Prospective Memory: The Difference Between Older and Younger Adults

Thesis
Submitted to
The Graduate School of Arts and Sciences
UNIVERSITY OF DAYTON

In Partial Fulfillment of the Requirements for
The Degree
Master of Arts in Psychology

by
Jacqueline Malie Brucker

The University of Dayton
Dayton, Ohio
July 1995
APPROVED BY:

Greg C. Elvers, Ph.D.
Chairperson, Thesis Committee

Frank DaPolito, Ph.D.
Thesis Committee Member

Kenneth Graetz, Ph.D.
Thesis Committee Member

CONCURRENCE:

Thomas Eggemeier, Ph.D.
Chairperson, Department of Psychology
ABSTRACT

PROSPECTIVE MEMORY: THE DIFFERENCE BETWEEN OLDER AND YOUNGER ADULTS.

Name: Jacqueline Malie Brucker

University of Dayton, 1995

Advisor: Dr. Greg Elvers

Prospective memory is the memory for things in the future. A great deal of research has been conducted in the area of retrospective memory, memory for the past; however, prospective memory has received much less attention. Information regarding memory in the future has important applications both in business and everyday life. Improving one's memory for appointments and meetings could be beneficial to everyone. This research compared the prospective memory of older adults, who were over 60 years of age, to younger adults, who were between 18 and 22 years of age. This research also manipulated the difficulty of the memory tasks the participants were asked to perform. The hypothesized main effect of difficulty was significantly supported, so that those with more difficult tasks had lower prospective memory scores than those with easier tasks. Main effects were also predicted for age and retention interval. It was believed that as age increased, prospective memory ability would decrease. It was also thought that prospective memory ability would be negatively affected by an increase in the retention
interval from 3 days to one week; those in the longer condition were expected to perform less effectively than those in the other condition. These main effects were not supported by the data. An interaction between difficulty level and duration between the two meetings was also predicted, such that those in a hardest difficulty level and long time interval would have a harder time than those in the easy short condition. However, this interaction was also not supported. This research has failed to show a significant difference between the prospective memory abilities of older and younger adults, therefore as age increase memory ability for things in the future may not decrease. To determine if less stringent scoring criteria would lead to an age difference, the data were scored with both strict and lenient criteria. The same results were found with both the strict and lenient criteria. This lack of difference may be due to the activity level of all the participants and some other mitigating factors. It is often believed that older people live a more sedentary and quite life, while students are active and always busy. The participants in this study all lead active and full lives, and possibly this is a factor in why no difference was found between the two age groups with respect to prospective memory.
ACKNOWLEDGEMENTS

I would like to thank everyone who helped me complete this research project. My chairperson, Dr. Greg Elvers, advised me, helped me put together the study, assisted in working out the problems and gave me the encouragement and support that was vital to the completion of this project. Dr. Frank DaPolito and Dr. Kenneth Graetz gave me insight and suggestions, which were very important in the design and analysis of this study. I would also like to thank all the senior citizens that gave of themselves and their time to participate. Finally, the assistance given to me by the seniors organizations proved invaluable in attracting the participants, who would become volunteers.
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CHAPTER I

INTRODUCTION

The perception that most people have of memory is limited to retrospective memory; often prospective memory never comes to mind. In contrast to the well known retrospective memory, prospective memory is memory for events to be performed in the future. Prospective memory comes into use when remembering to take daily medication and when arriving at appointments promptly. It is not clear whether prospective memory can be viewed as a special instance of retrospective memory, or whether the two memory systems are distinct, as Tulving (1985) has proposed for other memory systems. The implications of this question are many: if all of the work on retrospective memory can be applied to prospective memory, then much work will not need to be duplicated, and the parsimony of memory theories will be greatly increased. This thesis partially addresses this question by considering whether the well studied effects of aging on retrospective memory are also observed in prospective memory. Craik (1987) found that retrospective memory ability decreases as age increases; as people become older, their retrospective
memories become less available. Studies have been done to determine if this decline is also seen in prospective memory, with mixed results (Einstein and McDaniel, 1990; see also Maylor, 1993).

A second implication of determining if prospective memory behaves in the same manner as retrospective memory is that it may allow people to become more productive both personally and in business. One improvement that can be made is enabling people to better perform daily activities. Meetings and appointments are commonplace within business, and the ability to timely and accurately maintain those commitments is the pinnacle aspect of a successful business. Since prospective memory is so prevalent in everyday life, it is important to determine the best method for maintaining it. To determine the best and most advantageous way of utilizing this memory could help people in every aspect of their lives. All of the research on this topic has added new and interesting insight, but has also been faced with a variety of problems, some which are surmountable and others which are not.

Various aspects and factors possibly influencing prospective memory have been the crux of the research conducted on this topic. Two experiments performed by Einstein and McDaniel (1990) embedded a prospective memory task inside a short term memory (STM) task. The objective was to compare the prospective memory of younger and older people, while also looking at the effect of an external memory cue or lack thereof on their ability to remember. The first experiment manipulated age (older vs younger) and external aid (external aid vs no aid) as between-subject independent variables. Einstein and
McDaniel's subject pool consisted of younger adults who were between 17 and 24 years of age, while the older adults ranged from 65 to 75 years of age.

Participants were told to make a specific response whenever a target word appeared during the STM task. Einstein and McDaniel (1990) imposed a forgetting period between the time that the prospective memory directions were given until the time of the experiment. During this forgetting period, the participants were "distracted" with other memory tests to allow them to forget the prospective memory instructions. This induced forgetting period prevented the subjects from maintaining the prospective memory task directions in STM. If the directions were remembered they would have to be entered into the long term memory (LTM), allowing the prospective memory to be activated through LTM and not through STM retention.

The STM task required participants to orally recall a list of words presented to them on a computer screen. A target word appeared three times during a STM block of trials. The prospective memory of the participant was invoked if they remembered to press the response key when this target appeared. In order to determine if an external memory aid influenced prospective memory ability, some of the participants were allowed to use an external memory aid while others were not. The participants using an external aid were given thirty seconds and an adequate assortment of supplies to make a cue.

As expected, Einstein and McDaniel (1990) found that the younger students were able to remember more of the test words during the retrospective memory task than the older volunteers remembered. Also, neither a significant effect of the memory cue nor an
interaction between memory cue and age was found for the retrospective memory condition. The authors measured prospective memory by counting the number of correct responses that the participants made out of three opportunities to respond to the target word. Although there was neither an effect of age nor an interaction of age and cue type, there was a significant main effect of the memory aid condition. Those who used a memory aid performed better on the prospective memory task of responding to the specified cue than those who were in the no memory aid condition.

In the second experiment, Einstein and McDaniel (1990) were again seeking to determine if age or the presence of retrieval cues had an effect on prospective memory. The design of this experiment was a 2 x 2 between-subject design. The younger students were between the ages of 17 and 24, while the mean age of the older participants was 67.33 years. The other variable manipulated by Einstein and McDaniel (1990) was target familiarity; the authors felt that more unfamiliar a target was the better prospective memory would be for that target. Those targets that were indistinguishable from "common" everyday words were presumed to be harder to remember.

As in the first experiment, no effect of age was found with the prospective measure nor was an interaction between the variables detected. However, the authors found that task familiarity had a significant effect on prospective memory. The more unfamiliar the target was, the better the participants were able to remember the target. The unfamiliar target stands out to the participant more primarily because the person may
not be used to seeing that target and it triggers their memory more efficiently. This finding for prospective memory is consistent with Shepard's (1967) finding for retrospective memory.

Since no effect of age on prospective memory was found, prospective memory may be unlike retrospective memory. Older adults do not appear to lose their capacity for remembering future events, as is seen with retrospective memory. However, this conclusion must be interpreted with caution as some of the participants in Einstein and McDaniel's (1990) study stated that they used rehearsal as a method of remembering the prospective memory directions. Rehearsal is an important way of transferring information from STM to LTM. This suggests that the participants were holding the target word in STM which is a typical of prospective memory strategies. It should not be a valid method of cuing oneself about tasks occurring in the future within this type of research. This therefore limits the generalizability of the results obtained in this study.

Another concern with the experiment is that the older participants received one less item per trial than the younger participants. This creates a confound, since a constant procedure was not used. Fewer items are equated with a smaller load on the STM which was where the target word was stored by several of the participants in this study. The confound creates unexplainable variability within the experiment, and a determination cannot be made as to whether the results were caused by the experimental condition or because the older subjects were not given as many trials per block.
Einstein and McDaniel (1990) also used a lenient criterion when judging a hit or
miss. As long as the participant responded sometime during the trial block then a
successful memory task was recorded, although the participant might have been
responding to another cue, or might have forgotten when the cue word was shown and
remembered spontaneously at a later point. A larger distinction might have been found
between the older and younger participants if a strict criterion had been used. These
experimental problems could influence the generalizability of these results as one no
longer knows whether the target word, or something else is cuing prospective memory.

One possible reason that Einstein and McDaniel (1990) failed to find an effect of
age on prospective memory may be that their task was not sufficiently complex to reveal
the difference. Einstein, Holland, McDaniel and Guynn (1992) completed two
experiments studying prospective memory in relation to age and task complexity. As with
the Einstein and McDaniel (1990) experiment, the prospective memory task was
embedded within a STM task. The first experiment included age (younger vs. older),
prospective memory retention interval (long vs. short), and number of different target
events (1 vs. 4) as independent variables. The mean age for the younger students was
20.56 years and was 69.13 years for the older volunteers.

The first experiment was designed to determine if age and task complexity had an
effect on the prospective memory abilities of the participants. The STM task was
preceded by a "forgetting" task to allow the instructions to either be removed from
consciousness or moved into the LTM. The time duration between the forgetting tasks
and the short term memory task was approximately 15 minutes. The complexity was achieved by having some participants respond to four cues during the STM trial block, where three of the cues were different. Other participants responded only to a single cue, which was used consistently. The authors also examined the effects of long and short retention interval, which when it is longer intervals should increase the complexity of the task.

Einstein, Holland, McDaniel and Guynn (1992) found that as complexity increased, prospective memory performance decreased. The hypothesis that older people have a decreased prospective memory ability when compared to younger adults was shown to be marginally significant. Also found was an interaction between task complexity and age. The results collected by Einstein et al. showed that the difference in prospective memory ability between younger and older adults was not constant across the different levels of task complexity. When testing a non-complex task, the abilities of the two groups were much closer than when the complexity was increased. Therefore an experiment with a number of levels of increasing complexity should increase the difference in prospective memory between the age groups. The second experiment by Einstein et al. (1992) was a replication of the first, and similar results were obtained.

The generalizability of some of the results found in this experiment are brought into question due to intrinsic problems with parts of the methodology. As in the Einstein and McDaniel (1990) experiment, the older subjects received one less item per trial than the younger subjects. The rational behind this procedure was that is was "necessary to
equate the difficulty of the short-term memory task across the age groups (p. 473)." This could be part of the reason that such a small, if any, difference was seen between the two groups.

The lack of difference between the older and younger participants could also be impacted by the 60 to 75 minute duration of the experiment. In order for prospective memory to be activated, the event or task must be performed in the future. Due to the fact that the task was embedded in a short term memory task, the time period of this experiment may not have been long enough to evoke the person's prospective memory. This is especially true if the task was rehearsed, therefore maintaining it in STM. There was a period of forgetting, but this only lasted 15 minutes. The possibility exists that a connection was made between the STM task and the prospective memory instructions. Although the prospective memory task directions may enter LTM, the association between the two sets of instructions may be activated during the course of the STM task, since the STM task directions are also needed at the same time. A greater time difference could expand the difference between the older and younger groups of participants.

Einstein et al. (1992) chose to use a lenient criterion for determining a hit or miss with regard to the prospective memory task. As long as a participant responded prior to the end of a trial block, a positive hit of prospective memory was recorded. There is a possibility that the participant may have forgotten to perform the task at the appropriate time, and that the action occurred due to some external cue. The remembering would not have been due to their prospective memory, but due to some non-consistent cue.
Extensive testing was also conducted by Maylor (1990) who performed two different experiments where the focus was to determine whether prospective memory is affected by age. Maylor (1990) also examined the effect of time on prospective memory ability. These experiments used only older volunteers, asking them to phone the experimenter either between two times, the between condition, or at a specific time, the exact condition. In both the between condition and the exact condition, some of the participants were assigned to call in the morning and some were assigned in the afternoon. For the between condition, as long as the volunteer called the experimenter at any time within the four hour long assigned period, it was considered a hit. It is possible that during that time period the participant forgot to call and some external cue triggered their memory, allowing a hit to be recorded, since they called within the time period. The subjects in the exact condition had to call at the specified time for a hit to be recorded.

This research found that people who were asked to call at an exact time relied heavily on internal cues, such as an encoding mnemonic. Whereas people who were asked to call between two times were more dependent on a conjunction cue, which is associating the memory between two other events, and external cues, such as writing oneself a note. The participants who relied on the external or conjunction cues were more successful with their task than the subjects who relied on internal cues. Since the conjunction and external cues were used more methodically, they tended to be more reliable than the internal cues used by the less successful participants in this experiment.
While age was an important variable within Maylor (1990) the lack of significantly younger volunteers within this experiment does not allow the results to be generalized to younger people. It is unknown whether a larger prospective memory gap would be seen between students of college age and participants over 60 years of age.

Maylor (1993) looked at the effects of age on prospective memory. The volunteers participating in this experiment were all above the age of 50. The younger participants had a mean age of 57.3 years, while the older participants had a mean age of 74.6 years. This is an important distinction from the Einstein and associates (1990, 1992) because the younger volunteers in the other experiments were approximately forty years younger than the older participants, and here that is not the case. During this experiment, the volunteers had to identify, by name, pictures of men that were shown via slides. They were instructed to put a box around the number of the slide if the man had a beard and cross out the slide number if the man was smoking a pipe. A forgetting task was inserted between the instructions and the beginning of the presentation of the slides. Maylor also used a lenient criterion, such that a hit was considered if the participant performed any action, even the wrong action or an action when a non-target stimulus appeared.

It was determined that younger participants forgot the prospective memory task less frequently than the older volunteers, showing that age apparently does influence prospective memory. While the difference did not reach statistical significance, more instances of recovery were seen in the younger volunteers than in the older volunteers. Recovery occurs when the person remembers to perform a task after forgetting to
perform the same task at a previous time. Therefore, the older subjects forgot the prospective task more often without realizing it, and consequently did not correct their mistakes. A negative correlation between age and memory successes was found. The older volunteers had fewer memory successes than the younger ones. An interaction was found between age and the trial block. During the later trial blocks, younger participants increased the number of memory successes they had, while there was a decrease in the number of memory successes by the older adults. Age hindered performance on subsequent blocks. Multiple regression analyses showed that age accounted for a significant part of the variance, which opposes some of the earlier literature where a difference was not found between the age groups.

Several factors could limit the generalizability of Maylor's (1993) results. A potential problem arises due to Maylor's use of a lenient criterion in both the 1990 and 1993 experiments. Prospective memory relies on acting correctly at the proper time. Therefore both remembering the task and completing the task at the appropriate time are important. Considering non-target actions and incorrect actions as correct responses decreases the reliability and generalizability of these results.

Another point that might have influenced the results is the smaller age difference between the two groups of adults, which is different than those typically used in this type of research. A greater span between the age groups may magnify the difference in ability between the age results. If the prospective memory differences can be seen with a smaller
age difference than is normally used, a larger prospective memory difference may be seen with a larger age difference.

Koriat, Ben-Zur, and Nussbaum (1990) compared the effect of testing mode, either recall or performance, on prospective memory ability. The task required the volunteers to memorize three or four short sentences, and then either verbally repeat the sentence to the experimenter or perform the actions specified by the sentences. Before the participants were shown the sentences they were informed of the mode of recall, either verbatim or perform.

The authors determined that the volunteers in the perform condition did significantly better than those in the recall condition. The advantage of the perform condition appears to be at the point of encoding rather than the point of retrieval. This is possibly due to the ability to imagine oneself performing the action, thus encoding the information in the same form as it will be recalled for the perform condition.

Koriat et al. (1990) believed that memory is dependent upon the type of cue, as opposed to the findings of Einstein et al. (1990). Prospective memory ability increases when the things to be remembered are actions that need to be carried out as opposed to something that is concrete, such as names. Prospective memory is more likely to encompass something active that the person needs to do rather than something that is passive, such as the verbatim recall of words.

Koriat et al. hypothesized that future action tasks are coded differently than non-action tasks because the use of mental imagery is also involved. The experiment had
participants either perform or recall the actions shown on cards. Mental imagery allowed for the use of two encoding strategies as opposed to the verbatim condition, where only one encoding strategy is used. Another cue with the ability to influence performance was the knowledge of the testing mode. When the volunteers knew the mode of testing, memory performance was enhanced. How advanced notice of the testing condition affects prospective memory was the subject of the second experiment performed by Koriat et al. (1990). The basis of this experiment was that when the subjects expected the mode of testing to be perform, but they were asked to recall the information verbatim, they would perform better than when the opposite occurred. Koriat et al. (1990) believed that when the participant encountered a surprise trial, where they expected perform and encountered verbatim recall, their memory should be better than when the participants expected recall and were then asked to perform the actions. The experimenters told the volunteers the actual mode of testing 75% of the time. The other 25% of the time were surprise trials, where what the volunteers expected was not what was asked of them. The support of these predictions suggests that the mode of encoding is linked to the expected mode of testing.

The knowledge of the mode of testing played a significant role in the participant’s ability to recall or perform the necessary tasks. Koriat et al. (1990) found that knowledge of the mode of testing did affect the participant’s ability to perform well. The surprise condition impaired the memory of the volunteers suggesting that performance is heavily dependent on the learning cue that is given, rather than the testing method that is used.
The third experiment tested the reliability of these results in a more realistic situation, that was extended over a longer, more differentiated set of circumstances.

Again, the volunteers were presented with one list of sentences to learn, while in part two of this experiment the participants were presented with a second list of sentences that would be learned and tested. The volunteers followed similar instructions as in experiment 1, where the volunteers knew the actual testing method. In the second part the instructions were similar to those given in experiment 2, where some of the participants were told that the testing method would be in one form and it was actually the other (i.e., they expected perform and were asked to recall). In this experiment a list of mini-tasks were used.

Again Koriat et al. (1990) found that the perform condition was much better than the verbatim condition. They also found results comparable to their second experiment, such that it appears that the important distinction between the conditions is at the encoding stage. The current experiment is partially based on the idea that items to be performed are more easily remembered than items that will not be performed. All the tasks required the participants to perform an action. No verbatim recall tasks were asked of the participants.

These experiments have taught many important things, not only about prospective memory, but also about methods concerning the successful testing of this type of memory. These authors have shown what experimental methods are successful in finding a significant difference between the prospective memory of older adults as
compared to younger adults, while also providing useful information on reasons that some of these authors did not find successful results. Many of the experiments previously conducted have been embedded within STM task, where some of the participants have used rehearsal as a method to remember the prospective memory task. Therefore the test does not appear to actually be testing the prospective memory of the participants, but their short term memory instead. One component of successful prospective memory is the ability to remember to perform the tasks that were asked of them. The volunteers need sufficient time so that they can essentially forget the instructions and then use their prospective memory to remember the task that was asked of them. If an essential aspect of prospective memory is to remember to perform the task, then sufficient time between the instructions and the performance of that task are required. In the current experiment this problem was combated by meeting with the volunteers twice, once to give them instructions and to set up the second meeting. The actions they performed prior to the second meeting was the test of their prospective memory. There was either approximately three days or a week between the first and second meeting.

Another problem cited by many authors is that many of the tasks posed were very simple and therefore were not difficult enough to show a difference between the ages of the participants used in the study. Some of the tasks that just expected volunteers to send back post cards or call the experimenter at specific times did not offer enough challenge to the subjects to show a difference between the older and younger volunteers. The current experiment has an easy, medium, and complex level to combat this problem. The
older volunteers will receive exactly the same experimental conditions as the younger volunteers. To combat the problem of familiarity, both groups of subjects were tested in a place that is familiar to them, either the University of Dayton or the senior citizen center to which they belong.

It is important to remember that all these experiments use functioning older adults. A larger difference would most likely be seen if the population of older adults was more stratified. These are the best of the older population and are not necessarily reflective of the whole population. A different subject pool brings into light another set of confounds to the experiment. There are many problems associated with old age, and among them is a possible loss of memory. However, there are many other problems that require medication and often in home or around the clock care of some kind. When a person is incapable of taking care of them self, they become more like the population norm for their age group, while also becoming harder to use as a participant. To use this population in a study precautions must be taken to combat the different types of medications that might be taken, and how those would affect memory in addition to other physical ailments that might also affect the memory of the individual being tested.

The research discussed disagrees on whether prospective memory is affected by age and aided by memory cues, along with many other factors. There are many issues that need to be resolved and the disagreements settled. The current research may be able to help settle some of these differences. It is believed that this research will show that there is a difference between the older and younger adults for prospective memory. It is
also believed that the younger adults will perform better on all three task levels than the older adults, but the differences between the two groups are not the same on all difficulty levels. The two groups should be more evenly matched on the easy tasks, and the disparity between the groups will increase as the difficulty level increases.

The other aspect being tested will be the amount of time between the first and second visit. It is expected that the subjects who return to the testing room within three days will perform better than the volunteers who will return in approximately a week. An interaction is expected between duration and difficulty. The participants who would be expected to do the worst would be those in both the difficult and long condition and the difficult and short condition. As time and difficulty increases, the participants should encounter more problems with their prospective memory.

The volunteers will be asked to come to the testing room under the guise that they need to complete some paperwork. The participants will be told that there are a number of tasks that they will have to complete the day of the experiment before they return to the testing room. Those tasks are the prospective memory test, and strict and lenient criteria will be used to evaluate them. To satisfy the strict criterion all the tasks must be completed in the correct order and at the correct time, while the lenient criterion will be satisfied if all of the tasks were performed regardless of order or time of performance. If these hypotheses upon which this experiment is based are shown to be true, then prospective memory may not be a special case of retrospective memory. Then more research can be conducted so as to determine the best method to increase the
prospective memory ability of everyone, which will allow everyone to be more productive.
CHAPTER II

METHOD

Subjects

There were 121 participants in this experiment, 60 undergraduate students from the University of Dayton and 61 older adults from area senior citizen centers. The students ranged in age from 18-22 years and were given research credit in partial fulfillment of an introductory psychology requirement. The older adults ranged in age from 60 to 90 years, and participated without compensation. The volunteers all participated individually and were treated according to the "Ethical Principles of Psychologists" (American Psychological Association, 1992).

A questionnaire was administered to gain descriptive data, such as education level, daily motivation level, age, and perceived difficulty of the tasks asked to be performed. The level of education for the older participants was usually between some college and a college degree, while the students had an average between high school and some college (See Table 1).
Table 1

Means from Descriptive Data from Questionnaire

<table>
<thead>
<tr>
<th>Variable</th>
<th>Younger Participant Mean</th>
<th>Older Participant Mean</th>
<th>Total Mean</th>
<th>Standard Deviation</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of Words Remembered</td>
<td>14.6</td>
<td>10.475</td>
<td>12.521</td>
<td>4.384</td>
</tr>
<tr>
<td>Age</td>
<td>18.98</td>
<td>70.836</td>
<td>45.124</td>
<td>26.45</td>
</tr>
<tr>
<td>Education Level</td>
<td>2.683</td>
<td>3.475</td>
<td>3.082</td>
<td>0.945</td>
</tr>
<tr>
<td>Health</td>
<td>1.75</td>
<td>2.115</td>
<td>1.934</td>
<td>0.938</td>
</tr>
<tr>
<td>Motivation Level</td>
<td>1.95</td>
<td>1.934</td>
<td>1.942</td>
<td>0.897</td>
</tr>
</tbody>
</table>

Note: Education level, health and motivation level were all based on a 5 point likert scale. Education level was from 1=high school and 5=graduate/professional school. for health 1=very healthy, 5=very poor health., and for motivation 1=very motivated, 5=very poor motivation.
Design

This experiment was a 2 x 2 x 3 between-subjects design testing prospective memory. The participants met twice with the experimenter. In the short-term condition, the participants returned three days after their initial visit, while those participating in the long term condition returned for their second meeting approximately one week after their first visit. The second between-subjects independent variable was the difficulty level of the prospective memory task, which was determined by the number of tasks the participant was asked to perform prior to returning to their final destination; the initial testing room. Simple, intermediate, and complex, were the three levels to the difficulty independent variable. Increased difficulty was attained by increasing the number of tasks the participant was asked to complete prior to returning to the testing room for the second meeting. The tasks included: checking a condition number in a specified location, returning with their informed consent sheet, and placing their name and address on a piece of paper in a designated locale. All of the participants were asked to call the experimenter sometime prior to their second meeting on that day, to confirm their meeting. One task that was changed between the older and the younger participants was the task of asking the participant to return with their informed consent sheet. The students were asked to obtain their informed consent sheet from a secretary on another floor, while the older participants were asked to take it home with them and bring it back at the time of the next visit. During the first meeting, each volunteer was given instructions concerning the tasks they were asked to perform prior to the next meeting. In addition to calling the
experimenter, the simple condition had the participant complete the first task, the intermediate condition required the completion of the first two tasks, and the difficult condition required completing all of the tasks. These tasks caused the volunteers to rely only upon their internal memory in order to remember the tasks which needed to be accomplished before returning to the testing room. Strict and lenient criteria were both used as a measure of the prospective memory. The strict criterion required that all the tasks be completed at the appropriate time, while the lenient criterion took into consideration remembering the tasks although performing them at the wrong time.

Familiarity was controlled for by having the students participate on campus, and the older adults participate at the center they are affiliated with. Therefore the older adults are given neither an advantage or disadvantage by their unfamiliarity of the University of Dayton campus.

Procedure

Each participant had two meetings with the experimenter. The participant was told that the initial meeting was required to fill out the papers for the ethics committee, and also to obtain a baseline of their memory. At this time they were given a consent form to sign along with the necessary instructions to be completed before the second meeting. The second meeting was set up after the ethics form was signed and before the instructions were given and a "baseline" of their memory obtained. This was the time that the condition of the participant was determined. Then the participant was given two
recall tests to allow the participant to forget the prospective memory directions. These recall tests took approximately 15 minutes to complete. Once all the necessary duties were completed the volunteer was allowed to leave without any reminder of either the appointment or the tasks to be completed before the second meeting.

During the second appointment, the participant was expected to follow the directions that they were given at the first meeting, eventually leading them back to the testing room. All of the volunteers were asked to call the experimenter on the day of the second meeting some time before the meeting. Obtaining their condition number, returning with their informed consent sheet, and placing their name and address on a piece of paper in a designated place were the tasks that were asked of the participants. The volunteers in the simple condition were asked to complete two tasks, the participants in the intermediate condition were asked to perform three of the tasks, and those in the difficult condition were asked to perform all four tasks. The older and younger participants performed a different task with their informed consent sheet. The older people were asked to bring their informed consent sheet home and return with it at the time of the next meeting, while the younger students were asked to obtain their informed consent sheet from a secretary on another floor.

Once the subjects reached the testing room they were asked to participate in a recall memory experiment and then fill out a questionnaire. The post session questionnaire included demographic information as well as information regarding the method the
participants used to remember the tasks to be completed (See Appendix A). Then the subjects were debriefed and thanked.
CHAPTER III

RESULTS

It was predicted that this research would support three main effects and one interaction. Main effects were predicted for time duration, difficulty, and age. The main effect of time duration suggested that the longer the time between the first and second meeting the more problems would be seen with the prospective memory ability of the participant. The predicted main effect of difficulty stated that the more difficult the tasks, in this case the larger number of tasks, the less effective the person would be in remembering all the necessary items to be performed. It was also predicted that the younger participants would have a better prospective memory than the older participants, thus giving a main effect of age. An interaction between the time length between the two meetings and difficulty level with which the participant was faced was also predicted. The effects of duration should increase as the number of tasks increase. The time delay between the two appointments was seen as a measure of difficulty, since the longer between the two meetings the harder it will be to retain the instructions as opposed to those in the shorter condition.

The data were scored with both strict and lenient criterions to determine if differences were present. Qualification for the strict criterion was met when the
participants performed the correct behaviors at the specified times, while satisfaction of the lenient criterion occurred when the performance of the tasks was accomplished without regard to order and exact time specificity (i.e. the wrong time or place). The maximum possible scores ranged from 2 to 4 points, depending on the condition in which the participant was randomly assigned. Within the easy condition the highest possible score was 2 points, within the medium condition the highest score was 3 points, and finally within the difficult condition 4 points was the highest attainable score. The participants' raw score was simply the number of tasks completed by that person, and their proportion correct score (PCS) was computed dividing the raw score by the number of tasks they were asked to complete. Therefore if a person in the difficult condition completed 2 tasks, their raw score would be 2, while their percent correct score would be 2/4.

Using the strict criterion on the PCS, an analysis of variance (ANOVA) was performed and a significant main effect was found for the level of difficulty, 
\[ F(2,109) = 3.54, \ p = .033, \ MS_{error} = 0.11. \] The lenient criterion also yielded a significant main effect for difficulty, 
\[ F(2,109) = 3.70, \ p = .028, \ MS_{error} = 0.09. \] The mean proportion correct for the easy, medium, and difficult level was 0.613, 0.692, and 0.500 when scored using the strict criteria. The lenient criteria yielded means of 0.688, 0.718, and 0.548 for the easy, medium, and difficult conditions respectively. Tukey's multiple comparison, for both the strict and lenient criteria, yielded differences between the
medium and difficult conditions. In addition, no significant difference was found between the easy and difficult conditions, or easy and medium conditions upon analysis.

The other predictions made were not supported by the data. Using the strict criteria, no main effect for age was found $F(1, 109) = 1.73, p = .1909$ nor was a significant main effect found using the lenient criteria, $F(1, 109) = 2.02, p = .1586$. The mean proportion correct for the different age groups was 0.638 for the younger students and 0.561 for the older participants under the strict criterion; when using the lenient criterion the means found were 0.688 for the younger volunteers and 0.611 for the older volunteers.

The main effect of time duration also resulted in non-significant results irrespective of the criteria used, $F(1, 109) = 0.15, p = .701$ under the strict and $F(1, 109) = 0.00, p = .966$ for the lenient. The mean proportion correct under the strict criterion was 0.608 for those in the short condition, while those in the long condition had a mean of 0.590. The lenient criterion produced a mean of 0.648 correct for the short condition and a mean of 0.650 correct for the long condition.

The interaction between difficulty and time duration which was predicted was not significant, $F(2, 109) = .75, p = .477$ when examined with the strict criterion and $F(2, 109) = 1.39, p = .254$ under the lenient criterion. Therefore there was no significant difference in the effect of task difficulty for the long delay compared to the short delay. The means for both criteria can be found in Table 2. An ANOVA was also completed for the raw data (before the proportion correct score was completed) and the same trends
in the same direction were found as the previous ANOVA. A test of homogeneity of variance was performed to assure that none of the assumptions of the ANOVA were being violated. The Bartlett-Box test for the strict criterion yielded a $F(11,8108)=.43256$, $p=.942$ and for the lenient criterion the $F(11, 8108)=.28119$, $p=.986$, showing that the assumption that all the means are the same was not violated.

For the retrospective task, the students remembered on average approximately 4 more words than the older participants during the final recall task of the experiment. The means and standard deviations are found in Table 1.

A stepwise multiple regression was performed with the IVs and demographic questions as the possible predictors and prospective memory as the DV. The three variables that reached a significance level of .1500 and were included into the model were: the perceived difficulty faced by the participants when attempting to remember to perform the required tasks, the education level of the participant, and finally the number of words recalled on the retrospective memory task used as a time filler. The perceived difficulty variable, from the questionnaire, accounted for approximately 14% of the variability, the participant' education level accounted for 4.8%, and the retrospective memory task success accounted for 1.6%. The partial $R$ squared values can be seen in Table 3.
Table 2

Means for the interaction between the condition difficulty level and age of the participant

(a) Strict Criteria

<table>
<thead>
<tr>
<th>Condition Level</th>
<th>Younger Volunteers</th>
<th>Older Volunteers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Easy</td>
<td>0.690</td>
<td>0.335</td>
</tr>
<tr>
<td>Medium</td>
<td>0.526</td>
<td>0.353</td>
</tr>
<tr>
<td>Difficult</td>
<td>0.667</td>
<td>0.343</td>
</tr>
</tbody>
</table>

(b) Lenient Criteria

<table>
<thead>
<tr>
<th>Condition Level</th>
<th>Younger Volunteers</th>
<th>Older Volunteers</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Mean</td>
<td>SD</td>
</tr>
<tr>
<td>Easy</td>
<td>0.738</td>
<td>0.301</td>
</tr>
<tr>
<td>Medium</td>
<td>0.632</td>
<td>0.327</td>
</tr>
<tr>
<td>Difficult</td>
<td>0.722</td>
<td>0.289</td>
</tr>
</tbody>
</table>

Note: These means were calculated after the data had been converted to represent the proportion correct.
Table 3

The partial R squared values obtained by the performance of a stepwise multiple regression analysis.

<table>
<thead>
<tr>
<th>Variable Label</th>
<th>Partial R2 Value</th>
<th>F</th>
<th>Significance Level</th>
</tr>
</thead>
<tbody>
<tr>
<td>Difficulty (Perceived)</td>
<td>.1434</td>
<td>19.9231</td>
<td>.0001</td>
</tr>
<tr>
<td>Education Level</td>
<td>.0484</td>
<td>7.0621</td>
<td>.0090</td>
</tr>
<tr>
<td>Number of Words Recalled in Recognition test</td>
<td>.0157</td>
<td>2.321</td>
<td>.1303</td>
</tr>
</tbody>
</table>

Note: Each variable added to the base model gave additional information not previously known prior to the inclusion of the variable.
CHAPTER IV
DISCUSSION

This research has shown that as difficulty level increases a decrease in prospective memory ability is found. These results are similar to those found by Einstein, Holland, McDaniel and Guynn (1992). The more tasks asked of a participant, the more difficult the task is and, the less likely the participant is to remember to perform all the tasks. Einstein et al. (1992) also found a significant main effect of difficulty level on prospective memory. In addition, they found a significant interaction between the difficulty level and age; however, this predicted interaction was neither made for the current research, nor found.

No significant main effect of age was supported by the data. Although previous research was unsuccessful in finding a significant difference between the prospective memory of older adults versus that of younger adults, a main effect for age was predicted for this research. In some of their past research, Einstein and McDaniel (1990) did not treat younger and older adults in the same manner. The older participants received fewer items to remember than the younger ones received, and this may have been a partial cause for a lack of significance between the age groups. Maylor (1993) used two groups of people having a mean age difference of 15 years, while the current research uses two
groups with a mean difference of approximately 40 years. These problems may have limited the results found by Einstein et al. (1992) and Maylor and the ability to find a significant age difference. Avoiding these two problem in addition to creating a situation where some people in both age groups should fail was the object of this research.

Einstein and McDaniel (1990) and Einstein et al. (1992) were also unsuccessful in finding a significant difference between the older and younger participants with respect to their prospective memory ability.

The predicted main effect of time duration was not supported by the current research. The previous research does not use comparable delays to the current research. Previous research has used shorter delays of approximately 60 to 75 minutes in duration, while the time delay used in the current research was either 3 days or one week. It was believed that the time delay was related to task complexity, since it added another dimension of difficulty to the tasks. The difference did not lead to any significant results. Those in the long term condition were faced with a harder task due to the length of time that they were required to remember the task directions, which was 5 days longer than those in the short term condition.

The stepwise multiple regression showed that the perceived difficulty of the tasks, the education level and the number of words recalled during the retrospective task were all important in predicting the ability to perform a prospective memory task. The relationship between the perceived difficulty and the prospective memory ability was inversely related. Possibly those participants who thought that it would be difficult to
remember the tasks made more conscious effort to remember than those who thought the tasks would be easily remembered. The education level of the participant also has a inverse relationship to their performance on the prospective memory tasks. This may be related to the jobs and tasks that people performed during their working lives. Some jobs requiring a higher education may require less reliance on memory, such as a CPA, while those jobs requiring less education may entail more memory work of this type, such as maintenance worker. Finally, those who performed better on the retrospective recall test also performed better on the prospective memory test. Those people who exercise their retrospective memory may also have inadvertently exercised their prospective memory, therefore enhancing their performance on this task.

Many differences exist between the two populations of people who participated in this research. One of these difference may possibly be a cause for the lack of difference found. These differences may explain the failure to find significance. One major difference was the reason the volunteers participated. The older participants devoted their time to participate from their very busy schedules, without receiving any compensation. Since each person was tested individually, I talked to them and found that most of the participants were very busy and led full and active lives engaging in many different activities. The activity level of the students' lives as compared to those of the older participants' lives was somewhat similar. Many of the older volunteers were involved in dance classes, exercise groups, art groups, and card groups in addition to many other activities. A student has many responsibilities and actives to complete, but
there is also free time for them to relax, and the same was true for the older participants. This similarity between life styles may have been a contributing factor to the lack of a significant age difference.

Other factors might influence the prospective memory ability of older people. These factors were not examined within the context of the current research, although they might be important considerations. The first item to consider is marital status, whether the participant has a significant other (either a close friend or partner or is married), is single or is has recently become widowed. Those with a significant other may rely heavily upon their partner as a memory aide. Someone recently widowed may have a hard time remembering daily activities and appointments if they previously were heavily dependent upon a spouse. They may not yet have redeveloped the skills to remember everything for them self, without relying on another for assistance. Someone who is single may have an easier time remembering activities since it is important for them to rely upon themselves, since there is no one else there to depend on. If there is someone to lean on, remembering becomes a shared activity instead of something one does for themself. The couples that I spoke to who participated at the same time, seemed to use each other as an external memory device.

Another factor to be considered is the person's employment status, whether working, volunteering or holding no position at all. The more "work" activity engaged in, the more potential exercise is given to both retrospective and prospective memory. The demands of a position, whether paid or volunteer, allows people to actively use their mind
in a way that is similar to the way that was required to remember to perform the tasks asked of them in this research. The average population of people over 60, may not be as active as the group of individuals tested within this experiment. The activity level of the participants may have a significant affect on one's prospective memory.

Both of these factors could have contributed to the lack of significant difference found between the younger and older participants within this experiment. If examined these factors might have led to more insight regarding this type of memory. Future studies should be completed such that these factors could be examined in conjunction with the prospective memory ability of both older and younger adults.

Although this research did not support all of the predictions hypothesized, the reasons that the research was conducted still holds, and the manner of testing may be the answer to why no difference has been seen between the prospective memory ability of both younger and older people. Even though the predictions were not supported, more sensitive testing may find that a difference does exists between different aged people with regard to their prospective memory. A possible solution might be to use different populations of people. Instead of using college students, who participate due to the need to gain research credits, significant results might be obtained if people participated on a strictly voluntary basic with no extrinsic rewards, while looking into the business community for participation. The activity differences between older and younger people might be more accentuated within these groups as opposed to using college students.
Also, a more normal or more varied population of people over 60 or 65 is required. Although this research excluded volunteers who were confined to a nursing home or other similar facilities, those people do compose a portion of the normal population of this age group. Another change that might aid in finding a difference would be to change the tasks involved to make them more realistic so that the cover story is more believable, while maintaining the tasks as active ones as opposed to recall or passive tasks.

These finding suggest that there is multiple memory systems, since it appears that retrospective and prospective memory do not behave in the same manner. If the prospective memory of the older participants had decreased in the same way that retrospective memory decreases with age, then support would be given to the single memory theory.
APPENDIX A

Questionnaire

1. What is your age? _______

2. What is your gender? Male or Female (please circle the correct one)

3. What is the highest level of education you have completed? (please circle the correct answer)
   - Middle School (grades 6-8)
   - High School
   - Some College
   - College
   - Graduate/Professional School

4. How would you rate your present health status.
   - Very Healthy
   - Slightly Poor Health
   - Moderately Healthy
   - Very Poor Health
   - Average Health

5. How would you rate your motivation or interest in getting daily activities of life accomplished.
   - Very Motivated
   - Slightly Poor Motivated
   - Moderately Motivated
   - Very Poor Motivated
   - Average Motivated

6. The tasks that you were asked to perform were easy.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

7. The tasks that you were asked to perform before the second meeting were difficult to remember.

<table>
<thead>
<tr>
<th>Strongly Disagree</th>
<th>Disagree</th>
<th>Neutral</th>
<th>Agree</th>
<th>Strongly Agree</th>
</tr>
</thead>
</table>

8. How did you remember the time and place of the first meeting?

9. How did you remember about the different stops that you were asked to make prior to returning the second time?

10. Do you take any medication on a regular basis?
REFERENCES


