
   A) 1918
   B) 1916
   C) 1915
   D) 1917

7. What is Europe's second longest river?
   A) Danube River
   B) Volga River
   C) Seine River
   D) Thames River

8. Which element has the highest melting point?
    A) Carbon
    B) Hydrogen
    C) Uranium
    D) Tungsten

9. Infant beavers are called what?
    A) Cubs
    B) Kittens
    C) Joeys
    D) Kids

10. Who was the first American to be awarded the Nobel Peace Prize?
    A) Theodore Roosevelt
    B) Jimmy Carter
    C) Martin Luther King, Jr.
    D) Woodrow Wilson

11. Who invented the telephone?
    A) Thomas Watson
    B) Marconi
    C) Alexander G. Bell
    D) Thomas Edison

12. Who was the first Black actor to win an Oscar?
    A) Denzel Washington
    B) Halle Berry
    C) Sidney Poitier
    D) Cuba Gooding, Jr.

13. Who was the first explorer to reach the North Pole?
    A) James Cook
    B) Robert E. Peary
    C) Francis Drake
    D) George Vancouver

14. Who was the U.S. President who wanted to increase the size of the Supreme Court from nine to fifteen?
    A) James Buchanan
    B) Franklin Roosevelt
    C) Millard Fillmore
    D) Theodore Roosevelt

15. Who has the most statues in the United States?
    A) George Washington
    B) Robert E. Lee
    C) Thomas Jefferson
    D) Sacajewa

16. Which state was the first to allow women to vote?
    A) Georgia
    B) Wyoming
    C) Ohio
    D) New York

17. Which plant bears fruit a mere 15 months after planting?
    A) Orange
    B) Apple
    C) Banana
    D) Apricot

18. The study of insects is called
    A) Etymology
    B) Insectology
    C) Entomology
    D) Ethology

19. The word "honcho" came from
    A) China
    B) Japan
    C) Spain
    D) Portugal

20. A 'jiffy' is an actual unit of time for
    A) 1 second.
    B) 1/10th of a second
    C) 1/100th of a second
    D) 1/1000th of a second

21. What was the highest denomination bill ever released for public circulation by the United States?
    A) $100
    B) $500
    C) $1,000
    D) $10,000

22. Which saying is attributed to Henry David Thoreau?
    A) Any fool can make a rule
    B) Fool's money soon parts
    C) Fools don't make good leaders
    D) Fools should die

23. In 1884, people of what U.S. city were annoyed by enormous amounts of power and telephone lines along their streets?
    A) Chicago
    B) New York City
    C) San Francisco
    D) Washington, D.C.

24. What is a doggerel?
    A) Tree
    B) Instrument
    C) Poem
    D) Star

25. Which country is not considered a kingdom?
    A) Belgium
    B) Denmark
    C) Monaco
    D) Sweden

26. What does it mean to "anthropomorphize"?
    A) To act like an anthropologist
    B) To do the "typical, stupid human thing" (with animals)
    C) To influence an animal with human ways, so it is less like its relatives in the wild
    D) To treat animals as if they were like humans

27. What is a pheromone, technically speaking?
    A) An interspecies signaling system
    B) A chemical used with members of the same species to communicate over a distance
    C) By definition it is a sexual attractant
    D) Any chemical which causes strong attraction or repulsion

28. What is a “chunk,” in short term memory?
    A) A partial memory, not complete
    B) A single organized thing or item
    C) A “magic number” which aids retrieval
    D) A binary “bit” of information

29. By the 1920s a new definition of psychology gained favor. Psychology was said to be the science of
    A) Mind
    B) Consciousness
    C) Behavior
    D) Philosophy

30. What chemical burns violently when mixed with water, but not at all in kerosene?
    A) Tellurium
    B) Sodium
    C) Chlorine
    D) Manganese

31. Which is not a fruit?
    A) Quince
    B) Marengo
    C) Pomegranate
    D) Loquat

32. Which British title of nobility is “highest”?
    A) Baron
    B) Viscount
    C) Earl
    D) Duke

33. Which was the largest land empire in history?
    A) British Empire
    B) Empire of Alexander the Great
    C) Mongol Empire
    D) Roman Empire

34. What was the first capital of Ancient Egypt?
    A) Memphis
    B) Thebes
    C) Alexandria
    D) Cairo

35. Which of these language families is the Magyar tongue of Hungary a member of?
    A) Arabic
    B) Germanic
    C) Romance
    D) Greek

36. The oldest living trees in the world are the bristlecone pines. They grow in which area of the United States?
    A) West
    B) East
    C) South
    D) North

37. Which was the Roman name for Scotland?
    A) Caledonia
    B) Helvetia
    C) Gallia
    D) Galatia

38. When the world's first adhesive postage stamp was issued in Great Britain in 1840, how much did it cost?
    A) Farthing
    B) Penny
    C) Half crown
    D) Crown

39. On which continent are you most likely to see a bowerbird in the wild?
    A) Australia
    B) North America
    C) South America
    D) Asia

40. What is animism?
    A) Rapid, excited discourse
    B) The attribution of conscious life to nature or natural objects
    C) The behavior of a wild animal
    D) Acquiring animalistic characteristics

41. The leotard gets its name from an aerial gymnast of what country?
    A) India
    B) France
    C) Britain
    D) The United States

42. Which of the eight planets in the solar system did the Voyager 2 spacecraft fly by in January 1986?
    A) Saturn
    B) Venus
    C) Uranus
    D) Jupiter

43. In what U.S. state was the first toll road operated?
    A) New Jersey
    B) New York
    C) Maryland
    D) Virginia

44. The commercial wireless telephone was first introduced in Chicago in 1982 by
    A) AT&T
    B) Bell South
    C) Ameritech
    D) Sprint

45. What desert receives the smallest amount of annual rainfall?
    A) Sahara Desert
    B) Kalahari Desert
    C) Gobi Desert
    D) Atacama Desert

46. Ayers Rock or Uluru, is a giant outcrop that draws visitors to the interior of which continent?
    A) Australia
    B) South America
    C) Africa
    D) Asia

47. What was the average age at death in the U.S. in 1900?
    A) 45 years
    B) 47 years
    C) 40 years
    D) 43 years

48. What is green film that forms on copper or bronze from long exposure called?
    A) Panacea
    B) Patina
    C) Panache
    D) Paregoric

49. What is a hamburg muscat?
    A) Black grape
    B) Fancy pastry
    C) Squirrel stew
    D) Freshwater fish

50. Writer Anais Nin is best known for her ten-volume what?
    A) History of the world
    B) Diary
    C) Lives of the presidents
    D) Women's encyclopedia

51. All of these are kinds of boats or ships except:
    A) Brigantine
    B) Funicular
    C) Ketch
    D) Trimaran

52. Who was the first secretary-general of the United Nations?
    A) Sidney Holland
    B) Reinhard Heydrich
    C) Trygve Lie
    D) Dag Hammerskjold

53. Which two countries are located on the same island?
    A) Haiti – Dominican Republic
    B) Trinidad – Tobago
    C) Suriname – Guyana
    D) Antigua – Bermuda

54. Who said, 'I can resist everything except temptation"?
    A) Will Rogers
    B) Groucho Marx
    C) Oscar Wilde
    D) Ernest Hemingway

55. In the New Testament, people referred to as "publicans" were:
    A) Tax collectors
    B) Religious leaders
    C) Slaves
    D) Governors

56. Which French town was history's greatest military evacuation?
    A) Dunkirk
    B) Bordeaux
    C) Lyons
    D) Nice

57. The greatest single volcanic explosion in the last 3000 years was the eruption of:
    A) Vesuvius
    B) Mauna Kea
    C) Cotopaxi
    D) Krakatoa

58. An autopsy showed more than 10 drugs in his system, who was that man?
    A) Harry Houdini
    B) Jim Morrison
    C) Elvis Presley
    D) John Belushi

59. The Witch of Endor is a sorceress in:
    A) The Bible
    B) Goethe's Faust
    C) In a Celtic myth
    D) In the Salem witch trials

60. Which baseball player topped Babe Ruth's single-season home run record?
    A) Willie Mays
    B) Joe DiMaggio
    C) Roger Maris
    D) Mickey Mantle

61. Which term denoted a southern supporter of the reconstruction after the Civil War?
    A) Carpetbagger
    B) Mugwumper
    C) Teetotaler
    D) Scalawag

62. Most of the world's production of _____ is used for heat-resistant and magnetic alloys:
    A) Selenium
    B) Rubidium
    C) Cobalt
    D) Tungsten

63. Where was the original “Skid Row”?
    A) Seattle
    B) New York City
    C) Chicago
    D) New Orleans

64. The 1920’s city of Zenith is the setting for which famous novel?
    A) East of Eden
    B) Babbitt
    C) Mainstreet
    D) The Great Gatsby

65. Dr. Seuss is the nom de plume of:
    A) William Sidney
    B) Theodore Geisel
    C) Charles Perrault
    D) A. A. Milne

66. Which person would you go to if you needed to have a barrel repaired?
    A) Wainwright
    B) Gaffer
    C) Cooper
    D) Podiatrist

67. Who was the first U.S. President to have a telephone on his desk at the White House?
    A) Herbert Hoover
    B) Calvin Coolidge
    C) Theodore Roosevelt
    D) Woodrow Wilson

68. Which pitcher allowed the most grand slams in baseball history?
    A) Nolan Ryan
    B) Milt Pappas
    C) Wilbur Wood
    D) Jerry Koosman

69. By a 1919 agreement, a vacancy in its crown forces Monaco to become a protectorate of:
    A) France
    B) Belgium
    C) Italy
    D) England

70. Which event took place the same year that World War I began?
    A) Perry reaches North Pole
    B) San Francisco earthquake
    C) Panama Canal opened
    D) McKinley gets shot

71. Which animal cries when in distress?
    A) Gorilla
    B) Asian elephant
    C) Red kangaroo
    D) Humpback whale

72. Soyuz, Vostok, Salyut, and Venera are all names of:
    A) Soviet space programs
    B) Polish festivals
    C) Black Sea islets
    D) Czech aeronautical programs

73. Poet Carl Sandburg wrote a six-volume biography of this famous American:
    A) Henry Ford
    B) Abraham Lincoln
    C) Mark Twain
    D) George Washington

74. In which city are you most likely to be served couscous?
    A) Paris
    B) Casablanca
    C) Rio de Janeiro
    D) Munich

75. The Provincetown Players theater group discovered this major playwright:
    A) Arthur Miller
    B) Tennessee Williams
    C) Noel Coward
    D) Eugene O'Neill

76. What animal is University of Arkansas football team named for?
    A) Tomcat
    B) Beaver
    C) Bull
    D) Razorback hog

77. Little boots, little cords, and little tongues are the translated names of:
    A) Danish pastries
    B) Russian soups
    C) Italian pasta
    D) German sausages

78. The Chinook is the largest member of this fish family:
    A) Tuna
    B) Salmon
    C) Sunfish
    D) Marlin

79. Who is referred to as the "father of the atomic bomb"?
    A) Albert Einstein
    B) Enrico Fermi
    C) Niels Bohr
    D) Robert Oppenheimer

80. The world's highest active volcanoes are found on this continent:
    A) South America
    B) Europe
    C) Asia
    D) Australia

81. Which country does not border the Red Sea?
    A) Sudan
    B) Yemen
    C) Ethiopia
    D) Turkey

82. The elegy for Abraham Lincoln, "When Lilacs Last in the Dooryard Bloom'd," is by:
    A) Henry W. Longfellow
    B) Emily Dickinson
    C) Walt Whitman
    D) Oliver Wendell Holmes

83. The German and Russian Struves are a noted family of:
    A) Physicists
    B) Astronomers
    C) Chemists
    D) Geologists

84. What does the medical specialty of nosology deal with?
    A) Artificial limbs
    B) Back problems
    C) Holistic medicine
    D) Disease classification

85. Who was not a famous pirate?
    A) William Kidd
    B) Edward Teach
    C) Henry Cavendish
    D) Jean Lafitte

86. The "con" in con man is short for:
    A) Conniving
    B) Confidence
    C) Convicted
    D) Consternation

87. In the Gershwin opera "Porgy and Bess," Porgy is a:
    A) Beggar
    B) Criminal
    C) Store clerk
    D) Railroad conductor

88. Which river empties into the North Sea?
    A) Ebro
    B) Elbe
    C) Po
    D) Rhone

89. What physicist discovered that a wave's frequency changes when the source and observer are in motion relative to one another?
    A) Max Planck
    B) Christian Doppler
    C) Enrico Fermi
    D) Albert Einstein

90. To which language group does modern Arabic belong?
    A) Semitic
    B) Dravidian
    C) Slavic
    D) Romance

Answers

1. (B) Czech Republic
2. (C) James K. Polk
3. (A) Honshu
4. (A) San Marino
5. (A) Milk
6. (D) 1917
7. (A) Danube River
8. (A) Carbon (melts at 3550 °C. Tungsten melts at 3410 °C)
9. (B) Kitten
10. (A) Theodore Roosevelt
11. (C) Alexander G. Bell
12. (C) Sidney Poitier
13. (B) Robert E. Peary
14. (B) Franklin Roosevelt
15. (D) Sacajewa

16. (B) Wyoming
17. (C) Banana
18. (C) Entomology
19. (B) Japan
20. (C) 1/100th of a second
21. (D) $10,000 (It is no longer being printed. Since 1945, no bill higher than $100 has been printed.)
22. (A) Any fool can make a rule
23. (B) New York City
24. (C) Poem
25. (C) Monaco
26. (D) To treat animals as if they were like humans
27. (B) A chemical used with members of the same species to communicate over a distance
28. (B) A single organized thing or item
29. (C) Behavior
30. (B) Sodium

31. (B) Marengo
32. (D) Duke
33. (C) Mongol Empire (At its peak, the Mongol Empire stretched from the Pacific Ocean across most of continental Asia to the Danube River in Europe, and to the Persian Gulf in the Middle East.)
34. (A) Memphis
35. (A) Arabic

36. (A) West
37. (A) Caledonia
38. (B) Penny
39. (A) Australia
40. (B) The attribution of conscious life to nature or natural objects
41. (B) France (from Jules Leotard)
42. (C) Uranus
43. (D) Virginia
44. (C) Ameritech
45. (D) Atacama Desert

46. (A) Australia
47. (B) 47 years
48. (B) Patina
49. (A) Black grape
50. (B) Diary
51. (B) Funicular
52. (C) Trygve Lie
53. (A) Haiti – Dominican Republic
54. (C) Oscar Wilde
55. (A) Tax collectors
56. (A) Dunkirk
57. (D) Krakatoa
58. (C) Elvis Presley
59. (A) The Bible
60. (C) Roger Maris

61. (D) Scalawag
62. (C) Cobalt
63. (A) Seattle
64. (B) Babbitt
65. (B) Theodore Geisel
66. (C) Cooper
67. (A) Herbert Hoover
68. (A) Nolan Ryan
69. (A) France
70. (C) Panama Canal opened
71. (B) Asian elephant
72. (A) Soviet space programs
73. (B) Abraham Lincoln
74. (B) Casablanca
75. (D) Eugene O'Neill

76. (D) Razorback hog
77. (C) Italian pasta
78. (B) Salmon
79. (D) Robert Oppenheimer
80. (A) South America
81. (D) Turkey
82. (C) Walt Whitman
83. (B) Astronomers
84. (D) Disease classification
85. (C) Henry Cavendish
86. (B) Confidence (for “confidence game” that con men used to pull)
87. (A) Beggar
88. (B) Elbe
89. (B) Christian Doppler
90. (A) Semitic

Appendix G

Naturalistic Setting Materials and Instructions

Naturalistic Setting Materials and Instructions

Materials:

1. Box labeled “Return Here”
2. 80 copies of mall questionnaire
3. 80 copies of debriefing statement
4. List of men shirt type and color (for me)

Instruction for the Naturalistic (Mall) Setting:

1. Instructions of acting like “secret shoppers” and going around the mall, writing down the store and price of the displayed mannequin or part (i.e. torso) of mannequin wearing men’s shirt with specific criteria.
2. There will be no backtracking around the mall.
3. No assistance!
4. No following one another!
5. There are two stores on the second level and two on the first level, excluding the department stores.
6. Instruction after completing the shirt task: Return the pieces of paper and complete the questionnaire. On back of questionnaire, write down the shirt of the best value (cheapest price) and the store from memory.
7. Put the completed questionnaire in the box labeled “Return Here” and pick up a debriefing statement.
8. You can leave the mall now.

Appendix H

Men's Shirt Types and Colors

Pilot Study, June 14, 2008

Types of men shirts and specific colors:

J. Crew	Light blue with thin strips	$64.50
Hollister	Navy blue polo shirt	$29.50
Banana Republic	Orange polo w/ white strip on collar	$39.50
Gap	Purple dress shirt	$22.99 (original $39.50)

Actual Data Starts Here, June 21, 2008

J. Crew	Blue plaid shirt	$39.99
Hollister	Navy blue polo shirt	$29.50
Banana Republic	White polo w/ brown & red stripes	$36.99 (original $44.50)
Gap	Orange V-neck w/ navy trim around neck	$16.50

July 12, 2008

J. Crew	Long-sleeve blue/black shirt w/ white collar (Rugby shirt)	$59.50
Hollister	Gray shirt w/ 1922 & seagull on left chest	$29.50
Banana Republic	Light blue dress shirt w/ white stripes	$59.50
Gap	Red/brown plaid (checkerboard pattern) dress shirt	$39.50

July 19, 2008

J. Crew	Long-sleeve blue/black shirt w/ white collar (Rugby shirt)	$59.50
Hollister	Long-sleeve plaid cotton flannel shirt (Plaid – blue/gray/light brown/beige/red)	$49.50
Banana Republic	Light blue dress shirt w/ white stripes	$59.50
Gap	Red/brown plaid(checkerboard pattern) dress shirt	$39.50

July 26, 2008

J. Crew	Long-sleeve blue/black shirt w/ white collar (Polo/Rugby shirt)	$59.50
Hollister	Long-sleeve plaid cotton flannel shirt (Plaid – blue/gray/light brown/beige/red)	$49.50
Banana Republic	Light blue dress shirt w/ white stripes	$59.50
Gap	Red/brown plaid (checkerboard pattern) dress shirt	$39.50

Aug.2, 2008

J. Crew	Long-sleeve blue/black shirt w/ white collar (Polo/Rugby shirt)	$59.50
Hollister	Long-sleeve plaid cotton flannel shirt (Plaid – blue/gray/light brown/beige/red)	$49.50
Banana Republic	Light blue dress shirt w/ white stripes	$59.50
Gap	Red/brown plaid (checkerboard pattern) dress shirt	$39.50

Aug. 16, 2008

J. Crew	Navy blue/white plaid dress shirt w/ red lines	$65.00
Hollister	Short-sleeve gray polo shirt w/ white stripes & collar	$39.50
Banana Republic	Green w/ gray/beige diamond pattern golf sweater (cashmere sweater)	$79.00
Gap	Red/brown plaid (checkerboard pattern) dress shirt	$39.50

Aug. 30, 2008

J. Crew	Yellow/navy blue plaid dress shirt w/ red lines	$65.00
Hollister	Short-sleeve gray polo shirt w/ white stripes & collar	$39.50
Banana Republic	Green w/ gray/beige diamond pattern golf sweater (cashmere sweater)	$79.00
Gap	Long-sleeve dull green polo shirt	$29.50

Sept. 6, 2008

J. Crew	Yellow/navy blue plaid dress shirt w/ red lines	$65.00
Hollister	Long-sleeve gray shirt w/ no collar “1922”on left chest	$39.50
Banana Republic	Green w/ gray/beige diamond pattern golf sweater (cashmere sweater)	$79.00
Gap	Long-sleeve olive green polo shirt	$29.50

Sept. 20, 2008

J. Crew	Yellow/navy blue plaid tartan shirt w/ red line	$49.50 (original $65.00)
Hollister	Long-sleeve gray shirt w/ no collar "1922"on left chest	$39.50
Banana Republic	Green w/ gray/beige diamond pattern golf sweater (cashmere sweater)	$79.00
Gap	Long-sleeve gray v-neck sweater	$49.50

Sept. 27, 2008

J. Crew	Navy blue/blue/gray diamond pattern vest	$65.00
Hollister	Navy blue jacket w/ no hood	$60.00
Banana Republic	Dark green w/ gray diamond pattern golf sweater	$89.00
Gap	Long-sleeve gray v-neck sweater	$49.50

Oct. 4, 2008

J. Crew	Navy blue/blue/gray diamond pattern vest	$65.00
Hollister	Navy blue jacket w/ no hood	$60.00
Banana Republic	Dark green w/ dark green/gray diamond pattern golf sweater	$89.00
Gap	Long-sleeve orange v-neck sweater	$49.50

Oct. 11, 2008

J. Crew	Navy blue/blue/gray diamond pattern vest	$65.00
Hollister	Long sleeve navy blue shirt w/ “1922” and a stomach pocket	$39.50
Banana Republic	Dark green w/ dark green/gray diamond pattern golf sweater	$89.00
Gap	Long-sleeve orange v-neck sweater	$49.50

Oct. 18, 2008

J. Crew	Navy blue/blue/gray diamond pattern vest	$65.00
Hollister	Long sleeve navy blue sweatshirt w/ “1922” and a tummy pocket	$39.50
Banana Republic	Dark green golf sweater w/ gray diamond pattern	$89.00
Gap	Long-sleeve orange v-neck sweater	$49.50

Oct. 25, 2008

J. Crew	Long-sleeve purple V-neck sweater	$59.50
Hollister	Long-sleeve navy blue sweatshirt w/ “HCO” on chest	$34.50
Banana Republic	Dark green sweater w/ gray diamond pattern	$89.00
Gap	Navy blue sweater with horizontal purple lines and gray lines in the middle of the purple lines	$44.50

Nov. 1, 2008

J. Crew	Long-sleeve purple V-neck sweater	$59.50
Hollister	Long-sleeve navy blue sweatshirt w/ "HCO" on chest	$34.50
Banana Republic	Gray vest w/ orange and red diamond pattern	$54.50
Gap	Navy blue sweater with horizontal purple lines and gray lines in the middle of the horizontal lines	$44.50

Nov. 8, 2008

J. Crew	Long-sleeve purple V-neck sweater	$59.50
Hollister	Long-sleeve navy blue sweatshirt w/ "HCO" on chest	$34.50
Banana Republic	Long-sleeve gray and red horizontal striped sweater	$59.50
Gap	Long-sleeve orange, light brown, and brown horizontal striped crewneck sweater	$44.50
	Sale	$34.50

Nov. 14, 2008

J. Crew	Long-sleeve purple V-neck sweater	$59.50
Hollister	Navy blue, light blue, and beige flannel plaid shirt	$50.00
Banana Republic	Long-sleeve gray and red horizontal striped sweater	$59.50
Gap	Long-sleeve orange, light brown, and brown horizontal striped crewneck sweater	$44.50

Appendix I

Questionnaire for the Naturalistic Setting

Name: _____

Naturalistic Questionnaire

1) How frequently do you visit Crabtree Valley Mall?

2) How was your experience visiting Crabtree Valley Mall in the last month?

3) How familiar are you with the floor plan of Crabtree Valley Mall?

Appendix J

Representative Responses from Participants in the Naturalistic Portion of the Experiment

Naturalistic Questionnaire

1) How frequently do you visit Crabtree Valley Mall?
   - *Once a month*
   - *Once a year*
   - *Once every 2 to 3 months*
   - *Once every other month*
   - *Been here once before*
   - *Never*
   - *Not often, maybe once every 5 months*
   - *1-2 times per year*

2) How was your experience visiting Crabtree Valley Mall in the last month?
   - *Exhausting*
   - *N/A and exhausting*
   - *Can't complain because s/he made money instead of spending it*
   - *Good*
   - *It was rushed, never been through the entire mall.*
   - *N/A*
   - *N/A*
   - *Like the shopping center*

3) How familiar are you with the floor plan of Crabtree Valley Mall?
   - *Not very*
   - *Only major department stores*
   - *Not very familiar*
   - *Not familiar at all*
   - *Not familiar at all*
   - *Not at all*
   - *Not familiar*
   - *Not very familiar*

Appendix K

Results of Young and Older Participants Familiar with the Mall Floor Plan

Young Participant

Navy blue, blue, diamond pattern vest	J. Crew $65.00
Navy blue jacket with no hood	Hollister $60.00
Dark green, grey, diamond pattern golf sweater	Banana Republic $55.00
Long grey v-neck sweater	Tickners $225.00

Cheapest shirt = Banana Republic $55.00 which is not the same considering the four listed above. It would be Hollister 39.50 from the list on Appendix H dated Oct. 18 (Note: if anyone picks shirts/clothes from at least one or more designated stores, then they must give the exact price of the specific shirt).

Older Participant

Long-sleeve purple v-neck sweater	Martim + Osa 170.00 (30% off)
Long-sleeve navy sweatshirt with HCO on chest	Hollister 34.40
Grey vest with orange/red diamond pattern	Banana Republic $89.00
Navy blue sweater with horizontal purple lines, gray lines in the middle of the purple lines	no price

Cheapest shirt = Hollister 34.40 however the older participant forgot to write anything down on the back of the questionnaire.

Appendix L

Debriefing Statement

Debriefing Statement

Dear participant,

The purpose of this study was to investigate your ability to remember to carry out intended actions at a later time (prospective memory) in laboratory and naturalistic (mall) environment. The two prospective memory tasks studied are: event-based intentions and activity-based intentions. Event-based intentions refer to remembering to perform an action when an external cue appears and completing the task. It involves interrupting an ongoing activity to complete the event-based task. Activity-based intentions refer to remembering to do something after finishing an ongoing activity or before starting another activity. They (activity-based) also include an external cue but the finished activity is the external cue that prompts to complete the intended task. To test the difference in performance between these two intentions, I asked you to answer the 90 general-knowledge questions while remembering to do certain things: (1) to circle your answer whenever you see questions related to "telephone" and (2) to write "yes" or "no" whether there was a telephone question in the block at the bottom of the page.

The second part of the study asked you to come to a mall after a few days later (Crabtree Valley Mall) and complete prospective memory tasks. The naturalistic event-based task required you to go around the mall and see the respective mannequins in the clothing stores, wearing the specific type and color of the men's shirt: record the shirt's price and the name of the store. After returning to the designated spot the investigator was sitting at, you picked up a naturalistic/mall questionnaire. Filling this up, you were required to turn the paper over and write down the shirt with the best value and price and place it in the box labeled "Return Here". Then you were supposed to pick up the debriefing statement. The two tasks of writing the price down, placing it in the box, and picking the debriefing statement constituted the naturalistic activity-based task.

Your answers and information will remain confidential and will be used only for research purpose. After the data are analyzed, they will be destroyed.

Thank you,
Paul Kim