THE EFFECT OF DIVIDED ATTENTION ON INADVERTENT PLAGIARISM FOR YOUNG AND OLDER ADULTS

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THE EFFECT OF DIVIDED ATTENTION ON INADVERTENT PLAGIARISM FOR YOUNG AND OLDER ADULTS

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SUMMARY

Older adults inadvertently plagiarize more than young adults (McCabe, Smith, & Parks, 2007). One current explanation proposes that this effect can be understood in terms of age-related declines in working and episodic memory (McCabe et al., 2007). The current study tested this hypothesis by placing groups of young and older adult participants under divided attention while performing within the typical experimental paradigm. Results indicated that for some measures, dividing the attention of young adults equated their performance to older adults with full attention. For other measures, older adults still produced more errors. Except for false recall, regression analyses revealed that episodic and working memory accounted for age-related variance in these plagiarism errors. The current findings provide tenuous support for the McCabe et al. (2007) hypothesis and suggest other factors may be at play.

CHAPTER 1

INTRODUCTION

Inadvertent plagiarism is functionally defined as generating information with the notion that it is original, when, in fact, it had been previously generated and therefore is not novel (Brown & Murphy, 1989). Examples of this type of error can be seen in everyday living and notably in domains such as literature in music. In one quintessential example, George Harrison was sued for plagiarizing the melody of the Chiffons' "He's So Fine" (Columbia Law School, 2002). In Judge Owen's opinion on the case he wrote:

> It is apparent from the extensive colloquy between the Court and Harrison covering forty pages in the transcript that neither Harrison nor Preston were conscious of the fact that they were utilizing the He's So Fine theme… In seeking musical materials to clothe his thoughts … there came to the surface of his mind a particular combination that pleased him as being one he felt would be appealing to a prospective listener … Why? Because his subconscious knew it already had worked in a song his conscious mind did not remember (Bright Tunes Music, 1976).

In other words, as Harrison himself had claimed, his act of plagiarism was inadvertent or unconscious. The field of psychology has accumulated a substantial literature on inadvertent plagiarism and the conditions that produce it. However, inadvertent plagiarism in old age has only been recently addressed (i.e., McCabe, Smith, & Parks, 2007). Encoding, recalling and generating ideas, thoughts, and words are daily, mental activities that are error prone. Inadvertent plagiarism is just one interesting example of an error that occurs because of memory failures. An examination of these errors in old age can yield information about the cognitive mechanisms involved in plagiarism.

The Inadvertent Plagiarism Paradigm

Most studies of inadvertent plagiarism follow a basic experimental procedure introduced by Brown and Murphy (1989). A graphic depiction of the paradigm is shown in Figure 1. In the first phase of the procedure, participants are given categories by the experimenter. Their task is to pay attention to the exemplars given for each category and when prompted, to provide a unique exemplar for that category that was not already presented. This is known as the *initial generation phase*. Participants who repeat an item that was previously generated within this phase commit *initial plagiarism*. After some delay, participants are then asked to recall the exemplars from the first part of the study. This second phase is known as the *recall phase*. In this phase, participants are asked to perform two separate tasks. That is, they are to write down the items they generated for each category, and they are asked to recall the remainder of the items not produced by them. Participants can make two different types of memory errors at this stage. *Recall plagiarism* occurs when a participant incorrectly names an item produced by others as having been produced by him- or herself. When an item is recalled that was not presented in the initial generation phase, it is known as *false recall*. In the final phase, participants are asked to generate new items for each category that were not produced during the initial generation phase. This is called the *generate new phase*. Words

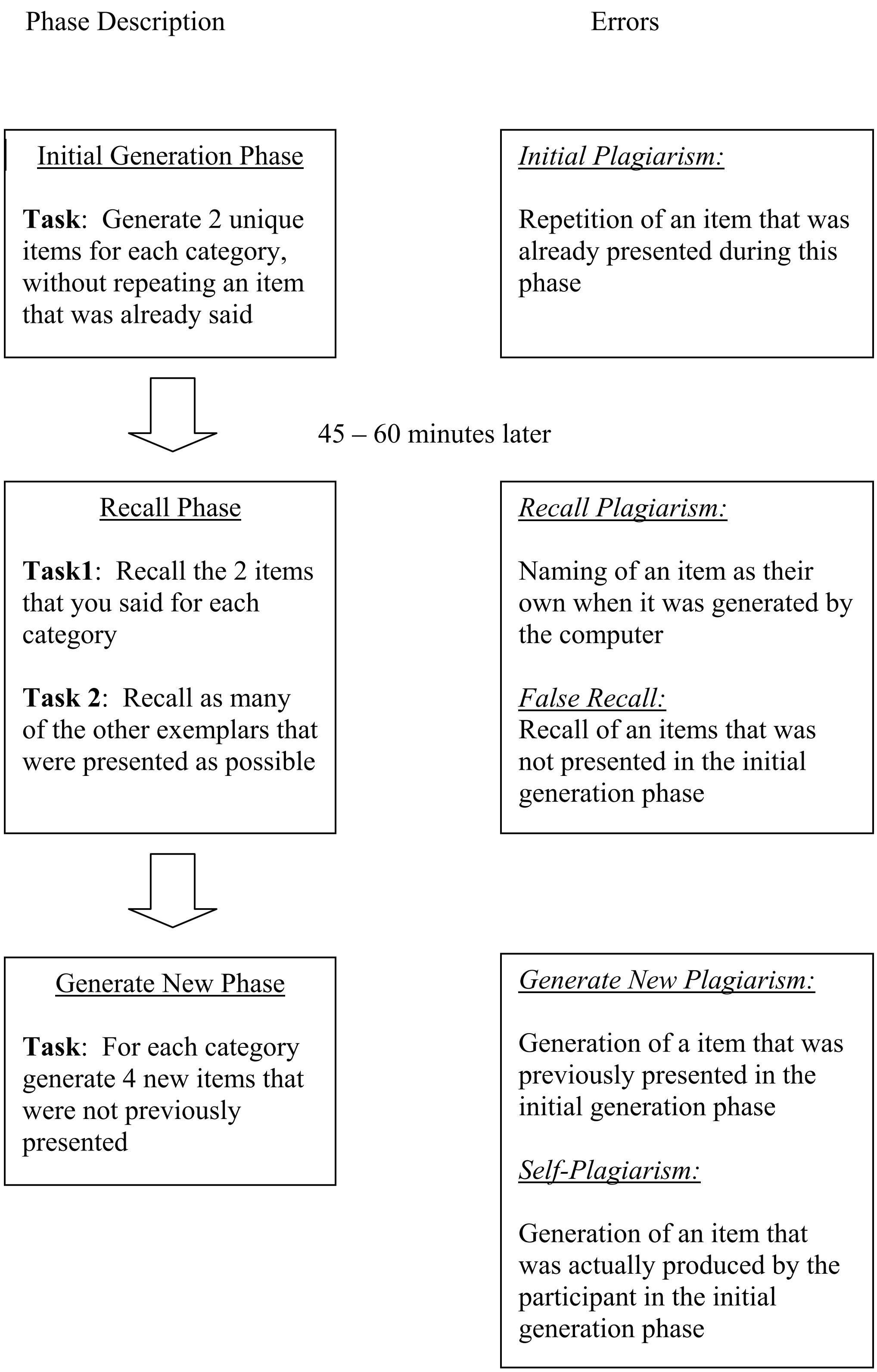

Figure 1. Inadvertent Plagiarism Paradigm

produced by participants in this phase that were previously generated in the initial generation phase are taken as instances of *generate new plagiarism*. *Self-plagiarism* occurs when the new item was actually generated by the participant in the first part of the experiment.

Source Monitoring Framework

The first prominent explanation for inadvertent plagiarism was the source monitoring framework. The framework explains errors in terms of a failure to monitor the source of the information as well as decision processes (Johnson, Hashtroudi, & Lindsay, 1993). Under this framework, recall plagiarism occurs because participants are unable to determine the source of the generated category member. In other words, participants cannot distinguish whether the item they have recollected was their own or someone else's. Proper discrimination involves accurate source memory. This type of memory involves deliberate and effortful recall, and is resource dependent. Confusion in determining the source of an exemplar is most likely a byproduct of the similarity of the sources (i.e., semantic relatedness). Unlike, recall plagiarism, errors in the "generate new" phase are accounted for by familiarity-based judgments (Macrae, Bodenhausen & Calvini, 1999). When generating novel exemplars, an item experienced as familiar can be immediately rejected as having been generated before. This is a distinctively different type of process because it does not require discrimination of source. Rather, this decision is an evaluation of feelings, which is automatic, and not resource dependent.

Landau and Marsh (1997) had participants generate unique solutions to a puzzle in conjunction with a computer. In one condition, participants were to guess the computer's solution as it was revealed one letter at a time. In the second condition, the computer's responses were given in full, so that participants did not have an opportunity to guess. Those who guessed the computer solution were more likely to commit recall plagiarism. This is because guessing the computer solution in effect made the origin of a particular solution highly confusable. Interestingly, there were no differences of "generate new" plagiarism found between the two conditions. These findings are concordant with a source monitoring framework because manipulations affecting source memory only increased recall plagiarism and not "generate new" plagiarism. To review, the source monitoring framework posits two distinct processes that account for recall plagiarism and "generate new" plagiarism respectively. Recall plagiarism is seen as a failure of source memory, which can be traced back to deficits in effortful, deliberate recall. Conversely, errors of familiarity-based decision processes are responsible for instances of "generate new" plagiarism.

The source monitoring explanation of inadvertent plagiarism yields several hypotheses about the performance of young and older adults. First, older adults should show higher levels of recall plagiarism when compared to younger adults because source memory becomes increasingly impaired with age (Hashtroudi, Johnson, & Chrosniak, 1989; Spencer & Raz, 1995). Source memory declines because it requires finite processing resources, which older adults lose as they grow older (Craik, 1983; Craik & McDowd, 1987). For "generate new" plagiarism, it is predicted that young and older adults should demonstrate commensurate error levels. The aging literature shows that older adults' recognition abilities are more often based on familiarity than younger adults. Further, recognition memory is relatively well maintained over the course of aging as compared to recall (Craik & McDowd).

McCabe et al. (2007) tested the above predictions by comparing the performance of young and older adults in the inadvertent plagiarism paradigm. In their study McCabe et al. reported greater levels of recall plagiarism and "generate new" plagiarism for older adults. Several other published studies, using only young adults, have also obtained similar results.

Marsh, Landau, and Hicks (1997) adjusted the typical experimental paradigm so that time for responding during the "generate new" phase was limited for half the participants. Those in the control condition were given an unlimited amount of time to generate new solutions to the problem (instead of category exemplars). This manipulation aimed to inhibit effortful recollection, allowing only for the use of familiarity in this decision process. Under the source monitoring framework, speeded responses should have no effect on "generate new" plagiarism, since familiarity based decisions are not based on effortful recollection. Contrary to this prediction, the findings demonstrated an increase in "generate new" plagiarism, accompanied by a decline in participants' confidence in the uniqueness of their responses. Other research, altering study – test delay and level of processing instructions elicited errors in younger adults as compared to control conditions (Marsh & Bower, 1993). For example, Brown and Halliday (1991) prolonged the time interval between initial generation and the recall and generate new phase. They found significant increases in plagiarism associated with a longer delay.

All of the aforementioned manipulations reduce one's ability to employ deliberate recollection, leaving only familiarity-based decisions. Taken together, these studies suggest that an effortful, resource-based recollection component is involved in memorial decisions, and may be quite important in avoiding several types of inadvertent plagiarism. As it pertains to the source monitoring framework, it suggests that "generate new" plagiarism errors are not failures of familiarity judgments. It follows that the source monitoring explanation is not longer a viable framework for explaining plagiarism errors. However, an alternative explanation, based on the dual process model of memory (Jacoby, 1991; 1999), can account for increased plagiarized responses by older adults.

Dual Process Framework

The dual process memory model contends that memory decisions are made from two separate but related bases: recollection and familiarity (see Yonelinas, 2002). Jacoby (1991) defines recollection as a consciously controlled, deliberate process, whereas familiarity is an automatic and unconscious process. Recall tasks are thought to primarily measure recollection abilities, and recognition tests are primarily used to measure the familiarity component of memory (Jacoby). Since recollection is an effortful process it heavily relies on processing capacity, while familiarity does not. Consequently, divided attention tasks affect recollection measures, but show no detriments to familiarity abilities (Jacoby, Jennings & Hay, 1996). It may be useful to think of recollection and familiarity in terms of the amount of analysis they each contribute to memory retrieval. Recollection decisions are made on the foundation of some defining cue, are often associated with contextual details of a memory trace (i.e., source memory), and are considered to be analytical in nature (Jacoby). Familiarity is nonanalytic in that it is based on a general feeling and does not involve the evaluation of memory traces. Jacoby, Kelley, and Dwyan (1989) noted that familiarity is open to errors of confusion because it is nonanalytic. Finally, it is worth mentioning that these processes are most likely not completely independent (Jacoby). Tests of recognition and recall most likely require both bases of memory for accurate remembering.

The predominant technique used by dual process theorists is the process dissociation procedure (Jacoby,1991). In this process, estimates of familiarity and recollection are mathematically derived from performance on memory tests, under the controversial assumption that familiarity and recollection are independent constructs. Although there have been several criticisms of this procedure, this tool has been influential in understanding memory and in particular, age-related changes in memory. According to the model, age is associated with declines in effortful recollective ability (Jacoby, 1999). However, familiarity abilities should not decline with age. This is because familiarity is automatic and does not rely on finite general resources needed for processing (Yonelinas, 2002).

Support for the Dual Process Model

A large amount of support has been gathered for the dual process theory in the literature using the process dissociation procedure and other methods (Jacoby, 1996; 1999; Jacoby, Woloshyn, & Kelley, 1989; Jennings & Jacoby, 1997). Evidence for this theory comes directly from performance of older adults and young adults under resource demanding manipulations. Jacoby (1999) had participants try to remember words from two lists. On the first list, participants were presented with words visually, and instructed to read the words aloud. The list was constructed so that certain words were presented multiple times. Theoretically, being presented with an item increases that item's familiarity, and also increases the likelihood that the item is correctly recalled. On the second list, participants heard the word and were to repeat it aloud. In the third phase of the experiment, participants were presented with a list of words constructed from both lists, and were instructed to respond ‘yes’ to words they had heard (i.e., List 2) and respond ‘no’ to words they had not heard earlier. If recollection abilities are intact, one would expect repeated words from List 1 to correctly receive ‘no’ responses. In other words, if participants could recollect some contextual feature of the memory trace, such as modality of the presentation (e.g., visual or auditory), they could also determine the source, and in turn make the correct decision. On the other hand, if recollection fails, allowing for decisions primarily based on familiarity, then repeated items would receive ‘yes’ responses (i.e., false alarms) because they seem familiar. Older adults with ample time and younger adults with limited time to respond both produced more false alarms than young adults with ample time to respond. Jacoby claims incorrect responses were driven by a failure to engage in effortful recollection. In Experiment 4, Jacoby used the process dissociation procedure using the same basic protocol as Experiment 1. An inclusion test was added because it is a requisite procedure to obtain estimates of familiarity and recollection. In the test phase, participants were presented with a list and instructed to respond ‘yes’ to words they had either seen or heard, and ‘no’ to words that were new. Experiment 4 showed that older adults and young adults differed in terms of recollection, with younger adults exhibiting higher estimates. Familiarity estimates were similar between all groups. Jacoby and Kelley (1992) found a similar pattern of results when they compared young and older adults with a divided attention manipulation.

Prior to the establishment of the process dissociation procedure, Jacoby, Woloshyn, and Kelley (1989) also used a divided attention manipulation to examine familiarity and recollection. Subjects were presented with a list of names that they explicitly knew to be non famous. In the second part of the experiment, those names were integrated with famous and new nonfamous names. Participants were asked to make fame judgments on this list of names. Previously seeing names in the first phase of the experiment held the potential to make subjects more likely to say that name was famous. This is commonly referred to as the "false fame" effect. However, if one could recollect that a particular name was from the first list, then they could be sure that the name was not famous. Participants were assigned to either a full attention condition or a divided attention condition. The interfering task asked participants to listen to a continuous string of numbers and indicate when they heard a run of three odd digits. This task is posited to use up the processing capacity on which recollection relies. Results indicated that subjects in the full attention condition opposed the false fame effect and made fewer incorrect fame judgments as compared to those under divided attention task. The increased rate of false fame judgments for the divided attention group was taken as evidence for lack of recollection. Dywan and Jacoby (1990) used this paradigm with older adults and found that they were also more susceptible to making false fame judgments, similar to young adults in the divided attention condition. In other words, dividing attention in younger adults seems to produce similar results to the effects of normal aging in this paradigm.

The Dual Process Explanation of Inadvertent Plagiarism

In the context of inadvertent plagiarism, the dual process model is relevant as follows. Evidence from a host of aforementioned studies shows that aging, speed manipulations, and increased delays elicited increased plagiarism errors of all types (Brown & Halliday, 1991; Marsh et al., 1997; McCabe et al., 2007). These outcomes suggest that “generate new” plagiarism requires a resource demanding, recollection component. The dual process model proposes that recollection abilities are required for most memorial decisions, and thus would predict increases in “generate new” plagiarism with increased age. Specifically, recollection might be required because participants are using self-initiated retrieval of items from memory to help in their decision process (Craik & Jennings, 1992; McCabe et al.). In all, the dual process explanation serves as a more accurate model of inadvertent plagiarism because it can explain the patterns of errors of older and young adults.

Reservations About the Dual Process Model

However, several studies contend that such a strong hypothesis of age differences may be inappropriate (Light, Prull, LaVoie, & Healy, 2000). Familiarity, in addition to recollection, may decline with advanced age. If this is true, it could be argued that a dual process model is less accurate. “Generate new” plagiarism errors may in fact be due to simultaneous declines in familiarity and recollection. However, because it is unmeasured in studies of inadvertent plagiarism we cannot know for sure.

Prull et al. (2006) collected estimates of familiarity and recollection from young and older adults using three separate methods. What was especially unique about the study was it’s within subjects design, which would rule out other possible confounds that other studies had not addressed. Prull et al. reported that familiarity estimates were lower for older adults when “Remember/Know” and Receiver Operating Characteristic (ROC) methods were used. Under the ‘strong’ hypothesis, one would expect the estimates for older and young adults to be the same for all methods. Toth and Parks (2006) investigated the possibility that the effect of noncriterial recollection on familiarity estimates would be similar for young and old adults. Contrary to a 'strong' hypothesis, estimates of familiarity for older adults did not increase, and on the whole were smaller than those reported in the literature. Duarte, Ranganath, Trujilllo, and Knight (2006) using event-related potentials, found that high and low performing older adults did not show the neural correlates of familiarity that young adults did. Moreover, high performing older adults showed intact recollection. In all, these reports suggest that older adults may show declines in familiarity processes as compared to young adults. Moreover, there is great variability in older adults' memory abilities that may not be able to be characterized by such a 'strong' hypothesis of age-related declines (Prull et al.).

Mediators of Age – Related Memory Errors

Working Memory

Beyond these general frameworks, McCabe et al. (2007) proposed that age-related increases in recall plagiarism, "generate new" plagiarism, and false recall might be comprised of changes in episodic and working memory. Engle et al. (1999) conceptualizes working memory as the ability to bring memory representations into full attention, or conversely, to inhibit interfering representations. Working memory is involved in the retrieval of exemplars, which can then be analyzed to determine if that word was self-generated or not. Hence, working memory is necessary to avoid recall plagiarism. Less clear is how working memory can help avoid "generate new" plagiarism. Balota et al. (1999) proposed that working memory, or attentional control, allows an individual to differentiate the activation of the relevant recollection process from the activation of irrelevant activations. In the context of inadvertent plagiarism, working memory is necessary to separate activations of exemplars conjured up during retrieval from activations of those exemplars presented in the initial generation phase (McCabe et al., 2007). A similar process is required to avoid false recall errors. In line with this notion, McCabe and Smith (2002) provided evidence that working memory is crucial in the ability to distinguish between similar sources of activation, which is particularly relevant for this paradigm. Further, higher working memory scores were related to greater success in the avoidance of false recognition.

The literature on working memory and aging supports the conclusion that older adults lose working memory capacity as a part of normal aging (Salthouse, 1990). Therefore, older adults would find it harder to distinguish between the relevant activation and those activations arising from the familiarity of the items, leading to increased levels of plagiarism for both memory tasks. At face value, it appears working memory can account for both types of plagiarism and false recall. Further, because working memory declines are apparent with advancing age, it is a tenable mechanism for explaining age-related increases in memory errors.

Episodic Memory

Episodic memory is another potential mediator of these age -related memory errors. Perhaps the most widely cited finding in the cognitive aging literature is that episodic memory abilities decline with age (Smith, 1996; Zacks, Hasher, & Li, 2001). Concerning plagiarism errors, if one can recall all the items presented, including the exemplars produced by the subject themselves, then one can avoid errors. That is, correctly recalling items would stop one from producing old items during the "generate new" phase, and remembering self-produced items will help avoid recall plagiarism. Episodic memory is also needed to avoid false recall. Broadly speaking, false memory is an inability to accurately recall episodes or items (Benjamin, 2001; Roediger & McDermott, 1995). The aging literature suggests that increases in false recall due to advanced age are linked to poorer episodic memory (Lovden, 2003). Theory suggests that older adults are also more susceptible to false recall because of a reliance on familiarity, arising from deficits in recollection abilities (Dwyan & Jacoby, 1990; Jacoby, 1999). Lovden (2003) used a hierarchical structural equation model to assess the contributions of veridical episodic memory and working memory, respectively on false recall. The findings suggested that episodic memory differences accounted for more of the variance than did working memory. Moreover, Lovden (2003) reported that measures of working memory did partially mediate episodic memory performance, which is consistent with other research (Park et al., 1996; Salthouse, 1996). From the previous review, it is clear that declines in episodic memory associated with age also contribute to memory errors.

Previous Work

McCabe et al. (2007) performed hierarchical regression analyses on the data from two experiments. The results established that Stroop Span (i.e., working memory; McCabe, Robertson, & Smith, 2005) and recall of exemplars from the study (i.e., episodic memory) accounted for nearly all the variance in "generate new" plagiarism. Further, after both variables were entered into the equation, the effect of age did not predict additional unique variance. Using the same predictors, identical results were found for false recall. Due to a lack of power, McCabe et al. did not attempt to explain recall plagiarism using this technique.

One problem associated with the regression analyses reported by McCabe et al. (2007) was their predictors. Specifically, the measure of episodic memory was participants' performance for items generated by other individuals (i.e., 'Recall Other'). The problem with using said predictor is that one is essentially predicting errors on a task by using correct performance on a very similar task. To alleviate this concern, two independent measures of working and episodic memory were used. Hierarchical regression techniques allowed us to test for another possibility not considered by McCabe et al. Namely, that errors of "generate new" plagiarism might be related to an ability like category fluency, and not just a problem with recollection. Individuals who can conjure up more category examples have a better chance of avoiding errors by producing more and possibly more obscure exemplars. Thus, a category fluency measure, may predict "generate new" plagiarism.

The Present Study

The present study is a more direct way to test the hypothesis of McCabe et al. (2007). We had participants perform a task analogous to Murphy and Brown's (1989) inadvertent plagiarism task while simultaneously performing a distracting task. Divided attention procedures have been used before to make young adults' memory more like older adults' (Jacoby et al., 1989). The divided attention task is thought to occupy the general resources that are required for effortful cognitive processing. This in turn, should also produce declines episodic working memory abilities because they also rely on these general resources. The McCabe et al. hypothesis holds that age differences in working memory capacity and episodic memory are responsible for the differences in instances of inadvertent plagiarism between young and older adults. Thus, using the divided attention manipulation on young adults should limit the effectiveness of working memory, and produce greater plagiarism, equivalent to older adults under full attention. In other words, by taxing the resources necessary for conscious recollection in young adults (via the number monitoring task), we should simulate the effect of aging. Of course, this manipulation assumes the difficulty level of the distracting task is enough to equivocate performance between the two age groups (Salthouse, 1991). Since number monitoring tasks have been shown to lower memory performance and often equate performance between older and younger adults we feel confident that this is an effective manipulation. Nevertheless, the assumption is still untested, The effect of dividing attention of the older adults' already diminished resources capacity should further lower their performance so much that the amount of "generate new" plagiarism will be even greater.

Our predictions for the present study are as follows. First, older adults are expected to produce more plagiarism, false recall, and show poorer recall performance, in both the single and dual task conditions than young adults under full attention. Most important, if the divided attention design is effective, and the McCabe et al. hypothesis is correct, we expect that the amount of plagiarism (in the "generate new" and recall phases) produced by younger adults in the divided attention task would be commensurate to the amount of plagiarism generated by older adults in the full attention condition. A similar prediction can be made for false recall and recall performance. Older adults in the single task condition should produce fewer errors and demonstrate better recall performance as compared to the divided attention condition. The same pattern should be seen for young adults as well. In regard to regression analyses, working memory and episodic memory, each measured by two different tests should account for a significant portion of the variance associated with plagiarism. Together, these two factors should predict a large portion of variance in memory errors, as reported by McCabe et al. Finally, if plagiarism is due to age-related changes in working memory and episodic memory, then the age variable should not account for any more of the variance over and above the contributions of working memory capacity and episodic memory.

CHAPTER 2

METHOD

Participants

Seventy-one young adults and seventy older adults were enrolled for this study. Young adults were recruited from the undergraduate population at the Georgia Institute of Technology. Older adults were recruited from the Atlanta metropolitan area via newspaper advertisements. Older adults were screened over the phone to ensure that they were healthy and had no physical handicaps (i.e., vision or hearing problems) that could hurt their performance. Young adults received course credit for their participation in the experiment, whereas older adults were paid $20.

Four young adults and seven old adults were removed from the analysis because of failures to follow instructions. An additional two older subjects were removed from the analysis because of past medical experiences that affected their memory abilities (i.e. stroke). Thus, the final analysis was performed on sixty-seven young adults and sixty-one older adults.

The mean age for the older adult group was 73.69 (SD = 6.1) and for young adults it was 19.3 (SD= 1.6). Older adults reported more years of education (M = 15.34, SD = 2.2) as compared to young adults (M = 13.42, SD = 1.4). On the Shipley Vocabulary test (Zachary, 1986), older adults (M = 34.43, SD = 3.4) obtained higher scores than young adults (M= 31.58, SD = 2.9; $t(126)$= -5.122, p<.01). Conversely, young adults (M = 49.13, SD =6.9) recalled more colors correctly than old adults (M =30.67 , SD =10.0) on the Stroop Span task (t (126) = 12.174, p<.01). Table 1 displays these data divided by age group and condition. For each age, group there were no significant differences between conditions. Thus, no group had a distinct advantage over the other at the onset of the experiment. The finding of larger scores on vocabulary measures and worse performance on a working memory test for older adults is consistent with reports from the literature at large (e.g., Park et al. 2002).

Table 1

Means for Demographic and Cognitive Variables

VARIABLE	AGE GROUP AND CONDITION			
	Young Adults		Old Adults	
	Full	Divided	Full	Divided
N	34	33	33	28
Age	19.18 (1.4)	19.42(1.7)	73.82 (4.1)	73.54 (7.8)
Education	13.41 (1.4)	13.42 (1.5)	15.42 (1.9)	15.25 (2.5)
Vocabulary	31.29 (2.8)	31.85 (3.0)	34.45 (3.48)	34.39 (3.4)
Stroop Span	66.06 (9.97)	63.18 (9.5)	28.12 (7.0)	36.68 (6.9)

Note. Standard deviations are enclosed in parentheses. Data are presented separately for young and older adults as well as for divided and full attention conditions.

Materials

Due to the divided attention manipulation used in this experiment, testing could only be done singly. However, we still needed a way to simulate the group setting that is pivotal to the experiment. Exemplars generated by other individuals allow for instances of plagiarism to occur. In light of these considerations, a JAVA program was developed to control the experimental sessions. The program displays six boxes, five of which are given names, representing other individuals who also generate category members. The program allows the participant to input a response after noting all other responses in a category. Six categories were used for this experiment: Fruits, Vegetables, Articles of Clothing, Sports, Musical Instruments, and Metals. Computer generated exemplars for each category were drawn from a list of published norms (Battig & Montague, 1969; Van Overschelde, Rawson, & Dunlosky, 2003). These items tended to be of high to medium typicality for their category. The aforementioned categories were also used in McCabe et al. (2007). A majority of individuals had trouble coming up with four members of the Metals category during the "generate new" phase. Due to this hardship, this category was dropped from the analysis.

A number monitoring task was created using Inquisit 2.0 millisecond software. The purpose of this task was to distract participants in the divided attention group. Participants were presented single digit numbers (1 – 9) in a female voice once every 1.5 seconds. The algorithm was written so that every third number presented was '1', '5' or '7'. When presented with anyone of these numbers, participants were instructed to hit the spacebar. Thus, the participant was at a minimum, to respond to every third number they heard, which occurred roughly once every 4.5 seconds.

In addition to these programs, we used other established measures in this study. We employed two working memory tasks: Stroop Span (McCabe et al., 2005) and Automated Operation Span (AOSPAN; Unsworth, Heitz, Schrock, & Engle, 2005). For the Stroop Span task (McCabe et al., 2005), participants were presented with Stroop words on the screen for two seconds. For each word they made a yes or no response aloud, concerning whether the word and the color of the word matched. Also, when the word "RECALL" was presented on the screen, participants recalled the color of the words in the order they appeared. Span sizes of six words were possible. The total number of correct colors recalled, in order was recorded for each participant. For AOSPAN (Unsworth et al., 2005), participants are presented with math problems to evaluate. Once an answer has been made, a single letter appears on the screen for the subject to remember. After a series of letters and math problems, a recall screen appears asking the participant to recall the letters they just saw in the correct order. Absolute AOSPAN scores for each participant were recorded. An immediate free recall was also developed. Using E-Prime software (Schneider, Eschman, Zuccolotto, 2002) participants were presented with a list of 24 words on the screen. Each word appeared for 3 seconds. After a 20 second delay the word "RECALL" appeared on the screen. Participants wrote down as many items as they could remember on a sheet of paper in front of them. The proportion of correctly recalled words was calculated for each individual. For a category fluency test, participants simply produced responses aloud into a microphone, and were recorded into .wav files. Participants' score on this task was the total number of unique exemplars produced. Finally, we also employed the Shipley multiple-choice vocabulary test (Zachary, 1986).

Procedure

Participants were randomly assigned to one of two conditions: full attention or divided attention. Both conditions required subjects to perform the following computer task. On the screen there were six different colored boxes, each one associated with a person's name. The participant's box, located in the lower right hand corner of the display was colored white and denoted by the name "Subject". On each trial, participants were given a category and their task was to watch the computer screen as category exemplars appeared in each box. Only one category member was displayed at a time, and it remained on the screen for 4 seconds. When the participant's box turned red, he or she was to respond by saying out loud a member of the category that had not already been presented on the screen (i.e., generated by one of the other simulated participants in the experiment). This exemplar was subsequently entered into the computer program by the experimenter. Participants were explicitly told not to repeat an item that was previously presented either by him- or herself, or by one the other five participants. Twelve items were displayed per category, with each participant generating two unique exemplars. The order of responding was counterbalanced using a Latin Square so that participants responded once in each position (e.g., first, second, third, etc.). The order of category presentation was also randomized. All participants were given one example trial, using the category of animals, to get them familiar with the program. Note that instead of actual animals name, category exemplars were simply placeholders (i.e., Animal 1, Animal 2, etc.). This was done because the category of animals was used in the category fluency task, and we wanted to avoid priming participants with animal exemplars.

In addition to the computer task, individuals assigned to the divided attention condition were given instructions on a number monitoring task. For this task, participants listened to a string of numbers presented through headphones, and pressed the spacebar whenever they heard the numbers 1, 5 or 7. On each trial, the number monitoring task began 30 seconds prior to the onset of the computer task. This is a way of ensuring that the participant's attention is on the number sequencing task and not fully on the category task. Participants were instructed to do their best on both tasks (i.e. highly accurate and no repetitions).

Once this portion of the experiment was finished, participants completed a battery of tasks, which lasted approximately an hour. In order, these tasks were: Demographic Questionnaire, Shipley Vocabulary Test (Zachary, 1986), AOSPAN (Unsworth et al., 2005), Immediate Free Recall Test, Category Fluency Test, and Stroop Span (McCabe et al., 2005).

After the battery was completed participants were given three lined sheets of paper with each of the category names written on them. The experimenter told the participant that they were to write down all the items they could remember from the first part of the experiment, including the items they specifically generated (i.e., recall own phase). For each category, the first two specially marked lines were to be used for the items they said. The remaining lines were used for the participant to write down all of the other-generated items for each category. Further, participants were explicitly told to only write down items that they knew were presented (i.e., to not guess) and to attempt recall for all six categories. Eight minutes were provided for this phase of the experiment. Previous studies suggest that this was an ample amount of time to complete the task (McCabe et al., 2007).

Following recall, participants were given another sheet of paper denoted with category labels, and were instructed to generate four new category members that were not presented in the first part of the experiment (i.e., “generate new” phase). Again, they were advised that it was better to leave an item blank than to write an exemplar they knew was previously presented. Twelve minutes were allotted for this task. Previous work has shown that this was enough time for participants to complete the task, and indeed, no participants needed longer than this amount.

Upon completion, participants were asked to go over their answers and rate how confident they were that each item was truly new, and not said before. Individuals used a scale from 1 to 3, with 3 being very confident that the item was new, and 1 being not confident that the exemplar was new. Participants were given 6 minutes for this task, although no one used the full amount of time.

CHAPTER 3

RESULTS AND ANALYSIS

The alpha level for the following analyses was set to .05. The results are organized into four sections. First, results concerning plagiarism errors will be reported followed by results concerning episodic memory measures (i.e. "recall other", recall self, etc.) Next, the outcomes of several regression models will be described. Finally, the findings from confidence responses will be analyzed.

Plagiarism Errors

<u>Initial Plagiarism</u>

The means associated with all plagiarism errors are presented in Table 2. Initial plagiarism occurred when participants generated an exemplar that was previously presented by the computer during the initial generation phase for that category. This error was scored as the number of repetitions supplied divided by the number of responses made by the participant in the initial generation phase (10). No participant failed to produce two items for each category, thus everyone produced 10 responses. A main effect of age was present with older adults producing more errors than young adults, $F\ (1, 124) = 19.88, p < .05; MS_e = .009$. In addition, there was a significant main effect of condition with individuals in the divided attention condition displaying more errors than those in the full attention condition, $F\ (1, 124) = 14.031, p < .05$. Both main effects were qualified by an significant Age x Condition interaction, $F\ (1, 124) = 4.453, p < .05$. The interaction emanates from the significant increase in initial plagiarism errors by older adults under divided attention. However, young adults and older adults with full attention seemed to be near floor for this error.

Table 2

Means for Plagiarism Errors, as a Function of Age Group and Condition

VARIABLE	AGE GROUP AND CONDITION			
	Young Adults		Old Adults	
	Full	Divided	Full	Divided
Initial Plagiarism	.018 (.06)	.046 (.08)	.057 (.09)	.157 (.15)
Recall Plagiarism	.000 (.02)	.018 (.02)	.088 (.02)	.100 (.02)
Generate New Plagiarism	.075 (.02)	.108 (.02)	.150 (.02)	.129 (.02)
Self-Plagiarism	.000 (.00)	.000 (.00)	.004 (.00)	.006 (.00)

Note. Standard deviations are enclosed in parentheses.

Recall Plagiarism

When participants are asked to recall the items they supplied in the first part of the experiment, they may incorrectly produce items that were generated by the computer. This error is known as recall plagiarism. This error was scored as a proportion of errors made to the total number of responses possible (10). The only significant effect evident in the analysis was a main effect of age, F (1, 124) = 24.82, $p< .05$; $MS_e = .009$. As expected, older adults on average produced this error more often than younger adults. Notably, the divided attention manipulation did not seem to have an effect on young adults, because they were also near floor on this error.

"Generate New" Plagiarism

"Generate new" plagiarism errors occur when an individual produces an item that has already been produced, under the auspices that it is novel, and was not said before. Once again, this score was transformed into a proportion by dividing the number of errors by the total number of responses. In order to mirror true inadvertent plagiarism, items that were produced in both the recall phase and the "generate new" phase were not included. In this way, we can be more confident that the plagiarized items were truly thought to be new, and not said before[1]. The main effect of age proved once again to be significant in the predicted direction, F (1, 124) = 9.387, $p< .05$; $MS_e = .008$. An independent samples t test on the older adult data suggests performance between the full and divided attention condition was not significantly different ($t = 1.09$, $p >.05$)

Self-Plagiarism

The final error that can occur in the "generate new" phase is self-plagiarism. This error is when a person writes down a particular item as being novel when in fact they said it themselves, in the initial generation phase. Again, to mirror true plagiarism, items that were produced in both the recall own and generate new phases

[1] When the analysis was run on all errors, regardless of whether it was produced in both the recall and generate new phases, the Age x Condition Interaction was significant, F (1, 129) = 4.078, $p < .05$. The interaction stems from a cross over effect in which the divided attention effect causes more errors in the younger adult group but is associated with slightly fewer errors in the older adult group.

were not included. Young adults in either group did not commit this error, however older adults were susceptible to this type of plagiarism (F (1, 124) = 7.49, p <.05). However, there is good reason to believe that these results are not significant but are rather skewed by floor effects.

Episodic Memory Errors

Recall Own

Table 3 displays the means for each group for all of the episodic memory variables of interest. Participants were asked to recall the two items they generated for each category. Scores on this task were calculated by dividing the total number of correctly recalled items possible by the number of correctly recalled self-generated items (10). The only significant effect found was a main effect of age, F (1, 124) = 99.120, p< .05; MS_e = .022. Older adults were less proficient at recalling the items they produced themselves in the initial generation portion of the experiment. In this situation, the distracting task was unable to equate performance between fully attending older adults and distracted young adults. There was no significant performance difference between older adults in the full and divided attention conditions.

Recall Other

In addition to recall of self-generated exemplars, participants were also asked to recall all other items displayed by the computer for each category. Proportions were calculated by dividing the number of correctly recalled exemplars by the largest possible number of exemplars recalled (50). Significant main effect of age, (F (1, 124) = 58.696, p< .05); MS_e = .012 and condition (F (1, 124) = 25.717, p< .05) were obtained. The main effects were qualified by a significant Age x Condition interaction, F (1, 124) = 4.281, p<

.05. This significant interaction stems from the fact that younger adults demonstrated a larger divided attention effect as compared to the older adults. Young adults in the full attention condition correctly recalled the most exemplars and older adults in the divided attention condition recalled the fewest.

Table 3

Means for Episodic Memory Variables Separated by Age Group and Condition

VARIABLE	AGE GROUP AND CONDITION			
	Young Adults		Old Adults	
	Full	Divided	Full	Divided
Recall Own	.985 (.04)	.936 (.09)	.694 (.23)	.707 (.16)
Recall Other	.469 (.09)	.329 (.11)	.279 (.14)	.219 (.09)
False Recall	.075 (.06)	.156 (.11)	.219 (.12)	.244 (.15)

Note. Standard deviations are enclosed in parentheses.

False Recall

False recall, or intrusion errors, were measured as the incorrect recall of items that were not generated by the participant or the computer during initial generation. This was converted to a proportion by dividing the number of errors made by the total number of responses for the participant. It should be noted that this includes self-generated items since false recall was possible for this task as well. Once again, there was a significant main effect of age, with older adults committing more false recall errors than young adults, F (1, 124) = 34.734, $p < .05$; $MS_e = .012$. The main effect of condition was significant in the expected direction as well, F (1, 124) = 7.224, $p < .05$. That is, participants in the divided attention condition showed more instances of false recall when compared to individuals who completed the experiment without a secondary task.

Regression Analyses

As a complement to the analysis of variance tests, we performed hierarchical regression analyses on the measures of "generate new" plagiarism and false recall from the experiment. Hierarchical regression is a useful tool in that independent variables only predict unique variance and not shared variance. This was done to mirror the procedures and test the predictions of McCabe et al. (2007). In addition, we also performed an analysis on recall own plagiarism, which was not performed by McCabe et al. "Recall other" and free recall (score on the independent free recall task) were both used as predictors of episodic memory, whereas Stroop span and Absolute AOSPAN predicted working memory ability. Table 4 displays the correlations between all of the measures used. For the measure of working memory, we formed a composite variable by averaging together the z scores of each measure. This was performed in order to increase the reliability of the predictor. This was justified because of the substantial correlation between the two measures ($r = .765$). A composite was not formed for measures of episodic memory because there is a much lower correlation between the two measures. This low correlation was somewhat surprising as other studies have found substantially higher correlations between similar measures. For example, Park et al. (2002) found a correlation of .69 between two free recall measures.

Table 4

Correlations Between Variables involved in Hierarchical Regression Analyses.

	Age	Stroop	OSPAN	FRL	RO	GNP	RP	FaR
Age	----							
Stroop	-.738*	----						
OSPAN	-.738*	.765*	----					
Free Recall (FRL)	-.607*	.592*	.469*	----				
Recall Other (RO)	-.519*	.602*	.455*	.388*	----			
Generate New Plag. (GNP)	.301*	-.351*	-.275*	-.219*	-.356*	----		
Recall Plag. (RP)	.401*	-.416*	-.386*	-.215*	-.403*	.147*	----	
False Recall (FaR)	.447*	-.334*	-.320*	-.222*	-.384*	.245*	.307*	----

Note. * denotes a significant correlation.

<u>“Generate New” Plagiarism</u>

Four models were evaluated for “generate new” plagiarism errors. The primary difference between the models was that Models 1 and 2 used “recall other” as the predictor of episodic memory whereas Models 3 and 4 used free recall. Each model used the working memory composite variable as the predictor of working memory ability. Additionally, for both models, the dummy variable "condition" was entered into the equation first. Controlling on this behavioral dimension allowed us to analyze the entire sample (N = 128), instead of being limited to only participants from the full attention condition. For Model 1, following condition, predictors of working memory, episodic memory, and age were entered in that order. In Model 2, the order of entry for working memory and episodic memory was reversed. Table 5 displays the results of the analysis. First, it should be noted that condition did not account for significant variance in either model. When working memory was entered first (i.e. Model 1), it accounted for a significant portion of variance (R^2 = .113), as did episodic memory after working memory had been controlled for (ΔR^2 = .042). When the order was reversed (Model 2), episodic memory was once again a significant predictor of plagiarism errors (R^2 = .136). After controlling on episodic memory, working memory no longer contributed significant incremental prediction (ΔR^2 = .019). Importantly in both models, the predictive ability of age did not account for a significant amount of variance over and above working and episodic memory. That is, age differences in "generate new" plagiarism may be explained by age-related changes in working and episodic memory abilities[2].

In a second analysis on "generate new" plagiarism, we used the out of task measure of free recall to predict episodic memory. The reasoning for this analysis was

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[2] Analyses aimed at direct replication of McCabe et al. (2007) were also performed. The results indicated that the episodic and working memory successfully accounted for all the age-related variance in generate new plagiarism.

Table 5

Summary of Hierarchical Regression Analyses on "Generate New" Plagiarism Using "Recall Other"

Model 1: Working Memory Before Episodic Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.001	-----	p>.05
2	Working Memory	.113	.112	p<.01
3	Recall Other	.155	.042	p<.05
4	Age	.156	.001	p>.05

Model 2: Episodic Memory Before Working Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.001	-----	p>.05
2	Recall Other	.136	.135	p<.01
3	Working Memory	.155	.019	p>.05
4	Age	.156	.001	p>.05

Note. R^2 signifies the amount of variance in "generate new" plagiarism accounted for by that predictor. ΔR^2 represents the change in variance accounted for due to the addition of another predictor, while controlling for the effects of the other predictors.

twofold. First, we wanted to see if we could replicate the findings of McCabe et al. (2007) using a different predictor. Second, since the predictor was intimately related to the task, it was postulated that perhaps the amount of variance "recall other" accounted for could be inflated. To rule out this alternative, we used scores from an independent free recall test. The results of the second analysis are displayed in Table 6. In Model 3, working memory accounted for significant variance ($R^2 = .113$). After controlling for the effect of working memory, episodic memory no longer contributed a significant increase in incremental prediction ($\Delta R^2 = .002$). In Model 4, when episodic memory was entered into the equation first it was significant ($R^2 = .052$). Working memory was also significant ($\Delta R^2 = .063$), after the other predictors were controlled for. For both models, after working memory and episodic memory were entered into the equation, age was not significant. The implications of obtaining discordant results for the episodic memory measures will be expanded upon in the Discussion.

For a third analysis we returned to the original predictors of working memory and "recall other". In this instance, we added the additional predictor of category fluency. This was done to rule out the possibility that an individuals' ability to generate new items might affect the number of errors they committed. That is, if an individual is more fluent, he or she should be able to generate more exemplars easily and be able to avoid "generate new" plagiarism errors. The predictor of category fluency was performance on the animal naming task in which participants were given sixty seconds to name as many animals as they could. In the first model, category fluency was entered prior to working memory and "recall other". In the second model, category fluency was entered after working memory and "recall other". The results of Models 1 and 2 are presented in

Table 6

Summary of Hierarchical Regression Analyses on "Generate New" Plagiarism Using Free Recall

Model 3: Working Memory Before Episodic Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.001	-----	p>.05
2	Working Memory	.113	.112	p<.01
3	Free Recall	.115	.002	p>.05
4	Age	.117	.002	p>.05

Model 4: Episodic Memory Before Working Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.001	-----	p>.05
2	Free Recall	.052	.051	p<.05
3	Working Memory	.115	.063	p<.01
4	Age	.117	.002	p>.05

Note. R^2 signifies the amount of variance in "generate new" plagiarism accounted for by that predictor. ΔR^2 represents the change in variance accounted for due to the addition of another predictor, while controlling for the effects of the other predictors.

Table 7. The condition effect was removed from the analysis because it was not significant in previous analyses. In Model 1, all three predictors were significant (CF: R^2 = .037; working memory: Δ R^2 = .077; recall other: Δ R^2 = .039). However, in Model 2 only the predictors of working memory (R^2 = .111) and "recall other" (*Δ* R^2 = .042) were found to be significant. That is, category fluency was not significant after the effects of working memory and episodic memory had been controlled for (Δ R^2 = .001). As was the case in other analyses, age was not a significant predictor of after entry of cognitive variables.

Recall Plagiarism

In McCabe et al. (2007) hierarchical regression analyses were not conducted on recall plagiarism because they did not have enough power to perform the analysis. However, the current study did have a sufficient number of subjects and power to perform the analysis. Table 8 displays the results for Models 1 and 2. In Model 1 both working memory (R^2 = .189) and "recall other" *(*Δ R^2 =.032) were significant predictors. Similar results were obtained in Model 2, when the order of entry was reversed (recall other: R^2 = .169; working memory: Δ R^2 =.052) . In both models, the addition of age as a predictor was not significant after controlling for shared variance with episodic and working memory.

Again, we tested alternate predictors to see if they would also account for age-related variance. Table 9 displays the results for these models. Note that in both models we accounted for all the age-related variance. Also, the effect of being in a particular condition did not significantly predict variance. In Model 3, working memory (R^2 = .189)

Table 7

Summary of Hierarchical Regression Analyses on "Generate New" Plagiarism Concerning Category Fluency

Model 1: Category Fluency Before Working Memory and Episodic Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Category Fluency	.037	-----	p<.05
2	Working Memory	.114	.077	p<.01
3	Recall Other	.153	.039	p<.05
4	Age	.154	.001	p>.05

Model 2: Working Memory and Episodic Memory Before Category Fluency

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Working Memory	.111	-----	p<.01
2	Recall Other	.152	.042	p<.05
3	Category Fluency	.153	.001	p>.05
4	Age	.154	.001	p>.05

Note. R^2 signifies the amount of variance in "generate new" plagiarism accounted for by that predictor. ΔR^2 represents the change in variance accounted for due to the addition of another predictor, while controlling for the effects of the other predictors.

Table 8

Summary of Hierarchical Regression Analyses on Recall Plagiarism Using "Recall Other"

Model 1: Working Memory Before Episodic Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.004	-----	p>.05
2	Working Memory	.189	.185	p<.01
3	Recall Other	.221	.032	p<.05
4	Age	.227	.006	p>.05

Model 2: Episodic Memory Before Working Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.004	-----	p>.05
2	Recall Other	.169	.166	p<.01
3	Working Memory	.221	.052	p<.05
4	Age	.227	.006	p>.05

Note. R^2 signifies the amount of variance in recall plagiarism accounted for by that predictor. ΔR^2 represents the change in variance accounted for due to the addition of another predictor, while controlling for the effects of the other predictors.

Table 9

Summary of Hierarchical Regression Analyses on Recall Plagiarism Using Free Recall

Model 3: Working Memory Before Episodic Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.004	-----	p>.05
2	Working Memory	.189	.185	p<.01
3	Free Recall	.189	.000	p>.05
4	Age	.203	.014	p>.05

Model 4: Episodic Memory Before Working Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.004	-----	p>.05
2	Free Recall	.055	.052	p<.01
3	Working Memory	.189	.134	p<.01
4	Age	.203	.014	p>.05

Note. R^2 signifies the amount of variance in recall plagiarism accounted for by that predictor. ΔR^2 represents the change in variance accounted for due to the addition of another predictor, while controlling for the effects of the other predictors.

was significant however free recall (i.e. episodic memory) was not (Δ R^2 =.000). In Model 4, free recall (R^2 = .055) and working memory (Δ R^2 =.134) were both significant predictors of recall plagiarism variance.

False Recall

To further validate the findings of McCabe et al. (2007) we also performed regression analyses on false recall. In McCabe et al., working memory and episodic memory were both significant predictors of false recall, and importantly accounted for the effect of age. Again, we first entered a dummy variable of condition to account for the fact the roughly half of the participants were under divided attention during the initial generation phase. The results for the current analysis are exhibited in Table 10. In Model 1, working memory was entered prior to "recall other". The condition variable did account for a significant amount of variance in false recall, which was not the case with "generate new" or recall plagiarism (R^2 = .039). Working memory added significant incremental prediction (Δ R^2 =.128) but "recall other" was not significant (Δ R^2 =.022). Most striking is that age still accounts for a significant proportion of variance over and above the other factors (Δ R^2 =.066). When the order or entry was reversed in Model 2, all predictors were found to be significant. Yet once again, working memory and "recall other" failed to account for all of the age - related variance in false recall. Models 3 and 4 (presented in Table 11) used a different set of variables for prediction yet the results remained consistent. In Model 3, working memory was significant (Δ R^2 = .128) but free recall was not significant (Δ R^2 =.004). For Model 4, free recall (Δ R^2 = .065) and working memory (Δ R^2 =.067) were significant predictors. While working memory and episodic memory (in Model 4) were significant predictors it did not account for the total age—related variance in false recall ($\Delta R^2 = .074$). Thus, we failed to replicate the findings of McCabe et al. Possible reasons for this failure will be addressed later.

Table 10

Summary of Hierarchical Regression Analyses on False Recall Using "Recall Other"

Model 1: Working Memory Before Episodic Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.039	-----	p<.05
2	Working Memory	.167	.128	p<.01
3	Recall Other	.189	.022	p>.05
4	Age	.255	.066	p<.01

Model 2: Episodic Memory Before Working Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.039	-----	p<.05
2	Recall Other	.152	.113	p<.01
3	Working Memory	.188	.037	p<.05
4	Age	.255	.066	p<.01

Note. R^2 signifies the amount of variance in false recall accounted for by that predictor. ΔR^2 represents the change in variance accounted for due to the addition of another predictor, while controlling for the effects of the other predictors.

Table 11

Summary of Hierarchical Regression Analyses on False Recall Using Free Recall

Model 3: Working Memory Before Episodic Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.039	-----	p<.05
2	Working Memory	.167	.128	p<.01
3	Free Recall	.171	.004	p>.05
4	Age	.245	.074	p<.01

Model 4: Episodic Memory Before Working Memory

Order	Predictor	R^2	ΔR^2	ΔR^2 Sig.
1	Condition	.039	-----	p<.05
2	Free Recall	.104	.065	p<.01
3	Working Memory	.171	.067	p<.01
4	Age	.245	.074	p<.01

Note. R^2 signifies the amount of variance in false recall accounted for by that predictor. ΔR^2 represents the change in variance accounted for due to the addition of another predictor, while controlling for the effects of the other predictors.

Confidence Ratings

Confidence ratings on uniquely produced items in the "generate new" phase were collected and analyzed to rule out demand characteristics as a plausible explanation of increased plagiarism. It could be the case that individuals produced items they know not to be new, just to say something and fulfill the demands of the experiment. If so, one would expect a large amount of low confidence ratings as compared to high confidence ratings for plagiarized items.

Participants' confidence scores were analyzed separately for the full and divided attention condition, and for correct and plagiarized responses. Collapsed across age group, confidence ratings for correct answers were significantly higher than ratings for plagiarized answers in the full attention (Wilcoxon $Z = -3.272$, $p<.05$) and divided attention (Wilcoxon $Z = -2.708$, $p<.05$) conditions. Table 12 displays the proportions of responses for old and young adults in their respective conditions. Notably, the largest percentage of responses for plagiarized items were given the most confident rating, for all groups and conditions. This argues against a demand characteristic explanation.

For correct responses in the full attention condition, there were significant age differences in the mean distribution of confidence ratings (Kolmogorov-Smirnov $Z = 1.489$, $p < .05$). Examination of the upper portion of Table 12 suggests this difference may be due to older adults showing more high confidence responses than young adults. Additionally, young adults were more likely to report a medium confidence rating than older adults. For correct responses in the divided attention condition, no age differences were reported (Kolmogorov-Smirnov $Z = 1.001$, $p > .05$). Analysis of plagiarized responses in the full attention group resulted in no age differences (Kolmogorov-Smirnov

Z = .530, $p > .05$). A similar result emerged for participants in the divided attention condition, (Kolmogorov- Smirnov *Z* = 1.147, $p > .05$).

Table 12

Percentages of Confidence Rating During the "Generate New"

FULL ATTENTION

Age Group	Confidence Rating		
Younger Adults	1	2	3
NEW WORDS	5.8%	19.6%	74.6%
PLAGIARISM	16.7%	31.3%	52.1%
Older Adults			
NEW WORDS	5.4%	11.3%	83.3%
PLAGIARISM	17.6%	20.9%	61.5%

DIVIDED ATTENTION

Age Group	Confidence Rating		
Young Adults	1	2	3
NEW WORDS	7.1%	27.2%	68.7%
PLAGIARISM	20.7%	25.6%	53.7%
Older Adults			
NEW WORDS	13.5%	13.1%	73.4%
PLAGIARISM	13.6%	22.0%	64.4%

Note. Responses are presented separately for plagiarized words and new or correct words and for older and young adults.

CHAPTER 4

DISCUSSION

To restate, the current experiment tested the McCabe et al. (2007) hypothesis that declines in working memory and episodic memory can account for plagiarism in older adults. To test this, we introduced a divided attention manipulation for half of the participants, which reduced the amount cognitive resources available to individuals. This is turn, should lower working and episodic memory performance, which rely on these abilities. If increased plagiarism by older adults results from declines in working and episodic memory abilities, then one would expect that older adults with full attention should demonstrate similar performance to young adults under divided attention. Further, we expected to replicate the outcome that older adults will produce more "generate new" plagiarism, a finding concordant with a dual process explanation.

Several types of plagiarism errors were possible over the course of the experiment. For most instances of plagiarism, predictions were not borne out. In recall plagiarism, we observed a main effect of condition, however older adults with full attention were still more likely to produce errors than young adults. A similar pattern was observed for generate new plagiarism, in which the distracting task did not produce enough errors in young adults to equate their performance with older adults under full attention. Confidence ratings were collected on the items produced in the "generate new" phase to rule out the possibility of demand characteristics. The results from the confidence analysis show that participants were highly confident that the items they produced were in fact novel. Thus, errors can be seen as true inadvertent plagiarism and not simply as a byproduct of experimental demands. Self-plagiarisms were rare across the experiment and only occurred for older adults.

Results concerning typical item memory were more in line with predictions. Older adults with full attention and young adults under divided attention performed similarly on "recall other". Although not exactly equal, a similar pattern was found with the false recall data. However, old adults produced slightly more errors than young adults in the divided attention condition. For self recall, the predicted findings were not observed. Older adults correctly recalled fewer of their own exemplars as compared to young adults. As was the case with "generate new" plagiarism, there was no significant difference in performance between the two groups.

As another means of testing the McCabe et al. (2007) hypothesis, regression analyses were performed on different types of errors made over the course of the experiment. Regarding "generate new" plagiarism, Models 1 and 2 replicated the findings of McCabe et al. We also performed regression analyses on recall plagiarism, which was a unique contribution of this study. Likewise, the results from Models 1 and 2 for recall plagiarism were consistent with theoretical predictions. In both of these cases, all of the age-related variance was accounted for by measures of working and episodic memory. Finally, we failed to find support for McCabe et al. regarding false recall errors. After the dummy variable of condition, working memory, and episodic memory had been entered into the equation, age was still a significant predictor of false recall errors.

In addition to the models already discussed, we tested other models in order to answer two other questions. First, we wanted to determine whether the predictive value of “recall other” might be significant because it is derived from the same experiment as the dependent variables. Thus, for each dependent variable, we ran models using an immediate free recall test instead of performance on “recall other”. Working memory remained a significant predictor in all models. However, free recall was only significant when it was entered first, and was not significant after working memory had been controlled for. This pattern is in stark contrast to “recall other”, which was reliably predictive of errors on the task. Therefore, one explanation is that “recall other” is highly predictive of plagiarism errors because it is tied to the same experimental procedure as the dependent variable. A related reason could be that “recall other” and the dependent measures are both categorically structured, whereas free recall is unstructured. Memory performance for structured lists is superior to performance on unstructured lists for both young and old adults (Kausler, 1994; Zacks, Hasher, & Li, 2001). Kausler (1994) noted that when presentation and recall are cued by category labels performance benefits for all age groups, as was the case in the current study. Thus, Free Recall may not have been predictive because it was unstructured. In support of this argument, there was a relatively low correlation between these two measures (r = .388), suggesting that they are predicting different constructs, namely structured recall versus unstructured recall. However, another reason could be that there is low reliability between the two measures. Future studies should use an independent, structured free recall test to determine if this is the reason for “recall other” being highly predictive of plagiarism errors. If this is not true, then it might be an artifact of predicting a person’s errors on a task, by using their correct recall.

Concerning analyses conducted on false recall, we were unable to account for all of the age-related variance. Working memory and sometimes episodic memory added significant incremental prediction yet the variable of age was still significant. One possible explanation for this shortcoming could be lack of power. However, we did have more participants in the analysis ($N = 128$) than did McCabe et al. ($N = 112$). Moreover a power analysis, suggested that we had a power level of .69. Finally, it seems peculiar that we would have the power to detect differences for "generate new" plagiarism and not for recall plagiarism or false recall. Thus, we can be reasonably confident that a failure to replicate the results of McCabe et al. was not due to a lack of power. Another possibility concerns an issue previously discussed, namely the failure of free recall to predict a significant amount of variance in plagiarism. The fact that free recall is measuring something distinct from "recall other" may be the cause of this failure. However, neither of these alternatives explains why all of the age-related variance in false recall was not accounted for. Perhaps we failed to replicate the findings of McCabe et al. because there was on the whole more false recall for both young and older adults. Another reason for this failure might be due to sampling error.

The second question tested the notion that one can avoid inadvertent plagiarism by being more fluent in category generation. The person who can name many exemplars will not have problems with "generate new" plagiarism, because they can conjure up somewhat more exemplars that were unlikely to have been presented in the first part of the experiment. To test this we used performance from an animal naming task as our predictor of category fluency. However, this variable was only significant when it was entered first. When entered into the equation after working and episodic memory, it no longer added significant incremental prediction. The cognitive constructs of working memory and episodic memory can account for individual differences in category fluency. This is not a surprising finding, given the literature on category fluency and working memory. For instance, Rosen and Engle (1997) found that high working memory ability individuals generated significantly more animals, on a category fluency task than did individuals with low working memory ability. Similarly, we found that older adults, who typically have much lower working memory ability, produced fewer animals than did young adults. Moreover, Rosen and Engle introduced a divided attention manipulation which caused high working memory capacity participants to produce fewer items. Azuma (2004) replicated this finding using several categories. Taken together, these findings posit a strong relationship between working memory and category fluency.

On the whole, the observed outcomes were not fully in line with McCabe et al. (2007)'s predictions. Only in several cases, did fully attending older adults show equal performance to young adults under divided attention. On the other hand, certain hierarchical regression models on "generate new" plagiarism and recall plagiarism were also in line with predictions. Therefore, it seems the current findings can only offer limited support for the McCabe et al. hypothesis.

At a higher, theoretical level, the results of the study are in line with a dual process model of inadvertent plagiarism as opposed to a source monitoring framework. The source monitoring account holds that "generate new" plagiarism errors are caused by failures of familiarity. Familiarity based decisions should be immune from the effects of a number monitoring task because it's automatic nature. However, instances of "generate new" plagiarism increased under the divided attention task, which argues against the source monitoring framework. Recollection then, must be playing an important role in the 'generate new' decision, which is in line with a dual process explanation. Greater levels of "generate new" plagiarism for older adults and younger adults under divided attention were reported, replicating the results of McCabe et al. (2007), and providing further support for a dual process framework of inadvertent plagiarism.

An interesting outcome from the study was a lack of difference between older adults in the full and divided attention groups in their amount of "generate new" plagiarism. The number monitoring task elicited increases for young adults but had no effect on older adults. It was expected that older adults would also show an increase in errors when under divided attention. Further, young adults under divided attention were expected to show equal levels of "generate new" plagiarism to older adults with full attention. For a dual process model, not demonstrating equivalent performance between full attention older adults and divided attention young adults is problematic. This would suggest that older adults are disadvantaged not only in recollection abilities but in some other fashion as well. Under a dual process framework, this is presumably due to declines in familiarity. If this speculation were true, it would be congruent with reports from recent papers suggesting that age can also be associated with declines in familiarity (Prull et al., 2006; Toth & Parks, 2006; Duarte et al., 2006). Future studies should clearly consider and address this alternative explanation.

There are several potential problems associated with the current study that need to be addressed. Assuming the number monitoring task subsumed working memory resources we should have witnessed the predicted pattern for all dependent variables.

There are several reasons why we might not have seen the predicted pattern. First, the number monitoring task may not have been demanding enough to cause a sufficient detriment to performance. Jacoby et al. (1989) used a number monitoring task but had participants respond after a run of three odd digits. In our task, participants responded whenever they heard certain digits. The number monitoring task of Jacoby et al. included an extra processing component by making participants remember previous digits in order to respond accurately. It could be the case that this extra component made the task more difficult and would cause a greater detriment to memory performance. Mäntylä and Bäckman (1992) successfully equated performance of younger adults under divided attention and older adults using a task in which participants had to counting backwards from a certain digit during an encoding phase. Thus, it is possible that our manipulation was not challenging enough to cause a noticeable decline in memory performance.

A variant of this notion is that the number monitoring task might have been of appropriate difficulty to cause errors for some measures and not for others. Several measures in the study assessed memory for self-produced items (i.e. recall plagiarism, self recall, self plagiarism). Memory for self-produced items is generally better (i.e. higher percent correct and very few errors) than memory for other-generated items. This phenomenon is known as the generation effect (Jacoby, 1978). The current data certainly show patterns predicted by the generation effect. Young adults performance on self-recall was at ceiling and recall plagiarism was near floor. Also, there were only a few instances of self-plagiarism, all committed by older adults. Meanwhile, the data concerning other-generated items (i.e. initial plagiarism, "recall other", and false recall) showed moderate levels of performance (i.e. no floor or ceiling effects). Thus, they were not remembered as well as the items they generated themselves. Since memory for self-generated measures has higher standing than memories for other-generated measures, perhaps the divided attention task was not difficult enough to hinder performance on self-generated items but was for other-generated items. Such an explanation is in line with the current results. The desired results were obtained for most measures of other-generated items. For measures of self-generated items, generally there were no significant interactions or main effects of condition.

One problem with a generation effect explanation is that older adults did not show very accurate memory performance for self-generated items. The generation effect should hold true for older adults in situations where generation is semantic in nature (Taconnat & Isingrini, 2004). In most experiments investigating the generation effect, participants generate all the words to be recalled (McDaniel, Waddill, & Einstein, 1988). In our study, participants are placed in a dynamic setting, in which they do not produce all of the items to be remembered. One theory proposes that conscious resources may be need to obtain the generation effect (Taconnat & Isingrini, 1996). Thus, it could be the case that the dynamic and complex nature of the task hurt older adults' ability to maintain the generation effect. Future studies should use more challenging and demanding divided attention tasks. It is possible that such a manipulation would yield results more congruent with the propositions of McCabe et al. (2007). Furthermore, it might create a larger difference between conditions for self-generated memory measures.

Another problem with the study might be related to performing the task singly, on a computer as opposed to performing the task in real time among a group of other participants. However, this issue most likely does not affect the findings from the experiment, as much as it is a representativeness issue. A comparison of the current results for individuals in the full attention condition and the findings from McCabe et al. (2007) show that performance in our study was less accurate and more error prone. That is, recall performance was poorer and more plagiarism errors were committed in the current sample as compared to McCabe et al. Perhaps generating exemplars and listening to other-generated exemplars in the presence of other non-simulated participants offered more information and cues, which in turn helped avoid errors. For example, faces, voices, and even the location where a participant is seated are all context clues that can assist an individual in remembering exemplars. Further, if a participant had any relationship with another individual in the initial generation session (i.e. spouse, friend, etc.) the participant may pay more attention to their spouse or friend's responses, and better remember them. It follows the better remembering would also be associated with committing less errors. In the current computer based study, an individual would have no context clues of this nature that could help him or her better remember. This may account for the, on average, poorer performance in the current sample. It is still our contention that our program was still valid and useful. That is, we did effectively simulate the typical experimental paradigm without the use of group testing, and this difference would only account for a minimal change in the results.

A third problem with the study is we failed to obtain a report of strategy usage from participants after completion of the experiment. It is fairly straightforward to see how strategy might influence performance on the task. One example of a strategy could be the use of distinctive items. By distinctiveness, we refer to the idea that highly salient items, in this case lower frequency exemplars (i.e. more obscure) help facilitate memory recall (Hunt & McDaniel, 1993; Smith & Hunt, 2000). This strategy could be employed in multiple ways. In the initial generation phase, individuals could produce obscure category members, which would make them easier to remember later. This strategy would simultaneously help participants avoid instances of initial plagiarism. A distinctiveness heuristic could be used to avoid "generate new" plagiarism, as well. For instance, one might attempt to call up more obscure category members that would not have been said in the first part of the experiment. Using such a strategy, a participant could be fairly confident that the items they produced were in fact new.

Another strategy somewhat related to the distinctiveness heuristic is the expectancy heuristic (McCabe & Balota, 2007). Individuals have an expected level of memorability for items, which is based on the context in which those words were presented (i.e. initial generation). In this case, all the words selected for presentation were all high (very typical) to medium frequency category exemplars. As a strategy to avoid "generate new" plagiarism, individuals may avoid writing down items they think to be of that level of typicality, and choose words that are more obscure, or of lower typicality. Future studies should at minimum collect strategy reports from participants. Further, it might be useful to explicitly address the strategy notion by instructing older adults in a particular strategy and then seeing if this helps reduce errors relative to a control group of older adults.

There are also more general problems associated with divided attention manipulations. As Salthouse (1991) noted, a serious problem with manipulations of this nature are the implicit, untested assumptions. The extent to which the assumptions are met or not met, weaken one's ability to generalize to the population of interest. Further, the difference in performance could be due to an entirely different process. However, it is our stance that our manipulation produced the desired effect. That is, for the most part, we did see performance detriments in the divided attention groups. In those situations where differences were not witnessed, we suggest that it may be due to the nature of the dependent measure.

In conclusion, the results from the experiment lend limited support to the theory of McCabe et al. (2007). In most cases, the number monitoring task did produce more errors and poorer recall performance relative to the full attention condition in young and old adults. The distracting task may not have been difficult enough to produce a very large effect, especially for those measures that were related to items produced by the participant. Nevertheless, the fact that performance declined in the midst of a distracting task suggests that avoiding plagiarism requires cognitive ability akin to working memory. Specifically, errors of "generate new" plagiarism increased when participants were under divided attention during initial generation. This result is in contrast to predictions from the source monitoring framework, which predicts no effect because decisions are made on familiarity and not on recollection. Meanwhile, this result is not only in line with McCabe et al., but also the dual process theory of memory. Regression analyses on "generate new" plagiarism also supply evidence for the McCabe et al. hypothesis. Age-related declines in working and episodic memory accounted for a significant amount of variance in "generate new" plagiarism errors.

Several regression models were not successful at accounting for all of the age-related variance. This was especially notable in the case of false recall. Thus, the current results provide only tenuous support for the notion that age related increases in plagiarism can be explained by declines in working memory and episodic memory. Future studies should investigate the use of strategy in avoiding plagiarism errors. Also, while this methodology has been useful in exploring inadvertent plagiarism, new ecologically valid paradigms should be explored as a means of investigating this memory error.

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