Do Older and Younger Adults

Use and Benefit from Memory Aids?

by

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AUTHOR'S DECLARATION

I hereby declare that I am the sole author of this thesis. This is a true copy of the thesis, including any required final revisions, as accepted by my examiners. I understand that my thesis may be made electronically available to the public.

Abstract

This research examines age differences in the use and value of memory compensation strategies for everyday memory tasks. Chapter 1 reviews the literature on memory compensation and aging. According to Selective Optimization with Compensation (SOC) model, older adults may be more likely than younger adults to take advantage of memory compensation strategies when they are available. Chapter 2 describes a diary study in which older and younger participants rated the extent to which they use compensation strategies in everyday life and reported everyday memory errors over the course of a week. Older adults reported fewer memory errors than younger adults and more use of memory aids. However, use of memory aids was unrelated to frequency of memory errors in either age group. Chapter 3 reports a laboratory experiment on the use of memory aids for recalling phone messages. Participants listened to phone messages while simultaneously completing a seating chart, and were asked to report the content of the messages to the experimenter. Participants were either allowed to use a memory aid for the phone message task, or not. Older participants reported using compensation strategies more frequently in everyday life, but they were no more likely than younger participants to search for or employ an aid in the phone message task. Using a memory aid was differentially beneficial, improving performance more for older than younger participants. In Chapter 4, participants completed two phone message recall and two seating plan tasks. Participants were encouraged to use whatever in the room that they might find helpful. On one round of tasks a pen was tied to a clipboard and participants could use it to write down the phone messages. On the other round no pen was available. The order of the trials was counterbalanced across participants. This design examined the calibration between participants' use of memory aids and their performance on the recall task – whether participants' performance on the first trial predicted their subsequent use of memory aids, and whether participants who chose to use a memory aid when it was available on the

first trial performed particularly poorly on the second trial when no aid was present. As in Study 1, older adults reported using memory aids more frequently in everyday life but age was unassociated with whether or not participants used the pen when one was available. There was little evidence of calibration. Participants' memory performance on an initial trial had little impact on their use of a memory aid on a subsequent trial. Participants who used a memory aid on the first trial actually recalled more phone message details on the second trial (without the aid) than those who did not. This was true for both age groups. Chapter 5 reflects on older and younger adults self-reported and observed uses of memory compensation strategies. Across all 3 studies older adults reported using external memory aids more frequently in everyday life. However, contrary to the SOC model, in Studies 2 and 3 there were no age differences in older and younger adults' use of a pen to write down phone messages on the lab task. Nor was participants' choice to use the memory aid associated with their unaided performance on the task. These results do not support the prediction derived from SOC that older adults use compensation strategies more frequently or more sensitively than younger adults. However, using the memory did improve performance on the task more for older than for younger adults. These results support the hypothesis that external memory aids are a particularly valuable strategy for older adults and suggest the need to better understand why some individuals engage in compensation use and others do not.

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Chapter 1:

Introduction

In everyday life, people occasionally forget appointments, the names of acquaintances, where their car is parked in the lot, and so on. Most of the time, the consequences of these memory errors are minor. Usually people can rebook the appointment; they eventually remember the acquaintance's name and locate their car. Such errors, however, can be worrisome. Older adults are likely to fear that memory errors are evidence of age-related declines in memory or of pathologies such as Alzheimer's disease (Reese, Cherry, & Norris, 1999).

Are older adults right to worry about changes in memory with age? The majority of studies on memory and aging would suggest that older adults' concerns are well grounded. Compared with younger adults, older adults are more likely to forget the source of retrieved facts and information (Johnson, Hashtroudi, & Lindsay, 1993; Schacter, Kazniak, Kihlstrom, & Valdiserri, 1991; Schacter, Osowiecki, Kaszniak, Kihlstrom, & Valdiserri, 1994). Age is also related to poorer memory of episodic (memories tied to a specific time or place) events (Light, 1991) and, at least in some studies, worse prospective memory (e.g., press a button when the word 'rake' appears) (Henry, MacLeod, Phillips, & Crawford, 2004). Older adults also typically perform more poorly on working memory tasks which require them to maintain information in active memory while performing other mental operations (Salthouse, 1991). On a more positive note, however, there is little evidence of age-related declines in implicit (Howard, 1992), procedural (Balota, Dolan, & Duchek, 2000) or semantic memory (memory for general information) (Balota et al., 2000; Verhaeghen, 2003).

It is unclear to what extent age deficits[1] on memory tasks in the lab predict errors on memory tasks in everyday life. According to Hertzog and Dunlosky (1996), there are several factors that distinguish memory tasks in real life from those in the lab. Memory tasks in everyday life, for example, are often familiar and well-practiced. In contrast, lab tasks are typically unfamiliar and novel. In everyday life, remembering is usually not a goal in itself but rather is a means by which individuals achieve goals. It matters that individuals show up to a doctor's appointment on time. It is less important whether they memorized the details of the appointment or wrote them down on a piece of paper. In everyday life, the result is more important that the means. People can and do adopt strategies to deal with some cognitive demands. Lab tasks, in contrast, are typically designed so that participants cannot use memory compensation strategies (particularly external memory aids).

According to some researchers, declines associated with aging may be offset in everyday life by compensatory adaptations such use as the use of memory aids (Bäckman & Dixon, 1992; Hertzog & Dunlosky, 1996; Rendell & Craik, 2000). Few studies, however, have systematically examined the relations among age, compensation strategy use, and memory performance.

Why Study Memory Compensation?

Bäckman and Dixon (1992) defined compensation as the investment of time and effort to counterbalance a perceived mismatch between the demands of the environment and the available skill set. Compensation can involve the acquisition of new skills or the use of latent skills to achieve an adaptive level of attainment, and to maintain or even surpass average levels of

[1] I am referring here to average differences between older and younger adults on memory tasks. I am not referring to deficits in performance that may indicate pathologies such as Alzheimer's Disease.

proficiency (Bäckman & Dixon, 1992; Dixon & Bäckman, 1995). In the context of remembering, Harris (1980) identifies two types of memory compensation strategies: internal memory aids and external memory aids. Internal memory aids rely on mental strategies and processes internal to the self (e.g. rhyming words, first letter searching, the method of loci, etc.). External memory aids (e.g. making lists, relying on others for a reminder, leaving objects in a special location, etc.) involve the use of some object or resource external to the self. Psychologists have studied neither type of memory aid extensively.

Psychologists have focused primarily on understanding the structure of memory and have largely neglected memory strategy (Hintzman, 2011). Researchers typically test recall on tasks for which memory compensation strategies (particularly external memory strategies) are difficult, if not impossible, to implement. In particular, psychologists routinely prevent participants from using external memory aids. On most lab tests of recall, writing down information about the task would be considered to be cheating.

There are certainly advantages to studying unaided recall. The findings of age-related declines in lab tests of memory provide important information about cognitive performance across the lifespan. Psychologists have learned which types of recall decline and, to some extent, why they decline. Psychologists have also learned a great deal about how biological, cognitive, and social changes relate to cognitive performance. I argue, however, that unaided recall should not be the only type of recall that psychologists study. If understanding changes in functioning is a goal of research on aging and memory, then it seems important to examine not only age differences in memory performance on lab tasks but also how adults of different ages strategically adapt to memory tasks in everyday life. If unaided recall does not reflect how individuals approach memory tasks in everyday life, lab research may help foster a more negative view of older people's memory performance in everyday life than is warranted. Lab findings may contribute to a negative stereotype of aging that exaggerates older people's failings and underemphasizes their competencies.

People report frequent use of compensation strategies to help them cope with resource-demanding tasks in everyday life (Harris, 1982; Intons-Peterson & Fournier, 1986). Intons-Peterson and Fournier presented university-aged participants with different types of situations involving memory (e.g., remembering directions to a friend’s house) and asked them how frequently they would use different types of internal and external memory aids for each task. Participants reported that they would use some kind of strategy on 90% of the situations presented. Participants also reported that they would use external memory strategies more frequently than internal strategies for the tasks (57% versus 34%). They described external memory aids as more reliable than internal strategies. Harris (1980) similarly found that a middle-aged sample (mean age 42) reported using external memory aids most frequently. The findings of both Harris and Intons-Peterson and Fournier should be interpreted with some caution given that they rely entirely on self-report. Nevertheless, this research suggests that, although rarely studied by psychologists, memory compensation strategies, particularly external memory aids, may be frequently used and may form an integral part of how people (everyone—not just older people) remember information in everyday life.

The goal of the current research is to study age differences in the use and utility of compensation strategies on memory tasks both in the lab and in everyday life. Across three studies, I examine the frequency with which younger and older adults spontaneously use memory compensation strategies and the relation of such strategies to performance on everyday memory tasks inside and outside the lab. In the current research, I focus primarily on the use of external memory aids both because external memory aids are the strategy most commonly reported by adults of all ages (Harris, 1980), and because people's use of external aids is directly observable rather than reliant on their self-reports. I also test a hypothesis derived from Selective Optimization and Compensation theory (SOC) (e.g., Baltes & Baltes, 1990) that older adults may use memory compensation strategies more frequently than younger adults when such strategies are available and not overly resource demanding.

Memory in the Lab and in the Field

Relatively few researchers have systematically examined age differences in memory outside the lab. In the majority of the field studies that do exist, researchers focus on prospective memory. Prospective memory is often defined as memory for future events and behavior (Rendell & Thomson, 1999). Arriving at a doctor’s appointment or taking medication on time exemplify tasks that involve prospective memory. Prospective memory involves a number of components, including planning the task (forming an intention), remembering the details of the task, and monitoring the time or event when the task is to be performed (Caprani, Greaney, & Porter, 2006; Dobbs & Reeves, 1996).

According to Craik (1986), the performance of older adults should be particularly impaired on prospective memory tasks. Prospective memory involves executive processes such as planning and inhibitory control which have been found to decline with age (Craik, 1986; d'Ydewalle , Bauckaert, & Brunfaut, 2001; McFarland & Glisky, 2009). Remembering to take medication, for example, requires that an individual form an intention to take the pills, trigger that intention at the appropriate time, inhibit other actions in which they might be engaged, and remember which pills and how many they are supposed to take. Remembering prospective memory tasks can become increasingly important with age (McFarland & Glisky, 2009). For example, non-compliance with medication regimes may have particularly dire consequences for older adults.

On tests of prospective memory in the lab, participants typically perform two or more tasks at the same time – a retrospective memory task such as remembering words from a list (Park et al., 1997), and a prospective memory task such as pressing a button at a specific time (e.g., d'Ydewalle et al., 2001) or in conjunction with the presentation of a specific stimulus (e.g., Kidder, Park, Hertzog, & Morrell, 1997). Older adults typically perform worse than younger adults on these types of prospective tasks (see Henry et al., 2004, for a review), although some studies have found no age differences in prospective memory on lab tasks (e.g., Einstein & McDaniel, 1990). To the best of my knowledge no studies have found evidence of an age advantage on prospective memory tasks in the lab. Whereas older adults generally perform worse on lab-based prospective memory tasks, researchers typically find either no age differences or improved performance with age on prospective memory tasks in the field. Observational studies in which participants are asked to phone the experimenter each day for five days (d'Ydewalle & Brunfaut, 1996; Maylor, 1990), 2 weeks (Moscovitch, 1982), 3 weeks (Poon & Schaffer, 1982) and four weeks (Devolder et al., 1990), have all found that older adults outperform younger adults. Older adults also are more likely than younger adults to remember to mail a postcard to the experimenter each day (Patton & Meit, 1993), or to press a button on an electronic organizer at certain times of the day (Rendell & Craik, 2000; Rendell & Thomson, 1993, 1999). More generally, older adults are also less likely to miss appointments (Frankel, Farrow, West, 1989; Gallucci, Swartz, & Hackerman, 2005; Neal et al., 2001). This is true even in the domain of mental health where arguably the importance of the appointments is equated across age groups (Mitchell & Selmes, 2007).

Why is there such a discrepancy in age differences between prospective memory tasks in the lab and in the home? The explanation most frequently offered for the discrepancy is that in field studies older adults can and do engage in more compensatory strategies to help them perform memory tasks whereas younger adults rely more on unaided memory (Caprani, Greaney, & Porter, 2006; Henry et al., 2004; Maylor, 1990; Maylor, Darby, & Sala, 2000; Vogels, Dekker, Brouwer, & de Jong, 2002). Lab studies are designed so that participants cannot write down the information that they are supposed to remember, or take extra time to process information so that they will remember it later. Researchers have suggested that over the lifespan older adults increasingly adopt strategies such as using external memory aids to help them cope with memory tasks in everyday life (Caprani et al., 2006; Vogels et al., 2002). If older adults use these strategies more frequently or more effectively than younger adults do, this could explain the divergent results in the lab and the field.

Selective Optimization with Compensation (SOC) Model

This account of an age-related increase in use of compensatory strategies is consistent with the Selective Optimization with Compensation (SOC) model (Baltes, 1997; Freund & Baltes, 2002; Li, Lindenberger, Freund, & Baltes, 2001). According to the SOC model, a key motivation throughout adulthood is to manage losses and enhance the potential for gains. Individuals achieve this goal by being selective about the goals that they pursue, optimizing the means by which they pursue their goals, and using alternative means to compensate to maintain functioning when faced with decline or loss in capability (Freund & Baltes, 2002; Li, Lindenberger, Freund, & Baltes, 2001). Throughout the lifespan there are increases and declines in skill across various domains. When faced with a decline, people can compensate for changes in performance. When compensation is not feasible (as on most tests of memory in the lab) or is resource demanding, people can change their standards for performance or develop new goals in a different domain.

P. Baltes (1987) distinguished between the mechanics (e.g., working memory capacity) and the pragmatics (e.g., learned expertise) of cognitive functioning. When faced with a decline in the mechanics of cognition, individuals can compensate for that loss with pragmatic knowledge or experience (Baltes & Baltes, 1990). Memory aids are an example of strategies that are developed, based on experience with a task, to help close the gap between the demands of the environment and the capacity of the mechanics (Bäckman & Dixon, 1992). The type of compensatory strategy that an individual adopts will depend on the nature of the task. As individuals develop expertise on a task, they may develop more effective strategies. They may also apply strategies more frequently to tasks on which they know those strategies to be effective. Across the lifespan, individuals become more adept at all aspects of SOC (Freund & Baltes, 2002). As adults are confronted with new experiences and attain knowledge and expertise in different domains, they become better at selecting and pursuing their goals. There is some debate, however, regarding whether improvements in compensation continue to increase or decrease in old age.

On the one hand, older adults may use more effective strategies than younger adults because of their greater knowledge and expertise (Baltes & Baltes, 1990). Salthouse (1984) found that older typists were more efficient than their younger counterparts even though their tapping speed was slower. Salthouse attributed this to an age difference in experience. Older typists were able to read farther ahead into the document and therefore maintain a more consistent typing speed. It is also possible that, based on prior experience, older adults use memory strategies more frequently on tasks for which they know those strategies to be effective. This is in part the logic that researchers such as Maylor (1990) use when they suggest that the age advantage in prospective memory outside of the lab may be due to a difference in the frequency with which older participants use compensation strategies. Older adults may notice reductions in their own memory capacity with age and consequently increase their use of strategies. Increased use of strategies may in turn lead to even greater expertise in their use and better performance on memory tasks.

On the other hand, aging is also associated with biological changes in functioning such as reduced activation in the prefrontal cortex that may affect older adults' ability to apply compensation strategies (Baltes, 1997). Older adults may use compensation strategies less frequently, may have fewer strategies available to them, or such strategies may become less effective because their use taxes cognitive resources that are already diminished with age (Baltes & Baltes, 1990). The SOC model does not specifically predict that older adults will always use compensatory strategies more frequently or effectively. However, it does suggest that to the extent that memory tasks outside of the lab can be compensated for, older adults may be more likely to take advantage of the opportunity to do so. This may be particularly true when the compensation strategy is less resource demanding.

Age Differences in Self-Reported Frequency of Memory Compensation Use

Dixon, de Frias, and Bäckman (2001) developed the Memory Compensation Questionnaire (MCQ) to study older adults' use of compensatory strategies in everyday life. The MCQ is a self-report measure that assesses how frequently participants use external memory aids, internal strategies (e.g., mnemonics), memory collaboration, extra time, and effort. Researchers have administered the MCQ to several large samples of older participants (aged 55 to 85) in the Victoria Longitudinal study (VLS) over more than a six-year time period (de Frias & Dixon, 2005; de Frias, Dixon, & Bäckman, 2003; Dixon & de Frias, 2004; Dixon et al., 2001). As participants aged, they reported using external memory aids more often and internal memory strategies less often in everyday life (Dixon and de Frias, 2004). Dixon and de Frias (2007) found that older adults identified as having mild memory deficits reported using fewer external memory aids than did control participants without such deficits. Individuals in the Victoria Longitudinal study who made fewer errors on word and story recall tasks in the first wave of the study reported increased use of external memory aids and effort six years later. Moreover, using a subset of participants from the Kungsholmen project in Sweden, Dixon et al. (2003) found that healthy older adults reported relying more on external memory aids than did Alzheimer's disease patients. All of these findings suggest that high functioning, healthy, older participants report using compensation strategies more frequently than their younger or less advantaged counterparts.

To the best of my knowledge, the MCQ has never been administered to participants younger than 50. It is therefore uncertain whether older participants' self-reported use of memory compensation strategies in everyday life differs from that of younger participants. Moreover, although the MCQ has high reliability (de Frias & Dixon, 2005; Dixon et al., 2001), its validity is unknown. The MCQ has never been administered in a context in which the use of compensation strategies can be observed directly. It is conceivable that participants' reports on the MCQ are influenced by their beliefs about how they ought to behave in addition to, or instead of, by what they actually do. Finally, we also know relatively little about the relation between scores on the MCQ and memory performance in everyday life among healthy high functioning younger and older adults.

Other researchers have examined age differences in self-reported memory compensation using different kinds of measures. Cavanaugh, Grady, and Perlmutter (1983) asked participants to keep a diary one day a week for 4 weeks. They recorded memory errors and use of compensation strategies. Older adults reported using memory compensation strategies more often than younger adults. Older adults also reported more memory errors. These findings should be interpreted with some caution, however, as the researchers did not collect data on the base rate of each type of task. Older adults may have reported forgetting more “routines” because they experienced more routine events throughout the day. Likewise younger adults may have reported using memory strategies less frequently to remember appointments because they had fewer appointments scheduled. The authors also did not report any results relating the use of compensation strategies and the number of memory errors reported.

In a chapter, Moscovitch (1982) described the results of several studies in which older and younger participants were asked to call the experimenter at a specific time each day for two weeks. When all participants were permitted to use external memory aids (e.g., writing down the date of the appointment and keeping it in a prominent location) (Study 1), older adults missed significantly fewer telephone appointments than younger participants did. When all participants were forbidden to use memory aids (Study 3), older and younger participants did not differ in their phone appointment accuracy. However, Moscovitch (1982) did not measure the extent to which older and younger adults used memory aids in Study 1, nor did he manipulate the availability of memory aids in a single study. It is therefore difficult to draw strong conclusions about age differences in the use or usefulness of memory aids based on this research.

D’Ydewalle and Brunfaut (1996, Study 1) asked participants to phone once a day for 5 consecutive days during a specific time interval. Participants also completed a questionnaire for each call describing how they remembered to make the call. Younger adults performed less well on the prospective memory task than older or middle aged (aged 35-45) participants did. Although the age groups did not differ in the frequency with which they reported using memory aids, they reported using different types of strategies. Younger adults reported using more internal than external aids compared with participants in the other age groups. In Study 1, d'Ydewalle and Brunfaut found that younger adults who reported using mostly internal strategies forgot more phone calls than younger adults who reported using mostly external strategies. The type of strategies that older and middle-aged participants reported using was not related to their performance on the task. In Studies 2 and 3, the kind of strategy participants were assigned to use was unrelated to the number of calls that they remembered to make.

Other studies have found few or no age differences in the frequency of strategy use. Patton and Meit (1993) gave older and younger participants 4 postcards and asked them to mail each postcard, one per day, for four days. Older adults mailed more postcards than younger participants. In a post-experimental questionnaire, participants were asked about any mnemonic devices they may have used to help them with the task. Older and younger adults did not differ in the frequency with which they reported using strategies (both internal and external). Older participants did rate the task as more important than younger participants. However, the authors did not report whether there was any relation between perceived importance of the task and memory performance. Rendell and Thomson (1999) asked participants to press a button 4 times a day at various time intervals on an electronic organizer. Older adults were more accurate in their button pressing than younger adults. At the end of the study, older adults reported using fewer strategies to recall the task compared with younger participants.

Only one study to date has found that older adults perform worse than younger adults on a prospective memory task outside of the lab. Dobbs and Rule (1987) asked participants between the ages of 30 and 99 to complete a questionnaire on metamemory problems at home. They were instructed to write the time and date on the corner of the questionnaire. Contrary to the findings in the majority of studies, the researchers found that older adults performed more poorly on this prospective memory task: They were less likely to remember to fill out the time and date information on the questionnaire. On the questionnaire itself, older adults reported a greater average number of memory problems in everyday life (e.g., remembering names) overall. Middle-aged adults (participants in their 40s) reported using memory aids more frequently than any other age group.

One limitation for some of these studies is that they have small sample sizes. Moscovitch (1982) included only 10 participants per cell. Cavanaugh et al. (1983), and d'Ydewalle and Brunfaut (1996) reported results based on 12 to 15 participants per condition. A limitation that is common to all of these studies is their reliance on self-reports to measure participants' use of compensation strategies. People are not especially accurate in their memory of the frequency with which they engaged in various actions (Bradburn, Rips, & Shevel, 1987), and it is unknown how such accuracy might change with age. Participants' estimates of their memory compensation use may have been influenced by a variety of factors including their beliefs about whether an individual in their age group should use compensation strategies. Studies in which participants were asked to recall the frequency of their memory aid use at the end of a study that lasted days or weeks (e.g., Patton & Meit, 1993; Rendell & Thomson, 1999) may be particularly problematic. Even studies where memory aid use was manipulated (e.g., Moscovitch, 1982) relied on participants' self-reported compliance with the instructions. Moscovitch (1982) noted that older adults seemed particularly unwilling to relinquish their memory aids, contrary to experimental instructions in Study 3. For example, they often left the phone number for the experimenter in a prominent place in their wallets.

Age Differences in the Observed Frequency of Memory Compensation Use

Relatively few researchers have directly observed people's use of memory compensation strategies. Burack and Lachman (1996) assigned participants to make lists during an encoding task or not. Morrow, Leirer, Carver, Decker, Tanke, and McNally (1999) gave participants a sheet of paper and told them that they could (if they wished) write down messages about appointments. The majority (over 95%) of both older and younger participants took advantage of the pen and wrote down the messages. However, it is possible that the demand characteristics of this particularly methodology may have encouraged most participants (even those who do not normally write down messages) to take the opportunity to write down information during the task. The goal of both the Morrow et al. (1999) and Burack and Lachman (1996) studies was to examine the effect of list making (not list using) on memory performance. Researchers for both studies took away participants' written memory aids at the time of recall.

Other researchers have examined age differences in internal strategy use (e.g., Lachman & Andreoletti, 2006; Lachman, Andreoletti, & Pearman, 2006). For example, Lachman et al. (2006) presented younger, older, and middle-aged participants with a list of words that could be categorized into semantically related groups. They found no age differences in the extent to which participants strategically used the categories to help them recall words in the list.

To the best of my knowledge, only one previous study has both experimentally manipulated the availability of external memory aids when the information is presented and allowed participants subsequently to use those aids during the recall task. Einstein and McDaniel (1990) asked participants to engage in two types of tasks: a word recall task and a prospective memory task. On the prospective memory task, participants were instructed to press a button every time the word "rake" appeared in the word list. The experimenters then manipulated whether older and younger adults were able to create their own memory aids to help them on the prospective memory task. Participants were given 30 seconds to create a memory aid to help them on their task. They found that older and younger adults were equally likely to create and use external memory aids. Participants who used a memory aid were more accurate on the prospective memory task, but there were no significant age differences in accuracy on the task.

Effectiveness of Memory Compensation Strategies

The relative utility of memory compensation strategies for adults of different ages is also in question. Some researchers have suggested that using compensation strategies can greatly reduce or eliminate cognitive deficits associated with aging (Bäckman & Dixon, 1992; de Frias & Dixon, 2005). They argue that using such strategies can eliminate the gap between environmental demands and cognitive resources (de Frias & Dixon, 2005). This hypothesis is consistent with Craik's environmental support theory (Craik, 1986; 1994). According to environmental support theory, when little environmental support is available at the time of recall to help cue memories, individuals rely on self-initiated processes. The rememberer has to reconstruct memories based on internally generated cues. Self-initiated retrieval is an effortful and resource-demanding process that becomes more difficult in older age. Environmental support theory suggests that when strong cues are provided at the time of recall, age differences in memory performance should be diminished.

Naveh-Benjamin, Craik and Ben-Shaul (2002) presented older and younger participants with a series of pictures of scenes paired with words. Half of the words were semantically related to the pictures. At the time of recall, participants were presented with the pictures and asked to recall the associated words. Half of the participants were given cues in the form of the first letter of the word at the time of recall. Older adults improved more compared to their younger counterparts when the words were both semantically related and a cue was provided at the time of recall. When no cue was available, the semantic association was more beneficial for younger than older adults. These results suggest that when environmental support is available in the form of strong cues at the time of recall, age differences in memory performance may be reduced or even eliminated.

Presumably compensation strategies, particularly external memory aids, function as strong cues. External memory aids should be particularly helpful if they are available when information is being retrieved. However, there is thus far little research examining age differences in the relation between the use of external memory aids and task performance. Most studies examining the effectiveness of memory compensation strategies have found that participants of all ages benefit from their use. Morrow et al. (1999) found that both younger and older adults were more accurate when they wrote down phone messages about appointments. However, writing down the information did not eliminate the age difference. Similarly, Einstein and McDaniel (1990) found that using an external memory aid helped both age groups equally. In contrast, Burack and Lachman (1996) found that list-making was particularly beneficial for older adults, and had little effect on younger adults' performance. It should be noted that both Morrow et al. and Burack and Lachman tested the effects of list-making, and not the effect of list-using on participants' recall of information. Participants were not allowed to use their lists at recall, which, according the environmental support theory is the point when strong cues would be most helpful. Therefore it is unclear whether using memory aids will differentially benefit older and younger adults' memory performance.

The usefulness of internal memory strategies across the age range is also debatable. Lachman, Andreoletti, and Pearman (2006) manipulated internal strategy use. They gave participants a list of words that could be categorized into meaning units. Participants were given no instructions about how to encode the list (control condition), were instructed to categorize the words (strategy condition), or were told to write the words down (alternative strategy condition). Younger and middle-aged participants in the two strategy conditions improved in the number of words that they recalled from an initial trial compared with participants in the control condition. Older participants who were instructed to categorize the list showed no benefit in subsequent recall.

Despite age-related declines in memory performance on most types of lab tasks, field studies of prospective memory have found either no age differences or an advantage for older individuals. Researchers have typically attributed this discrepant pattern of findings to a lack of experimental control in field studies (Caprani, Greaney, & Porter, 2006; Henry et al. 2004; Maylor, 1990; Maylor, Darby, & Sala, 2000; Vogels, Dekker, Brouwer, & de Jong, 2002). They argue that older adults perform better on memory tasks at home because they use compensatory strategies, particularly external memory aids, more frequently than younger adults to help them with their tasks. These memory aids, they suggest, allow older adults to perform as well if not better than younger adults on tasks such as making daily phone calls or sending postcards. This hypothesis is consistent with environmental support theory which suggests that to the extent that there are strong cues available at recall, age differences in memory performance should be reduced or eliminated. However, evidence of age differences in compensatory strategy use is sparse. So far there is no compelling evidence that older adults use memory compensation (either internal or external) more often than younger adults do or that memory aids are more beneficial for older than for younger adults. Also, there is little evidence that the superior performance of older adults on memory tasks in the field is due to age differences in memory compensation.

It is possible that age differences on prospective memory tasks outside of the lab may be due to factors other than memory or memory strategies. Rendell and Thomson (1999) suggested that older and younger adults might differ in their motivation to complete tasks outside of the lab. Rendell and Craik (2000) argue that older adults may lead more organized routine lives than university students. Calling the experimenter at a specific time each day may be easier if it fits within an established routine. However, there is, to date, no empirical evidence either that older adults lead more routine lives or that age differences in routine affect memory performance.

Current Research

In the current research, I examined older and younger adults' use of memory compensation strategies and the relation of those strategies to performance on everyday memory tasks. I studied the use of compensation strategies in both the field (Study 1) and the lab (Studies 2 and 3). Most previous studies have measured strategy use retrospectively following a prospective memory task. For example, Rendell and Craik (2000) asked participants in a follow-up interview whether they had used memory aids to help them with their tasks over the course of the week. There are several limitations to this type of methodology. First, participants did not necessarily realize that they were permitted to use memory aids during the week and therefore may not have invoked memory aids as frequently as they otherwise might. Second, participants may have misremembered or misrepresented (e.g., falsely denied using aids because they were uncertain whether aids were allowed) the extent to which they used memory aids to help them with their tasks. Moreover, it is unclear whether behaviors such as denying or forgetting compensation use may differ with age.

In the current research, I asked participants to report the frequency with which they used compensatory strategies to help them with everyday prospective memory tasks (e.g., taking medication) and then measured the frequency with which they reported forgetting each task (e.g., how pills they forgot to take) in a daily diary (Study 1). Unlike previous research (e.g. Cavanaugh et al., 1983), this design allowed me to examine whether compensation use predicts memory errors in everyday life taking into account how frequently participants engage in each type of memory task. I also experimentally manipulated the availability of memory aids and examined the effect of using memory aids on performance on a lab-based memory task (Studies 2 and 3). This design addresses the limitations of previous research by allowing the direct observation of age differences in the use and effectiveness of memory aids (rather than relying on self-report) in the context of an everyday memory task, phone message recall. Together, these studies allowed me to examine how age is related to strategy use, how strategy use is related to age differences in memory performance, and whether memory aids were particularly helpful to older adults. I also studied whether older or younger participants who potentially had the most to gain from the use of memory aids (because their performance without them was relatively poor) were more likely to use them when they became available (Study 3), as SOC theory predicts.

In Study 1, I measured the frequency with which older and younger participants reported using compensation strategies on a daily basis. I also examined the relation between participants' use of strategies and their memory for everyday prospective tasks (e.g., remembering appointments, keys, and medication) as reported in the daily diaries. My goal in this research was to address three main questions: Is there an age difference in the frequency with which older and younger adults report using memory compensation strategies to perform memory tasks in everyday life? On everyday memory tasks, are older adults more forgetful than younger adults are? Does the use of memory compensation strategies predict memory performance on everyday memory tasks for older or younger adults?

In Study 2, I manipulated participants' access to an external memory aid and measured the effect of the memory aid on older and younger adults' recall of phone messages. The availability of the memory aid was manipulated in a between-subjects design. Some participants were told they could use anything in the room they might find helpful and others were told they must rely on their memory to recall the phone messages. When an aid was available, participants could choose whether or not to use it. Einstein and McDaniel (1990) did not find an age difference in either the frequency with which older and younger adults used a memory or its usefulness. However, Einstein and McDaniel’s participants worked on two tasks, a prospective memory task (press the button when the word ‘rake’ appears) and a retrospective word recall task. Participants in the memory aid condition were only allowed to create and use a memory aid to help them with the prospective memory task and not with the more memory taxing retrospective memory task. In Study 2 of the current research, I asked participants to engage in two tasks: a seating plan task which was cognitively demanding but not memory taxing, and a phone message recall task which required more memory resources. This design allowed me to examine age differences in the usefulness of memory aids on performance for a common everyday memory task—remembering telephone messages.

In Study 3, I replicated Study 2 using a within-subjects design. All participants completed a trial in which the memory aid was available and a trial in which it was not. Again, the memory task involved remembering telephone messages. All participants had the opportunity to use an external memory aid in either Phase 1 or Phase 2 of the study. Half of the participants were given the opportunity to use a memory aid in the second, but not the first, phase. The remaining participants were allowed to use a memory aid in the first phase but not the second. This design allowed me to test in two ways the hypothesis that those individuals who need a memory aid will be more likely to use it. The first condition (no aid in trial one followed by possible aid in trial two) tested whether people’s choice to use or not use memory aids was predicted by their recent performance on the exact same task. This condition provides the most sensitive test of the relation between task performance and subsequent memory aid use. However, this condition is possibly somewhat artificial. Memory aid use is a dichotomous variable in this study and may not be sufficiently sensitive to individual differences in performance. The second condition (memory aid available on the first trial but not on the second trial) also tested the relation between task performance and memory aid use but in a slightly different way. The second condition allowed me to examine whether people know enough about themselves to make the "right choice" on the first trial in the absence of immediate prior experience on the task. In other words, this condition examined whether the participants who could potentially benefit the most from the memory aid used it. The within-subjects design of Study 3 also allowed me to test the effectiveness of the memory aid on performance across memory aid conditions. In Study 3, I compared performance when the memory aid was potentially available to when it was unavailable, thus replicating Study 2.

Finally, in both Studies 2 and 3, I administered Dixon, De Frias, and Bäckman’s (2001) Memory Compensation Questionnaire (MCQ). On the MCQ, participants report the frequency with which they use different kinds of memory compensation strategies in everyday life. I used this measure to examine the relation between participants' self-reported use of memory compensation strategies in everyday life and their use of memory aids on the experimental tasks. If self-reported memory aid use on the MCQ is related to use of the memory aid in the lab tasks, this would provide valuable evidence for the validity of the scale.[2] In Study 3, I also administered Sunderland, Harris, and Greave's (1984) Everyday Memory Questionnaire (EMQ). The EMQ is a measure of the frequency with which participants report making various types of memory errors (e.g., retelling the same story, forgetting where important items are located) in everyday life. I included the EMQ to examine the relations between participants' recall of the phone messages, their use of compensatory strategies on the lab task, and the frequency with which they report experiencing memory errors in everyday life. If memory compensation improves memory performance in everyday life, then I would expect that greater use of memory aids on the lab task and on the MCQ would be related to fewer self-reported memory errors in everyday life. This may be particularly true for older adults who are compensating for age-related declines in memory.

In sum, I examined age differences in the use and utility of memory compensation strategies. I studied participants' self-reported memory compensation use in everyday life (all three studies) and observed participants' actual use of an external memory aid in the lab (Studies 2 and 3). I also assessed the relation between use of memory aids and self-reported memory performance in everyday life (Studies 1 and 3) as well as the effect of memory aids on memory performance in the lab (Studies 2 and 3).

[2] If the MCQ is not related to memory aid use in the lab, however, it is not necessarily damning with respect to the validity of the scale. The MCQ measures the frequency of self-reported memory aid use on a variety of different memory strategies and across a variety of different kinds of tasks in everyday life.

Chapter 2

Memory Compensation in Everyday Life: Study 1

In an initial session conducted in the laboratory, older and younger participants reported the frequency with which they used compensatory strategies to perform specific everyday memory tasks (e.g., remembering an appointment). They were then asked to complete an online questionnaire each evening for five consecutive days. They reported how often they experienced a variety of memory tasks that day (e.g., how many appointments did you have scheduled today?) and how frequently they had forgotten each task (how many appointments did you miss today because you forgot?). The memory tasks were largely prospective in nature.

Method

Participants

Participants were 30 younger (*M* = 20.03, *SD* = 1.99, 19 females) and 29 older (*M* = 75.82, *SD* = 5.31, 14 females) adults. Younger participants were recruited from undergraduate classes. Older participants were community-dwelling adults who volunteered through the Waterloo Research in Aging Pool (WRAP) at the University of Waterloo. Although individuals were recruited only if they were able and willing to complete the study online, three older participants who had difficulty with the technology completed a paper version of the daily questionnaire. Participants reported that they had no current or recent history of neurological problems (strokes, head injuries, etc.). Older (*M* = 15.27, *SD* = 3.28) and younger (*M* = 15.36, *SD* = 2.09) adults did not differ in the number of years of education that they reported, $F(1, 55) = 0.02$, $p = .90$, $\eta_p^2 = .00$. All participants except for three (one younger and two older) reported that their first language was English. Participants were paid $25 in appreciation for their participation.

Participants completed a series of cognitive assessment tests during the in-lab session: the National Adult Reading Test – Revised (NART-R; Blair & Spreen, 1989), the Digit Span Forward and Backward tests (Wechsler, 1997), and the Trail Making test (Partington & Leiter, 1949). The NART-R measures the number of pronunciation errors participants make when reading aloud a vocabulary list and was used to calculate the Full Scale IQ (FSIQ) of participants in both age groups (Wiens, Bryan, & Crossen, 1993). Older adults ($M = 116.02$, $SD = 6.74$) scored higher on the FSIQ than younger adults did ($M = 108.00$, $SD = 5.85$), $F(1, 55) = 23.03$, $p < .01$, $\eta_p^2 = .30$.

The Digit Span task measures working memory capacity. Participants repeat strings of 3 to 9 digits read to them by the experimenter either in the same (Digit Span Forward) or reversed (Digit Span Backward) order. No significant age differences emerged on either the digit span forward, $F(1, 55) = 0.30$, $p = .86$, $\eta_p^2 = .00$, or backward, $F(1, 55) = 0.001$, $p = .98$, $\eta_p^2 = .00$.

The Trail Making task is a measure of cognitive flexibility and inhibitory control. Participants are timed while they trace a pattern of numbers alone (Part A) or numbers to letters (Part B), without making errors or lifting their pen from the page. Older adults were significantly slower than the younger adults were at completing both Part A (older adults, $M = 28.94$, $SD = 7.48$, younger adults, $M = 18.01$, $SD = 5.57$), $F(1, 55) = 38.79$, $p < .01$, $\eta_p^2 = .42$) and Part B (older adults, *M* = 77.50, *SD* = 33.08, younger adults, *M* = 33.69, *SD* = 10.91), F (1, 55) = 45.73, $p < .01$, $\eta_p^2 = .45$).

Procedure

The first session took place in the lab or (for seven older adults) in the participant's own home. Participants answered a questionnaire on their use of memory strategies in everyday life. The questionnaire included five different types of everyday memory tasks: recalling the location of keys, remembering to attend regular (e.g., exercise classes) and non-regular (e.g., dentist appointments) events, remembering to take medication, and remembering to complete chores (e.g., retrieving dry-cleaning). For each type of task, participants indicated on a scale of 0 (never) to 3 (often) whether they used a memory aid or strategy to keep track of the task, and how often they relied solely on their memory. Participants also described what type of memory aid or strategy they used (open-ended). Next, participants completed several cognitive assessment measures including the National Adult Reading Test (NART), the digit span forward and backward tasks, and the Trail Making task. Finally participants were given a unique password and a link to the online website.

After this session, participants were asked to complete the online questionnaire for five consecutive days (Monday through Friday) each evening before they went to bed. If they were unable to complete the questionnaire at the end of the day, they could fill it out by noon the following day. Participants' data were excluded from analyses if they failed to complete the online questionnaire for at least three of the five days during the week. One older and one younger adult were excluded because they completed only one of the online questionnaires, leaving a total of 29 younger and 28 older participants.

For each of the five tasks included in the memory strategy questionnaire, participants reported how often they confronted that task during the day (e.g., how many regular appointments did you have scheduled today?), and how often they forgot or were delayed in performing each task because of memory (e.g., How many appointments did you miss or were late for today because you forgot about them? How many times were you unable to immediately find your keys today?).

Results and Discussion

Gender was not a significant predictor in preliminary analyses therefore gender is not included as a factor in the analyses reported below.

Use of Memory Compensation Strategies

In the first lab session, participants rated how frequently they used a strategy and to what extent they relied on their memory for 5 common tasks: remembering where they put their keys, regular events, irregular appointments, medications, and household chores. Although strategy use and memory reliance tended to be negatively correlated, the size of the correlations differed across memory tasks. Strategy use and reliance on memory were more highly correlated for regular events, $r(55) = -.55$, $p < .01$, medication, $r(36) = -.57$, $p < .01$, and chores, $r(57) = -.37$, $p < .01$, than for keys, $r(56) = -.18$, $p > .05$, or non-regular appointments, $r(55) = -.13$, $p > .05$.

Compensation use and memory reliance for each memory task were submitted to a univariate ANOVA with age as a between subjects factor. Older adults reported using memory compensation strategies more frequently than younger adults to help them recall regular appointments, $F\ (1, 53) = 10.42$, $p < .01$, $\eta_p^2 = .16$, medications, $F\ (1, 36) = 4.53$, $p < .05$, $\eta_p^2 =$

.11, and chores, F (1, 55) = 9.70, $p < .01$, $\eta_p^2 = .15$. Older adults reported relying on their memory less often than younger adults when trying to remember regular events, F (1, 55) = 16.92, $p < .01$, $\eta_p^2 = .24$, and chores, F (1, 55) = 4.71, $p < .05$, $\eta_p^2 = .08$. In general when averaged across all of the different types of tasks, older adults reported using memory compensation strategies more frequently, F (1, 55) = 18.32, $p < .01$, $\eta_p^2 = .25$, and relying on their memory less often, F (1, 55) = 6.87, $p < .05$, $\eta_p^2 = .11$, than younger adults (see Table 1).

Participants described the strategies that they used for each type of task. Older adults typically reported using a smaller variety of compensation strategies per task (*M* = 1.25, *SD* = 0.32) than younger adults did (*M* = 1.43, *SD* = 0.36), F (1, 55) = 4.02, $p = .05$, $\eta_p^2 = .07$. An examination of participants' strategies revealed five main categories of strategy: location (e.g., always leaving keys in the same place), time (e.g., always taking pills at the same time each day), internal strategies (i.e., mnemonics), external memory aids (e.g., notes, calendars, or technological aids), and memory (i.e., relying on information to pop to mind). I calculated the number of times participants listed each strategy across the five types of tasks[3].

Older adults and younger adults did not differ in their reported use of location, F (1, 55) = 0.72, $p = .79$, $\eta_p^2 = .00$, time, F (1, 55) = 2.28, $p = .14$, $\eta_p^2 = .04$, or mnemonics, F (1, 55) = 0.12, $p = .73$, $\eta_p^2 = .00$ (see Table 2). Older adults reported using more strategies that involved external memory aids, F (1, 55) = 9.73, $p < .01$, $\eta_p^2 = .15$, and fewer strategies relying on memory, F (1, 55) = 5.40, $p < .05$, $\eta_p^2 = .09$ than younger adults did. No other effects were significant.

[3] Because there was a significant difference in the average variety of strategies that older and younger adults reported using, only the first (and presumably most frequently used) strategy listed in their descriptions was coded.

Table 1

Self-Reported Strategy Use and Memory Reliance on Everyday Tasks

	Strategy Use						Reliance on Memory					
Type of Task	Older adults			Younger adults			Older adults			Younger adults		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Keys	2.61	0.88	28	2.29	0.71	28	1.89	0.96	28	1.71	1.08	28
Regular Events	2.46*	0.76	26	1.62	1.12	29	1.93*	1.02	28	2.79	0.49	29
Irregular Appointments	2.89	0.42	27	2.82	2.82	28	0.86	0.76	28	1.24	0.79	29
Medication	2.58*	1.03	26	1.75	1.29	12	1.88	1.12	24	2.08	1.00	12
Chores	2.11*	1.07	28	1.21	1.11	29	1.54*	1.04	28	2.10	0.94	29
Mean across all tasks	2.53*	0.45	28	1.94	0.58	29	1.60*	0.66	28	1.98	0.38	29

Note. *p<.05

Table 1

Self-Reported Strategy Use and Memory Reliance on Everyday Tasks

	Strategy Use						Reliance on Memory					
Type of Task	Older adults			Younger adults			Older adults			Younger adults		
	Mean	SD	N	Mean	SD	N	Mean	SD	N	Mean	SD	N
Keys	2.61	0.88	28	2.29	0.71	28	1.89	0.96	28	1.71	1.08	28
Regular Events	2.46*	0.76	26	1.62	1.12	29	1.93*	1.02	28	2.79	0.49	29
Irregular Appointments	2.89	0.42	27	2.82	2.82	28	0.86	0.76	28	1.24	0.79	29
Medication	2.58*	1.03	26	1.75	1.29	12	1.88	1.12	24	2.08	1.00	12
Chores	2.11*	1.07	28	1.21	1.11	29	1.54*	1.04	28	2.10	0.94	29
Mean across all tasks	2.53*	0.45	28	1.94	0.58	29	1.60*	0.66	28	1.98	0.38	29

Note. *p<.05

Table 2 Mean Number of Times Participants Reported Each Type of Strategy						
Strategies	**Older Adults**			**Younger Adults**		
	Mean	**SD**	**N**	**Mean**	**SD**	**N**
External Aids	2.96*	1.04	28	2.10	1.05	29
Internal Strategies	0.07	0.26	28	0.10	0.41	29
Location	1.07	0.54	28	1.03	0.50	29
Time	0.32	0.55	28	0.14	0.35	29
Memory	0.25	0.65	28	0.66*	0.67	29
*p<.05						

Forgetting of Everyday Memory Tasks

Participants completed the online questionnaire an average of 4.7 times during the diary week. Remembering to complete an online questionnaire each evening is a prospective memory task. On average, older and younger adults completed the same number of online diary questionnaires, F (1, 55) = 0.29, p = .51, η_p^2 = .01. Each day, participants reported the number of tasks they had scheduled and the number of errors that they made for each task. For the following analyses, participants are only included if they mentioned at least one instance of the task (e.g., one regular event) sometime over the five days.

Younger adults reported having a greater number of regular events, F (1, 51) = 49.86, p < .01, η_p^2 = .49, and irregular appointments, F (1, 47) = 3.98, p = .05, η_p^2 = .08, scheduled during the week compared with older participants. Older participants reported taking more medication, F (1, 37) =14.80, p < .01, η_p^2 = .29, than younger adults. Overall, older adults reported a greater number of tasks than younger participants, F (1, 55) = 13.61, p < .01, η_p^2 = .20. However, this age difference became non-significant when the medications task was omitted from the composite, F (1, 55) = 1.55, p = .22, η_p^2 = .03.

For every memory task assessed in the daily diary, I calculated the mean percentage of events that participants forgot (e.g., the percentage of regular events scheduled for that day that the participant forgot). I then calculated a mean percentage of forgetting for each task across the days that the participants filled out the questionnaire. This measure of forgetting was analyzed in a univariate ANOVA with age as a between subjects variable. Older adults reported forgetting a significantly smaller percentage of medications, F (1, 37) = 7.42, p = .01, η_p^2 = .17, than younger adults did. When forgetting was averaged across the five types of tasks, older adults reported forgetting a smaller percentage of tasks than younger adults did, F (1, 55) = 7.37, $p < .01$, η_p^2 = .12. See Table 3. The age difference remained significant even when the medications task was omitted from the composite, F (1, 55) = 5.98, p = .02, η_p^2 = .10.

Table 3						
Number of Tasks Reported Over 5 Days						
Type of Task	**Older adults**			**Younger adults**		
	MEAN	**SD**	**N**	**MEAN**	**SD**	**N**
Keys	13.36	7.66	28	13.08	8.86	25
Regular Events	2.96	1.65	24	9.38*	4.19	29
Irregular Appointments	2.78	1.88	22	4.00*	2.34	27
Medication	26.72*	15.74	27	8.67	5.50	12
Chores	5.19	4.88	26	3.57	3.65	23
Mean Percent of Tasks Forgotten Over 5 Days						
Type of Task	**Older adults**			**Younger adults**		
	MEAN	**SD**	**N**	**MEAN**	**SD**	**N**
Keys	5.74%	12.57%	28	11.27%	18.84%	25
Regular Events	1.39%	76.80%	29	5.60%	13.32%	24
Irregular Appointments	5.68%	13.21%	22	15.00%	25.14%	27
Medication	6.65%	12.42%	27	21.35%	21.22%*	12
Chores	5.77%	12.64%	26	15.33%	27.16%	23
Average across all tasks	5.06%	6.04%	28	12.47%	13.18%*	29
*p<.05						

Relation between strategy use and forgetting

To examine whether participants' reports of strategy use or reliance on memory mediated the relation between age and forgetting on everyday tasks, I conducted a series of multiple regression analyses. Age and strategy use (or memory reliance) were entered in the first level of the analysis and the interaction between strategy use (or memory reliance) and age was entered on the second level. I conducted separate analyses for each type of task.

In general, individual differences in self-reported frequency of strategy use were unrelated to memory performance in the daily diaries (see Table 4). Age and strategy use did not interact significantly on any task except for medication. Younger adults who reported using a strategy more frequently to help them remember to take medications forgot a greater percentage of pills than younger adults who reported rarely using a strategy. In contrast, frequency of strategy use failed to predict older adults' memory for taking medication. However, this interaction should be interpreted with some caution: Fewer than half of younger adults (N = 12) reported taking any kind of medication or vitamin pills.

Table 4 **The Effect of Strategy Use on Memory Performance**							
	B	SE(B)	β	*t*	Sig. (*p*)	ANOVA F	ANOVA (*p*)
Keys							
Age (0=young, 1=older)	-.06	.04	-.18	-1.30	.20	.69	.57
Strategy Use	-.02	.03	-.13	-.62	.54		
Age X Strategy	.01	.05	.05	.23	.82		
Regular Appointments							
Age (0=young, 1=older)	-.04	.03	-.18	-1.28	.21	.72	.55
Strategy Use	-.01	.02	-.10	-.52	.60		
Age X Strategy	.02	.03	.13	.70	.49		
Irregular Appointments							
Age (0=young, 1=older)	-.09	.06	-.21	-1.43	.16	1.21	.32
Strategy Use	.04	.03	.17	1.11	.27		
Age X Strategy	-.00	.05	-.01	-.04	.97		
Medication *							
Age (0=young, 1=older)	-.17	.04	-.49	-3.85	.00	9.29	.00
Strategy Use	.14	.04	.91	3.79	.00		
Age X Strategy	-.12	.05	-.66	-2.72	.01		
Chores							
Age (0=young, 1=older)	-.10	.06	-.23	-1.58	.12	1.18	.33
Strategy Use	.04	.04	.17	.79	.44		
Age X Strategy	-.01	.06	-.03	-.15	88		
Overall Forgetting *							
Age (0=young, 1=older)	-.09	.03	-.43	-.2.89	.01	2.96	.04
Strategy Use	.02	.02	.21	1.12	.27		
Age X Strategy	-.01	.03	-.04	-.22	.83		
*p<.05							

Self-reported memory reliance was similarly a poor predictor of forgetting on everyday memory tasks (Table 5). Reliance on memory did not predict forgetting of keys, regular events, irregular appointments, or chores. The interaction between age and memory reliance was significant only for the medication task. Memory reliance was not related to older adults' forgetting of medications over the five days. In contrast, younger adults who reported relying on their memory more often to take medications forgot fewer pills than those who reported relying less on their memory.

Table 5

The Effect of Memory Reliance on Memory Performance

	B	SE(B)	β	*t*	Sig. (*p*)	ANOVA F	ANOVA (*p*)
Keys							
Age (0=young, 1=older)	-.06	.04	-.20	-1.44	.16	1.95	.13
Memory Reliance	.06	.03	.37	1.87	.07		
Age X Memory	-.04	.04	-.16	-.80	.43		
Regular Appointments							
Age (0=young, 1=older)	-.04	.03	-.19	-1.40	.17	1.12	.35
Memory Reliance	-.03	.02	-.22	-1.19	.24		
Age X Memory	.03	.03	.15	.81	.42		
Irregular Appointments							
Age (0=young, 1=older)	-.09	.06	-.21	-1.43	.16	1.31	.28
Memory Reliance	-.02	.04	-.10	-.54	.59		
Age X Memory	.07	.06	.23	1.77	.25		
Medication *							
Age	-.16	.04	-.49	-.37	.00	8.99	.00
Memory Reliance	-.13	.04	-.82	-3.53	.00		
Age X Memory	.10	.04	.54	2.34	.03		
Chores							
Age	-.10	.06	-.23	-1.56	.13	1.41	.25
Memory Reliance	.04	.05	.16	.67	.51		
Age X Memory	-.08	.07	-.29	-1.20	.24		
Overall Forgetting*							
Age	-.09	.03	-.40	-2.89	.01	2.85	.05
Memory Reliance	-.02	.03	-.17	-.63	.53		
Age X Memory	.00	.03	.02	.07	.95		

*p<.05

In summary, older adults generally reported using compensatory strategies more frequently and relying less on memory than younger adults. Furthermore, older adults reported being less forgetful than younger adults across the five memory tasks. This age difference in forgetfulness remained even when I computed the proportion of errors that participants made out of the total number of tasks that they had scheduled. I found no direct evidence in the current study, however, that this age advantage in memory in favour of older adults was the result of a difference in the frequency with which older and younger adults used memory aids. Indeed, individual differences in self-reported frequency of strategy use failed to systematically predict memory performance. Also, controlling for performance on working memory (digit span forward and backward), intelligence (FSIQ), and inhibitory control (Trail Making) tasks did not alter the findings[4].

Similar to Cavanaugh et al. (1983), older participants in the current study reported using memory aids more frequently than younger adults. Unlike Cavanaugh et al. (1983), older adults did not report a greater number of memory errors. In fact, older participants reported both a smaller number and a smaller proportion of errors on everyday tasks compared with younger adults. Why is there such a discrepancy between the two studies? One major difference between the current study and that of Cavanaugh et al. (1983) is that in the current research participants reported memory errors within five specific domains (keys, regular events, irregular appointments, medications and chores). In Cavanaugh et al., participants were simply asked to

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[4] None of these tests (Digit Span Forward and Backward, FSIQ, and Trail Making) was related to strategy use and only one task, digit span backward, was associated with forgetting on everyday memory tasks, $\beta = .37$, $t(53) = 2.33$, $p < .05$. The better participants performed on the digit span backwards task, the greater percentage of tasks they reported forgetting on the online questionnaires.

keep a diary of memory incidents including memory errors and use of memory aids. The areas in which older adults reported more errors included names, objects, and routines. It is possible that older adults in the Cavanaugh et al. study may have reported more errors in domains (e.g., names) that were not tested in the current research. However, within the domains that were included in the current research, older adults reported fewer errors and this held true even when base rate was taken into account.

In Study 1, my goal was to examine the relation between strategy use and memory performance in everyday life. The strength of this design was that it allowed me to examine strategy use and memory performance within the context of specific everyday memory tasks. In the daily diaries, I studied participants' reports of their performance on everyday memory tasks. However, there were a number of limitations to this research that make it difficult to draw any firm conclusions from the findings. In this study, I measured strategy use and memory performance in two separate sessions. Asking participants to report their strategy use over the five days might have influenced both the extent to which they used a strategy and their performance on the memory tasks, although this seems unlikely given that there was little evidence of a relation between strategy use and memory errors in this study. It should be noted, however, that I created the report of strategy use specifically for the current study so its reliability is unknown.

Another limitation is that I relied on self-report for both strategy use and memory performance in this study. Although participants' self-reported forgetting was assessed on a daily basis, it is possible that participants (and perhaps particularly older adults) could have forgotten some of their own memory errors by the end of the day. In Study 2, I addressed these limitations by examining age differences in strategy use and memory performance in the lab using an experimental design. I manipulated the potential for using a memory aid and measured the effect of using the aid on memory performance.

Chapter 3

Memory Compensation in the Lab: Study 2

This study had two primary goals. I examined whether older adults would be more likely than younger adults to use a memory aid when one was available. SOC theory predicts that to the extent that there is not a large cost to using a memory aid, older adults should be more likely to take advantage of the opportunity to engage in compensation. In the current study, half of the participants had the opportunity to write down the phone messages that they were going to recall later. Externalizing information by writing it down is a strategy that people can use to reduce the burden on internal resources. Therefore, to the extent that older adults are motivated to use compensatory strategies, then they should be more likely than younger participants to write down the messages when they are permitted to do so. I also assessed the relation between using a memory aid and participants' ability to remember the phone messages. I examined whether aids appear to be particularly useful to older adults, as some theorists have hypothesized (Bäckman & Dixon, 1992; Baltes & Baltes, 1990; Craik, 1986; de Frias & Dixon, 2005).

In Study 2, older and younger participants were presented with two tasks. They were asked to create a seating plan for a fictitious wedding and to remember a series of phone messages and pass them on to the experimenter. I chose the phone message task because it represented a common everyday memory task that would be familiar to both older and younger adults.

I focused on participants’ use of external memory aids rather than other types of memory compensation strategies. External memory aids are the kind of memory compensation strategy that people report using most frequently in everyday life (Dixon, de Frias, & Bäckman, 2001; Dixon & de Frias, 2004, Harris, 1982, Intons-Peterson & Fournier, 1986). The experimental sessions were videotaped so that not only what participants remembered (the number of details from phone messages) but also their behavior could be coded. Each videotaped session was examined to assess to what extent participants searched for and used an external memory aid for their tasks. Unlike much of the previous research (e.g., Caprani et al., 2006; Vogels, Dekker, Brouwer, & de Jong, 2002), I assessed the effect of memory compensation on a retrospective rather than a prospective memory task. Presumably writing down information helps individuals remember not only future events but also current information that they need to remember.

Participants were told that they were involved in a job simulation task. They would create a seating chart for a wedding and inform the experimenter about phone messages (the memory task). Participants were randomly assigned to a memory aid or a no memory aid condition. In the memory aid condition, they were told that they could use anything in the room that they might find helpful to recall the phone messages. In real life, there is often a cost to using compensatory strategies (Dixon & Bäckman, 1995). For example, when writing down phone messages, individuals often have to search for a pen and paper. I reasoned that if participants were motivated to use a memory aid to help them with the task they would, if given the opportunity, search through the room for a pen as they might in their own homes.

I conceptualized the seating plan task primarily as a distractor. I chose this task because it was cognitively demanding but not overly taxing on memory resources. Nevertheless, I examined whether having a memory aid available for the phone message task would have any cost or benefit for performance on the seating plan task. It is possible that using a memory aid on the message task could free up cognitive resources and thereby enhance performance on the seating plan task.

Dixon et al.'s (2001) Memory Compensation Questionnaire (MCQ) was administered at the end of the study. The MCQ measures the frequency with which individuals report using different types of compensation strategies in everyday life. I included the MCQ in this study to replicate the findings from Study 1 that older adults report greater compensatory strategy usage. To my knowledge, the MCQ has never previously been administered to samples of both younger and older adults. As in Study 1, I also assessed whether self-ratings of memory compensation use predicted use of a memory aid, when it was potentially available.

Method

Participants

Forty-nine younger (30 women) and 45 older (29 women) adults participated in the study. Data from two younger and two older adults were omitted from the analyses either because of experimenter error (one younger and two older adults) or because participants declined to allow their experimental session to be video-taped (one younger adult). Younger adults were undergraduate students aged 18 to 25 (M = 20.16, SD = 1.54) enrolled in an introductory class in psychology. They received partial course credit for their participation. Older participants were community-dwelling adults aged 65 to 84 (M = 74.72, SD = 5.47) recruited through the Waterloo Research in Aging pool. They received $10 in appreciation for their participation. On average, participants reported 15 years of education, with no difference due to age (M = 15.35, *SD* = 3.73, for older adults, *M* = 15.64, *SD* = 2.05, for younger adults), $F(1, 84) = 0.20$, $p = .66$, $\eta_p^2 = .00$. All participants reported that they were in good physical and mental health. None of the participants in Study 2 had taken part in the previous study.

Procedure

Prior to coming into the lab, participants were asked to leave their belongings in another room so that they would only be able to use the materials that were provided for the experiment. The lab room was designed to resemble a home office. There were desks on two sides of the room with two chairs back to back. The room included a comfortable chair, a plant, a kettle, and books on a shelf.

For the first part of the study, participants were asked to take part in a job simulation task. They were told to imagine that the experimenter was organizing a wedding for her cousin. Their job was to help her with some of her tasks. Their first task was to set up a seating chart for the wedding. They were given information about each of the guests coming to the wedding. This information was in the form of a logic puzzle. Some of the guests (e.g., the bride and groom, specific friends, and members of the same family) requested to be seated at the same table. Some guests disliked each other and needed to be seated at separate tables. Other individuals requested to be seated in specific locations (e.g., near the podium or near the door). Participants were to plan seating for each guest without violating any of the requests.

Participants worked on the puzzle using a large chart that was set up on the desk at the back of the room. Names of the guests were listed on cards in alphabetical order on the side of the chart. Participants were asked to place each name card by one of the tables drawn onto the chart. Instructions for this task were laminated so that participants could not write notes as they were working on the puzzle. Participants worked on this task for 22 minutes and then were stopped. Only one younger participant managed to complete the seating chart task within the time given.

Participants were informed that while they were setting up this wedding chart, they would be receiving "phone messages" that they should pass on to the experimenter. Phone messages were played on a laptop computer that was set up on a desk at the front of the room. Messages were played using E-Prime software. Participants were provided with an example message prior to the start of the experiment so that they could get an idea of the type of messages they would be hearing. With participants' permission, each session was videotaped using a webcam mounted on the top of the laptop.

During the course of the task, participants were presented with six messages that occurred at intervals of 5, 8, 11, 15, 18 and 21 minutes into the experiment. When a message was available, participants would hear the sound of a ringing telephone. They had to press a spacebar on the laptop to hear the message and the message would play only once. The experimenter left the room at the beginning of the task and returned to request her messages 12 minutes (for message 1-3) and 22 minutes (for messages 4-6) into the experiment. After the experimenter picked up the second set of messages, the job simulation task was declared complete regardless of whether participants had completed the seating plan task.

Participants were randomly assigned to one of two memory compensation conditions for the phone message task. In the no memory aid condition, participants were instructed that they had to use their memory to keep track of the messages. Individuals in the memory aid condition were told to “feel free to look around and use anything in the room that might be helpful” for this task. The room was staged to be deliberately messy, with random papers stacked on the desk and other objects such as rulers, tissues, etc. around the room. To make using a memory aid slightly difficult, a dead pen was placed in a penholder on the desk and a working pen was hidden in the desk drawer where participants had to search for it.

Following the job simulation task, participants were administered the Memory Compensation Questionnaire (MCQ; Dixon et al., 2001). The original MCQ was a 44-item scale. The compensatory strategies measured by the MCQ include: external memory aids (e.g., writing down information), internal memory strategies (e.g., repetition of information), time (spending more time processing information), effort (concentrating harder to process information), and reliance on others (i.e., relying on a spouse to help remember information). The original MCQ also included items measuring motivation to remember information accurately and perceptions of change in memory over the past five to ten years. For the current study, I omitted the five items measuring change in memory, resulting in a scale with 39 items. Many of the younger adults were children or adolescents ten years earlier. Perceptions of change in memory compensation would be difficult to interpret in this age group. Items on the MCQ are measured on a 5-point scale with higher numbers representing more of the compensatory behavior.

Results

Preliminary analyses revealed no effects of gender so gender was not included as a factor in the analyses reported below.

Do Older Adults Use Memory Aids More Frequently?

The videotaped sessions of all participants in the memory aid condition were coded for whether participants a) tried the dead pen on the desk (67% of younger and 68% of older adults did so), b) searched the room for a working pen (57% of younger and 73% of older adults did so), and c) wrote down the phone messages (47% of younger and 52% of older adults did so). A chi-square analysis revealed no significant age differences on any of these measures (all *p*'s > .05). Regardless of their ages, some participants tried the dead pen, searched for an alternative, or used the functioning pen to record the messages when they were allowed to do so; others did not. The videos were also coded for d) the time in the session when participants began searching for a pen, e) the length of time (in seconds) that participants spent searching for a memory aid, and f) the number of seconds participants spent writing down the phone messages. Age was unrelated to when (in minutes) participants began searching for a memory aid (Older Adults: *M* = 2.75, *SD* = 2.64; Younger Adults: *M* = 3.80, *SD* = 2.96) or the number of seconds that they spent writing down the messages (Older adults: *M* = 154.27, *SD* = 59.06; Younger Adults: *M* = 121.00, *SD* = 57.28) (all p's > .05). However, of those participants who did search for a memory aid, older adults (*M* = 44.31, *SD* = 32.17) did spend a longer amount of time searching than did their younger counterparts (*M* = 22.06, *SD* = 18.04), F (1, 31) = 6.11, p = .02, η_p^2 = .17.

Although participants were asked to leave their belongings in a separate room, some participants in the memory aid condition managed to bring and use their own aids for the phone message recall task. One younger adult took notes on a cell phone. Two older adults had pens in their pockets and used those for the experiment. One older adult took notes on the computer playing the messages. Other participants were creative in their use of a writing instrument and paper. Three participants (two older and one younger) wrote with the dead pen on the desk. They scratched hard on the paper and then held it up to the light to read their messages. Another three participants (one older and two younger) wrote with the highlighter they found in the desk. When these participants were excluded from the analyses, there was still no age difference in the percentages of younger and older adults who used a memory aid when they were allowed to do so ($p > .05$).

When participants chose to write down or not to write down the messages, they generally used that strategy throughout the entire experimental session. Only four participants (1 older and 3 younger) switched strategies (i.e., switched from not writing to writing or vice-versa) during the experiment and they all did so immediately after the first message.

To examine the quality of memory aids that older and younger participants created, two research assistants, blind to condition and participants' age group, assessed the number of correct details that participants included in their written messages. The raters coded the messages for both specific and core details. Specific details included information such as proper names, dates, times and facts from the messages (e.g., call LockCo Automotive). Core details included information that was necessary to respond appropriately to the message (e.g., call the auto repair shop). Agreement between the coders was high for both specific (Kappa = 0.84 ($p<.01$), 95% CI (0.80, 0.89)) and core details (Kappa = 0.73 ($p <.01$), 95% CI (0.66, 0.81). Coding from the first rater was used for the analyses. Written messages for one older and two younger participants were unavailable. The messages from these participants were illegible or had been erased (e.g., participant wrote the messages on her cell phone). The proportions of details that participants wrote down for each message were calculated.

Older (*M* = 0.75, *SD* = 0.11) and younger (*M* = 0.76, *SD* = 0.12) adults did not differ in the proportions of specific details that they included in their written messages, $F(1, 18) = 0.31$, $p = .86$, $\eta_p^2 = .00$. Older and younger adults also did not differ in the proportions of core details from the messages that they wrote down, $F(1, 18) = 0.33$, $p = .57$, $\eta_p^2 = .02$. Although the sample size was small (nine younger and 11 older adults), the data offer no indication that older and younger adults differed in the precision of the memory aids that they created.[5]

Accuracy in Recall: Proportion of Specific Details Remembered

Two coders, blind to condition, assigned one point for each correct detail that participants provided to the experimenter. The raters again coded for both specific and core details. Agreement between the coders was high for both specific, Kappa = 0.93 (p <.01), 95% CI (0.92, 0.95), and core details, Kappa = 0.92 (p <.01), 95% CI (0.90, 0.94). The ratings from the first coder were used for the analyses. The proportion of correct details out of the total number of specific message details (31 points) was computed for each participant (see Table 6). The data were entered into a 2 (age: young, old) x 2 (condition: memory aid, no memory aid) ANOVA. The memory aid condition in this analysis included the recall of all of those participants who could have used a memory aid for the task, not just those who did write down the messages.

Main effects of age group $F(1, 85) = 15.72$, $p < .01$, $\eta_p^2 = .16$, and memory aid condition $F(1, 85) = 5.93$, $p = .02$, $\eta_p^2 = .07$, were significant. Older adults (*M* = 0.54, *SD* = 0.21) provided

[5] Older and younger adults also did not differ in the proportions of gist details from the messages that they wrote down, $F(1, 18) = 0.33$, $p = .57$, $\eta_p^2 = .02$.

fewer details than younger adults did (*M* = 0.69, *SD* = 0.17). Participants who were allowed to use a memory aid (*M* = 0.66, *SD* = 0.22) provided more details than participants did in the no memory aid condition (*M* = 0.57, *SD* = 0.18). These effects were qualified by an interaction between age group and memory aid condition, $F(1, 85) = 7.98$, $p < .01$, $\eta_p^2 = .09$. When no memory aid was available, older adults (*M* = 0.44, *SD* = 0.13) provided significantly fewer correct details from the phone messages than younger adults did (*M* = 0.69, *SD* = 0.12), $F(1, 41) = 44.79$, $p < .051$, $\eta_p^2 = .52$. When the memory aid was available, this age difference was no longer significant. Older adults (*M* = 0.64, *SD*=0.22) recalled as many details as younger adults (*M* = 0.68, *SD*=0.21), $F(1, 44) = 0.46$, $p = .50$, $\eta_p^2 = .01$. To describe the interaction a different way, the proportion of details reported by younger adults did not differ between the memory aid (*M* = 0.68, *SD* = 0.21) and the no memory aid (*M* = 0.70, *SD* = 0.12) conditions, $F(1, 43) = 0.83$, $p = .78$, $\eta_p^2 = .00$. Older adults, however, reported a significantly greater proportion of details in the memory aid (*M* = 0.64, *SD* = 0.22) than in the no memory aid (*M* = 0.44, *SD* = 0.13) condition, $F(1, 42) = 12.77$, $p < .01$, $\eta_p^2 = 23$.

Not every participant in the memory aid condition wrote down the messages that they heard. To examine the effect of using the memory aid on participants' recall of the phone messages, I split participants in the memory aid condition into 2 groups: those who did and those who did not write down the messages. Each group included a fairly small number of participants. The groups included 11 younger adults and 12 older adults in the memory aid used condition, and 12 younger and 11 older adults in the no memory aid used condition. I analyzed recall of phone message details using a 2 (age group: older, younger) x 2 (Use of aid: used pen, did not use pen) ANOVA.

The main effect of memory aid use was significant, $F(1, 42) = 33.29$, $p < .01$, $\eta_p^2 = .44$. Those participants who used the pen to write down the messages recalled more details ($M = 0.80$, $SD = 0.11$) than did those who relied on their memory ($M = 0.52$, $SD = 0.21$). No other effects were significant. Older and younger adults who wrote down the messages when they had the opportunity to do so remembered more details than those who chose not to use the memory aid.

Accuracy in Recall: Proportion of Core Details Remembered

The above analyses reveal that the accuracy of younger adults' phone messages was unaffected by whether they were in the memory aid or the no memory aid condition. On average, younger adults recalled about 68% of the details so their performance did not appear to be at ceiling. It is possible, however, that participants in this study did not try to provide all of the details from the messages, but rather only those details that they considered most important to communicate the gist of the message. In everyday life, people probably try to provide the core details of a phone message, rather than its exact words.

To examine core details, I recomputed the measure of accuracy, focusing on details that would be most important for a recipient to respond effectively to the message. Participants received one point for recalling the name or description of the person or business that called. They also received points for providing the essence of the message (e.g., there is a problem). Finally, participants received one point for each piece of information that was necessary for the recipient to respond appropriately to the message – e.g., appointment = 1 point, tomorrow =

1point, 10:30 am = 1point. In total, participants could receive a total of 23 points for recalling the core details of the messages.

This scoring of core details yielded exactly the same findings as the more detailed scoring system. Most important, the interaction between age and condition remained significant, $F(1, 85) = 8.97$, $p < .01$, $\eta_p^2 = .10$. Older ($M = 0.69$, $SD = 0.18$) and younger ($M = 0.69$, $SD = 0.18$) participants did not differ in the proportion of core details that they provided in the memory aid condition, $F(1, 44) = 0.00$, $p = .97$, $\eta_p^2 = .00$. Younger adults ($M = 0.74$, $SD = 0.15$) recalled a significantly greater proportion of core details than older adults ($M = 0.52$, $SD = 0.19$) in the no memory aid condition, $F(1, 41) = 18.65$, $p < .01$, $\eta_p^2 = .31$). Younger adults provided a similar proportion of core details in the memory aid ($M = 0.69$, $SD = 0.18$) and no memory aid conditions ($M = 0.75$, $SD = 0.15$), $F(1, 43) = 1.25$, $p = .27$, $\eta_p^2 = .03$. Older adults provided more core details in the memory aid ($M = 0.69$, $SD = 0.18$) than in the no memory aid ($M = 0.52$, $SD = 0.19$) condition, $F(1, 42) = 9.03$, $p < .01$, $\eta_p^2 = .18$).

As with specific details, I examined the proportion of core details reported by participants who did and did not use the pen in the memory aid condition. In the memory aid condition, participants who used the memory aid ($M = 0.80$, $SD = 0.11$) reported a greater proportion of core details than those who did not ($M = 0.59$, $SD = 0.18$), $F(1, 42) = 22.33$, $p < .01$, $\eta_p^2 = .70$. No other effects were significant.

Memory Compensation Questionnaire (MCQ)

Older adults reported relying more on external memory aids in everyday life, $F(1, 86) = 44.14$, $p < .01$, $\eta_p^2 = .34$, and exerting more effort to remember information, F (1, 86) = 16.20, p

$< .01$, $\eta_p^2 = .16$, than younger adults did. Older and younger adults did not differ in their reported use of internal memory strategies, $F(1, 85) = 3.15$, $p = .08$, $\eta_p^2 = .04$, in the extent to which they relied on others to help them remember, $F(1, 86) = 0.20$, $p = .66$, $\eta_p^2 < .01$, or in the extra time they took to process information, $F(1, 86) = 1.29$, $p = .26$, $\eta_p^2 = .02$. Older adults also reported being more motivated to perform well on memory tasks, compared with younger adults, $F(1, 86) = 5.17$, $p = .04$, $\eta_p^2 = .06$. Averaging across all five types of strategies, older adults reported using more compensatory strategies than younger adults did, $F(1, 86) = 17.25$, $p < .01$, $\eta_p^2 = .17$ (see Table 6).

Table 6
Memory Compensation Questionnaire for Study 2

Types of Compensation	**Older Adults**		**Younger Adults**	
	Mean	SD	Mean	SD
External Aids	4.38*	0.42	3.54	0.72
Internal Strategies	3.35	0.55	3.14	0.59
Time	3.21	0.50	3.05	0.79
Effort	3.83*	0.58	3.30	0.65
Relying on Others	2.22	0.86	2.14	0.74
Motivation	2.93*	0.65	2.58	0.80
Overall Average	3.49*	0.34	3.10	0.51
*p<.05				

Although older adults reported using more strategies, both age groups were similar in the kinds of strategies that they were most likely to use. Both older and younger participants reported using external memory aids most frequently, followed by effort, internal memory strategies, time, and relying on others. This pattern of preferred compensation strategies is identical to that found by Dixon and deFrias (2004) in a larger sample of older adults.

Self-reported use of external memory aids on the MCQ was not significantly correlated with memory aid use in the memory aid condition for either age group (older adults, $r(22) = .03$, $p = .89$; younger adults, $r(23) = .30$, $p = .16$). Participants' self-reported use of compensation strategies was similarly unrelated to the proportion of details that they recalled from the phone messages (all *p*'s > .05).

Seating Chart Task

Participants were awarded one point for every name that they correctly placed on the seating chart without violating any of rules of the puzzle (e.g., placing two people who disliked each other at the same table) for a possible total of 34 points. Older adults placed significantly fewer correct names ($M = 19.36$, $SD = 6.82$) on the seating chart than younger adults did ($M = 27.71$, $SD = 4.02$), $F(1, 74) = 42.95$, $p < .01$, $\eta_p^2 = .37$[6]. No other effects were significant. Whether older and younger adults used a memory aid when one was available similarly had no relation to their performance on the seating plan task, $F(1, 37) = 0.51$, $p = .48$, $\eta_p^2 = .01$.

I also computed the number of errors (names placed incorrectly) and misses (names not placed at all) for the seating chart task. Older adults made more errors ($M = 8.92$, $SD = 5.15$) on the task than younger adults did ($M = 6.17$, $SD = 3.97$), $F(1, 74) = 37.39$, $p < .01$, $\eta_p^2 = .31$. Older adults also omitted more names from the seating plan chart ($M = 5.72$, $SD = 7.40$) than did their younger counterparts ($M = 0.12$, $SD = 0.63$), $F(1, 74) = 22.80$, $p < .01$, $\eta_p^2 = .27$. No other effects were significant.

[6] Seating plan scores from 11 participants were not available because of poor image resolution quality.

In sum, older adults performed more poorly than younger adults on the seating plan task. They made more errors and placed fewer names correctly. There was no evidence in this study of either a cost or a benefit of using a memory aid on performance on the seating plan task.

Discussion

SOC theory suggests that older adults may be more likely than younger adults to use a compensation strategy when one is available. Study 2 did not find support for this hypothesis. Older adults were no more likely than younger participants to use a memory aid when one was available. Older adults and younger adults did not differ in whether they searched for a pen, when in the trial they searched for a pen, or whether they wrote down the phone messages. Those older adults who did look for a pen spent longer searching than their younger counterparts; however, this finding is difficult to interpret. On the one hand, older adults may have spent more time looking for a pen because using they were more motivated to use a compensatory strategy. On the other hand, older adults may have been less efficient in their search strategies and therefore took longer to find the pen.

These results are consistent with Einstein and McDaniel (1990), Patton and Meit (1993), and Rendell and Thomson (1999) who found no age differences in observed or self-reported use of compensation strategies. Behavioural findings in Study 2 are not consistent with Study 1 of the current paper, Moscovitch (1982), or Cavanaugh et al. (1983), who found that older participants reported using more external memory aids than younger adults did.

In contrast, results from the MCQ (a self-report questionnaire) in the current study are consistent with the results from Study 1. In Study 1, older adults reported using compensation strategies more frequently than younger adults across a variety of different tasks. On the MCQ, older participants in Study 2 reported using memory compensation strategies more often in everyday life than younger participants did. However, when offered the opportunity to use a memory aid in the experiment, approximately the same percentage of both older and younger participants did so. The written memory aids that participants in both age groups created contained the same number of message details.

The lack of congruence between self-report measures and observed memory aid use may indicate that self-report measures of compensation misrepresent compensation use in everyday life. Conceivably, older adults' responses on the MCQ reflect, in part, how they believe they should act rather than how they actually behave. Alternatively, it is possible that some participants in the current study, regardless of their age, did not feel comfortable hunting for a pen in a strange office, despite our experimental instructions that they could use anything in the room that they might find helpful. Perhaps a greater percentage of older adults would have preferred to use a memory aid on the task but felt constrained from doing so. Study 3 addresses this possibility by making the pen more visible and easily accessible to participants in the memory aid condition.

The second goal of the current study was to examine age differences in the usefulness of external strategies for remembering information. Although older adults in Study 2 were no more likely to use a memory aid than younger participants, having a pen available to them did greatly improve their performance. When participants were not permitted to use a memory aid, the typical age difference in memory was evident. When participants were allowed to use a memory aid, older and younger adults reported a similar number of details from the phone messages. This result is consistent with environmental support theory which predicts that when strong cues are available at the time of retrieval, age differences in memory performance are diminished. However, the finding is different from Einstein and McDaniel (1990) who found that using a written memory aid helped both age groups but did not eliminate age differences in memory. One possible explanation for the pattern of results in the current study is that the memory task in Study 2 may not have been sufficiently difficult for younger adults. Although younger participants' recall was not at ceiling, they did remember an impressive number of details from the phone messages. It is possible that using a memory aid may be more helpful for younger adults when the task is more difficult and they have greater need of retrieval cues. In Study 3, I made the task more difficult for everyone by giving participants more phone messages to recall and two seating plans to complete over a shorter period of time.

Chapter 4

A Repeated Measures Design: Study 3

A limitation of Study 2 was that the number of participants who used the memory aid was relatively small (12 older and 11 younger participants). In Study 3, I addressed this problem by making memory aid availability a within-subject variable, allowing all participants to use a memory aid on one trial during the study. Participants completed two seating charts rather than one. One seating chart task required a pen (and a pen was provided). The second seating plan task (similar to Study 2) did not require a pen and no pen or writing utensil was available in the room. The goal in Study 3 was to examine whether older and younger participants would use the pen (when one was provided) to help them remember the phone messages that were played periodically during the experiment. Unlike Study 2, the pen in Study 3 was not hidden in a drawer; rather, it was tied to a clipboard on which the written version of the seating plan task was presented. Thus, in Study 3, I was able to compare older and younger adults' reports of the phone messages on trials when a pen was and was not available. All participants were able to use a memory aid in one condition, greatly increasing my sample size and thus allowing me to more effectively examine the link between age group and memory aid effectiveness.

In Study 2, some people in both age groups chose to use the pen and others did not. In Study 3, I used a within-subject design to assess whether people are well-calibrated in that those who stand to benefit more from an aid choose to use it. I used counterbalancing (i.e., whether the pen was available on the first but not the second trial or vice versa) to examine this question in two ways. The condition in which the pen was available on the second trial allowed me to examine whether participants in either age group who performed relatively poorly in recalling messages on the first trial were more likely to use a memory aid on the second trial. When the pen was offered on the first but not the second session, I examined the unaided performance of those who had or had not chosen to use a pen in the first session. This design allowed me to examine whether participants who chose to use the pen initially (presumably because they doubted their ability to recall the messages) performed more poorly in the second session than those who spurned the pen when it was available.

In Study 3, I also administered the same version of the Memory Compensation Questionnaire (MCQ) as in Study 2 and the Everyday Memory Questionnaire (EMQ). I included the EMQ as a measure of self-reported memory functioning in everyday life. This measure allowed to me examine whether older adults who used more memory compensation strategies (either on the lab task or on the MCQ) reported more or fewer memory errors in everyday life.

Method

Participants

Thirty-six younger adults aged 17 to 31 (M= 19.44; SD = 2.43) and 37 older adults aged 62 to 89 (M= 72.62; SD = 7.17) participated. Younger participants (19 women and 17 men) were recruited from psychology undergraduate classes at the University of Waterloo and received a course credit. Older participants (28 women and 9 men) were community dwelling adults recruited through the Waterloo Research in Aging Pool. Participants, on average, reported 14.44 years of education (M_{OLDER} = 14.38, SD = 3.15; $M_{YOUNGER}$ = 14.50, SD =1 .40), F(1, 71) = 0.04,

p = .83, η_p^2 = .00). All participants reported being in good mental and physical health. None of the participants had taken part in either of the two previous studies.

Procedure

As in Study 2, participants were invited to take part in a job simulation task. Upon entering the lab room, participants were asked to leave all of their belongings (purses, pens, cell phones, etc.) in a large bin at the side of the room. Similar to Study 2, the lab room was set up to look comfortable, informal, and slightly cluttered.

Participants were told that they would be completing two tasks: a series of seating plan tasks and a phone message task. All participants were informed that throughout the experiment they could use anything in the room that they might find useful to help them with their tasks.

Across two trials, participants were given two seating plan tasks. The first task, similar to Study 2, involved placing name cards on a large seating chart. For the second task, participants had to write the names of the attendees on a paper copy of the seating chart. The paper version of the seating plan chart was presented to participants on a clipboard. A pen was tied to the clipboard with a very long string. The only way to complete the written version of the seating chart task was to use the pen provided. No other pens, pencils, highlighters or writing utensils of any kind were located anywhere in the room. Thus each participant completed two seating plan charts, one poster version (for which no pen was available) and one paper version (for which a pen was necessary and provided). There were two different seating plan tasks, the wedding seating plan task from Study 2 and a new but similar banquet seating chart task. For each task, participants completed a poster or a paper version of the seating plan chart. The wedding and banquet tasks were matched for length.

Participants had 15 minutes to complete each seating plan task. While they were working on the seating plan tasks, participants were presented with a series of five phone messages that they needed to pass on to the experimenter. The phone messages occurred 3, 5, 9, 12, and 14 minutes into the trial. The experimenter came in and asked for her messages at 10 and 15 minutes into each trial. In total, participants heard ten phone messages (two sets of five messages) throughout the session. The phone messages were played using E-Prime software. For each message, participants heard the sound of a phone ringing and pressed the spacebar on the computer to hear the message. Each message was played only once. The two sets of phone messages were matched for the number of words and details in the messages (set A contained a total of 29 details and set B contained 30 details).

After participants had worked on the first seating plan task for 15 minutes, they were told to stop and take a break. While the participant was resting, the experimenter removed the first seating plan task (including the clipboard with the pen if participants were working on a written seating plan task) and set up the second task. The experimenter reset her stopwatch and started the next set of phone messages when the participants started working on the second seating plan task. With participants’ consent, the entire session was videotaped through a webcam on the computer. This allowed the experimenter to later transcribe participants’ recounting of each phone message. Each aspect of the study was counterbalanced across participants, including the order of the seating plan tasks (wedding and banquet), the type of seating task (poster and written), and the sets of phone messages (set A and set B).

Once participants had worked on the second seating plan task for 15 minutes, the second seating plan task was removed. The experimenter took a photograph of the poster seating plan chart so it could be scored. As the final task in the study, participants completed the MCQ and the Sunderland et al. (1984) Everyday Memory Questionnaire. The EMQ is a 27-item measure on which participants rate the frequency of common everyday memory errors (e.g., tip-of-the-tongue errors, forgetting the names of famous faces, etc.) on nine point scales ranging from ‘Not at all in the past 6 months’ to ‘More than once a day’.

Results

As preliminary analyses revealed no effects of gender, it was not included as a factor in the following analyses.

Do Older Adults Use Memory Aids More Frequently?

I assessed the proportion of older and younger participants who used the pen and did not use the pen (when one was available) to write down the phone messages. Younger adults (M = 0.75) were marginally more likely than older adults (M = 0.54) to write down the messages, $x^2(1, N = 73) = 3.53$, $p = .09$. Younger participants were more likely to use the pen when it was available on the first but not the second trial (M = 0.94) than when it was available on the second but not the first trial (M = 0.56), $x^2(1, N = 36) = 8.33$, $p = .02$. Older participants were just as likely to use the pen regardless of whether the pen was available on the first (M = 0.59) or second trial (M = 0.50), $x^2(1, N = 37) = 0.29$, $p = .74$. Younger adults were more likely than older participants to use the pen when it was available on the first trial, $x^2(1, N = 35) = 6.87$, $p = .01$. The age groups did not differ when the pen was available on the second trial, $x^2(1, N = 38) = 0.12$, $p = .73$. As in the previous study, there was no evidence that older adults are more likely to use an available memory aid; indeed, the trend was in the opposite direction.

Similar to Study 2, some participants devised their own external memory aids when a pen was unavailable. Two younger adults etched the phone messages into paper using a safety pin or compass. Three participants (one younger and two older) ripped or folded paper into the shape of letters from the messages. One older participant traced out the phone messages in coffee. The two age groups were equally likely to use these alternative types of memory aids, $x^2(1, N = 73) = 0.01$, $p = 1.00$. The results reported below include all participants but do not change if these six participants are excluded from the analyses.

As in Study 2, I examined the quality of the memory aids that participants created. Two coders blind to condition counted the average number of correct details that participants included in their written memory aids. Agreement between the coders was high for both specific (Kappa = 0.89 (p<.01), 95% CI (0.86, 0.92) and core (Kappa = 0.82 (p<.01), 95% CI (0.78, 0.86)) details. Ratings from the first coder were used for the analyses. The proportions of correct specific and core details were calculated for each message. Similar to Study 2, there were no age differences in the proportions of specific details that older ($M = 0.66$, $SD = 0.15$) and younger participants ($M = 0.69$, $SD = 0.15$) included in their written messages, $F(1, 46) = 0.45$, $p = .51$, $\eta_p^2 = .01$.Older and younger adults also did not differ in the proportion of core details that they included in their written messages, $F(1, 46) = 0.60$, $p = .44$, $\eta_p^2 = .01$.

Accuracy in Recall: Proportion of Specific Details Remembered

The accuracy of the phone messages was calculated in the same way as in Study 2. Two researchers, blind to condition, coded each message for the number of specific and core details that participants recalled. Agreement between the coders was high for both specific, Kappa = 0.89 (p<.01), 95% CI (0.87, 0.90) and core details, Kappa = 0.88 (p<.01), 95% CI (0.86, 0.89). Ratings from the first coder were used in the analyses reported below. The phone messages in Trial 1 included a total of 29 specific details; those in Trial 2 included a total of 30 details. Because the two sets of phone messages differed slightly in the number of details in each set, I calculated the average (rather than the absolute) proportion of details participants recalled in each memory aid condition. Data were analyzed using a 2 (Memory Aid: Pen available, No Pen available) x 2 (Age group: Older, Younger) x 2 (Order: Pen available on first trial, pen available on second trial) Mixed ANOVA.

A main effect of age group was significant, $F(1, 69) = 22.36$, $p < .01$, $\eta_p^2 = .25$. Older adults ($M = 0.44$, $SD = 0.22$) recalled fewer details than younger adults did ($M = 0.62$, $SD = 0.17$). The main effect of condition was also significant, $F(1, 69) = 25.64$, $p < .01$, $\eta_p^2 = .27$. Participants recalled a greater proportion of details from the phone messages when a pen was available ($M = 0.60$, $SD = 0.24$) than when a pen was unavailable ($M = 0.46$, $SD = 0.19$). This effect was qualified by an interaction with counterbalanced order, $F(1, 69) = 6.08$, $p = .02$, $\eta_p^2 = .08$. Participants in the pen condition reported marginally more details when the pen was available on the first trial ($M = 0.65$, $SD = 0.23$) than when it was available on the second trial ($M = 0.54$, $SD = 0.24$), $F(1, 71) = 0.36$, $p = .55$, $\eta_p^2 = .01$. The order of the conditions had little effect on accuracy on the no memory aid trials, $F(1, 71) = 3.46$, $p = .07$, $\eta_p^2 = .05$. Unlike Study 2, the interaction between age group and memory aid condition was non-significant, $F(1, 69) = 0.53$, $p = .53$, $\eta_p^2 = .01$. Examination of the simple effects revealed that older, $F(1, 36) = 13.74$, $p < .01$, $\eta_p^2 = .28$, and younger $F(1, 35) = 9.82$, $p < .01$, $\eta_p^2 = .22$, adults, benefited similarly from the availability of the memory aid.

As in Study 2, I examined the average number of details recalled by participants who did and did not use the pen in the memory aid condition using a 2 (Memory Aid: Pen used, Pen Not Used) x 2 (Age group: Younger, Older) between-subjects ANOVA. Younger participants ($M = 0.68$, $SD = 0.18$) recalled a greater proportion of details than their older counterparts ($M = 0.51$, $SD = 0.27$), $F(1, 69) = 7.72$, $p = .02$, $\eta_p^2 = .08$. Participants who used the pen to write down the messages ($M = 0.71$, $SD = 0.15$) recalled a greater proportion of details than those who did not use the pen ($M = 0.38$, $SD = 0.24$), $F(1, 69) = 43.04$, $p < .01$, $\eta_p^2 = .38$. The interaction between age group and memory aid use was not significant, $F(1, 69) = 0.50$, $p = .48$, $\eta_p^2 = .01$. Using the memory aid helped both age groups equally.

I also compared the proportion of details reported in the no memory aid condition by participants who had and had not taken advantage of the pen when it was available. The purpose of this analysis was to examine whether participants who used the memory aid would differ from those who did not on a trial on which no one was permitted to write down the phone messages. The main effect of age group was significant, $F(1, 69) = 20.15$, $p < .05$, $\eta_p^2 = .23$. Younger adults ($M = 0.56$, $SD = 0.16$) recalled more details than older adults ($M = 0.36$, $SD = 0.17$). The main effect of memory aid use was not significant, $F(1, 69) = 0.32$, $p = .57$, $\eta_p^2 = .01$. The interaction between memory aid use and age group was also non-significant, $F(1, 69) = 0.04$, $p = .95$, $\eta_p^2 = .00$. Participants who chose to use the memory aid when it was available did not differ from those who did not when that memory aid was taken away from them. This was true for both age groups.

Accuracy in Recall: Proportion of Core Details Remembered

As in Study 2, I examined the number of core details participants reported for each message. Phone messages in Trial 1 included a total of 20 core details. Messages in Trial 2 included a total of 21 core details. I calculated the average proportion of core details reported by older and younger participants in the pen available and no pen conditions. Data were analyzed using a 2 (Memory Aid: Pen available, No Pen available) x 2 (Age group: Older, Younger) x 2 (Order: Pen available on first trial, pen available on second trial) Mixed ANOVA.

Using this scoring system there was an effect of condition, $F(1, 69) = 8.09$, $p < .01$, $\eta_p^2 = .11$. Participants in the pen condition ($M = 0.68$, $SD = 0.26$) reported a greater proportion of core details than did participants in the no pen condition ($M = 0.58$, $SD = 0.22$). A main effect of age group was also significant, $F(1, 69) = 27.85$, $p < .01$, $\eta_p^2 = .29$. Older adults ($M = 0.53$, $SD = 0.24$) reported fewer core details than younger adults ($M = 0.74$, $SD = 0.17$). More interestingly, there was a marginally significant interaction between age group and memory aid condition, $F(1, 69) = 3.56$, $p = .06$, $\eta_p^2 = .05$. Younger adults reported a slightly (but not significantly) greater proportion of core details in the memory aid (M = 0. 77, $SD = 0.19$) than in the no memory aid condition ($M = 0.72$, $SD = 0.15$), $F(1, 35) = 2.89$, $p = .10$, $\eta_p^2 = .08$. Similar to Study 2, older adults reported more core details when a pen was available ($M = 0.60$, $SD = 0.28$), than when a pen was unavailable (*M* = 0.45, *SD* = 0.19), $F(1, 36) = 11.14$, $p < .01$, $\eta_p^2 = .24$. Unlike Study 2, the age difference in core recall remained significant even when participants were able to use a pen, $F(1, 71) = 8.55$, $p < .01$, $\eta_p^2 = .11$. No other effects were significant.

I also examined the proportion of core details reported by participants who did and did not use the pen in the memory aid condition. Older adults (*M* = 0.60, *SD* = 0.28) reported fewer core details than younger adults (*M* = 0.77, *SD* = 0.19), $F(1, 69) = 5.97$, $p = .02$, $\eta_p^2 = .08$. There was also a main effect of memory aid use, $F(1, 69) = 48.48$, $p < .01$, $\eta_p^2 = .41$. Participants who used the pen (*M* = 0.81, *SD* = 0.13) reported a greater proportion of core details than those who did not (*M* = 0.46, *SD* = 0.26). The interaction between memory aid use and age group was non-significant, $F(1, 69) = 1.45$, $p = .23$, $\eta_p^2 = .02$.

In the no memory aid condition, older adults (*M* = 0.45, *SD* = 0.19) similarly reported fewer core details than younger adults (*M* = 0.72, *SD* = 0.15), $F(1, 69) = 31.70$, $p < .01$, $\eta_p^2 = .32$. However, participants who had used the pen in the memory aid condition were no more likely to recall core details from the phone messages in the no memory aid condition than those who had not, $F(1, 69) = 2.35$, $p = .13$, $\eta_p^2 = .03$. No other effects were significant.

Counterbalanced Conditions: Is Memory Aid Use Calibrated with Performance?

One of the goals of Study 3 was to examine the relation between participants' performance on the phone recall task and their adoption of an external memory aid when one was available. To that end, I examined the two counterbalanced conditions (order 1: pen available on first but not on second trial vs. order 2: pen available on second but not on first trial) separately.

For the first order condition (pen available on Trial 1, not available on Trial 2), I conducted regression analyses with memory aid use on the first trial as a predictor and the proportion of correctly recalled specific and core details on the second trial as dependent variables. As almost all younger participants (94%) used a pen when it was available on the first trial, we only conducted these analyses for older participants. Memory aid use on the first trial did not predict a significant amount of variance in recall of overall details on the second trial, $R^2 = .33$, $F(1, 15) = 1.80$, $p = .20$. Memory aid use in Trial 1 did, however, predict a significant amount of variance in recall of core details in Trial 2, $R^2 = .50$, $F(1, 15) = 4.98$, $p = .04$. Older adults who used the memory aid in Trial 1 recalled more core details on the second Trial even though the pen was no longer available to them, $\beta=.17$, $t(15)=5.90$, $p=.04$.

For counterbalanced order two (pen available on Trial 2, and not on Trial 1) a sufficient proportion of both older and younger adults used a memory aid on the second trial. Therefore, for order two, I conducted a logistic regression analysis with age group, proportion of correct memory details recalled on Trial 1, and the interaction between age and recall as predictor variables; memory aid use in on the second trial was the dependent variable. I conducted these analyses separately using specific and core details as predictor variables. The model including overall details was not significant, x^2 (3, $N = 38$) = 0.43, $p = .94$. Age group, proportion of overall memory details recalled on Trial 1, and the interaction between the two variables did not predict use of memory aids on Trial 2 (all p's >.05). The model including core details was also non-significant, x^2 (3, $N = 38$) = 0.27, $p = .97$. Neither of the variables nor their interaction predicted memory aid use in Trial 2 (all *p's*>.05). These analyses should be interpreted with caution; the sample size is small for a logistic regression analysis. Nevertheless, the results do not indicate that participants whose unaided performance was relatively poor were more likely to use a memory aid on a second trial. If anything the results from the first order condition suggest that older adults who used the pen when it was available in Trial 1 were more accurate in their recall of core (though not necessarily specific) details even when the pen was taken away from them in Trial 2.

Seating Chart Performance

Each participant completed two seating plan tasks: one in which they seated guests at a wedding and one in which they seated guests at a company banquet. For the wedding task, participants could receive a maximum of 34 points. For the banquet task, participants could gain a maximum of 32 points. The order of two types of tasks and the versions of the tasks (i.e., written or not written) was counterbalanced across participants. I collapsed across the two tasks (wedding, and banquet) so that I had an index of the number of hits (correctly seated guests), misses (guests not seated), and errors (guests seated incorrectly) that participants produced in the pen versus the no pen conditions. I analyzed each data set using a 2 (Memory Aid Condition: Pen available, No Pen available) x 2 (Age Group: Younger, Older) Mixed ANOVA.

Younger participants (M = 16.81, SD = 7.17) accurately placed a greater number of names on the seating charts than older adults (M = 12.64, SD = 6.02), $F(1, 71) = 11.10$, $p < .01$, $\eta_p^2 = .14$. Participants in general were more accurate on the picture (M = 15.78, SD = 7.15) than on the written version of the seating chart (M = 13.60, SD = 6.77), $F(1, 71) = 5.87$, $p = .02$, η_p^2 =

.08. These effects were qualified by an interaction between age group and memory aid condition, $F(1, 71) = 4.65$, $p = .04$, $\eta_p^2 = .06$. Younger participants were significantly more accurate on the picture ($M = 18.89$, $SD = 7.05$) than on the written ($M = 14.72$, $SD = 7.28$) version of the seating plan task, $F(1, 35) = 8.23$, $p < .01$, $\eta_p^2 = .19$. Older adults' accuracy did not differ between the two types of tasks (picture version of task: $M = 12.76$, $SD = 5.90$; written version of task: $M = 12.51$, $SD = 6.14$), $F(1, 36) = 0.05$, $p = .83$, $\eta_p^2 = .00$.

Why did younger participants perform so much better on the picture than the written version of the seating chart task? In the written chart condition, four younger participants spent so much time plotting out the details of the seating plan chart that they neglected to write any of the names on the actual chart within the 15-minute time frame. If those four participants are omitted from the analyses then only a main effect of age group remains, $F(1, 67) = 16.87$, $p = .00$, $\eta_p^2 = .02$.

Younger adults made fewer errors (i.e., incorrectly placed names) on the seating tasks than older adults (Younger adults: $M = 4.31$, $SD = 3.14$; Older adults: $M = 7.16$, $SD = 3.92$), $F(1, 71) = 17.84$, $p < .01$, $\eta_p^2 = .20$. The main effect of condition was also significant, $F(1, 71) = 14.18$, $p < .01$, $\eta_p^2 = .17$. Participants made more errors on the picture version of the seating chart ($M = 6.68$, $SD = 4.21$) than on the written seating chart ($M = 4.82$, $SD = 3.43$). The interaction between age group and condition was non-significant, $F(1, 71) = 1.12$, $p = .29$, $\eta_p^2 = .02$. Omitting the four younger participants who did not write any information on the seating plan chart had little effect on analyses (main effect of age: $F(1, 67) = 13.16$, $p < .01$, $\eta_p^2 = .16$; main effect of condition: $F(1, 67) = 11.36$, $p < .01$, $\eta_p^2 = .15$; interaction between age and condition: $F(1, 67) = 1.45$, $p = .23$, $\eta_p^2 = .02$).

Although participants made more errors on the picture seating task, they had more misses (names not placed at all) on the written version of the seating task (picture task: $M = 10.64$, $SD = 7.17$; written task: $M = 14.73$, $SD = 7.61$), $F(1, 71) = 18.96$, $p < .01$, $\eta_p^2 = .21$.

No other effects were significant. These findings remained consistent even when the four younger participants are excluded from the analyses (age: $F(1, 67) = 3.47$, $p = .07$, $\eta_p^2 = .05$; condition: $F(1, 67) = 13.10$, $p < .01$, $\eta_p^2 = .17$; interaction between age and condition: $F(1, 67) = 0.21$, $p = .65$, $\eta_p^2 = .00$).

I also examined the number of hits that participants produced in the written seating chart condition alone, comparing those participants who had and had not used the pen to also write down the phone messages. Older adults ($M = 12.56$, $SD = 12.51$) placed fewer names accurately than younger adults ($M = 16.44$, $SD = 7.28$), $F(1, 69) = 5.62$, $p = .02$, $\eta_p^2 = .08$. More interestingly, participants who used the pen to write down the phone messages scored fewer points ($M = 12.48$, $SD = 6.23$) on the written seating chart task than did those who relied on their memory ($M=16.53$, $SD=5.95$), $F(1, 69) = 6.14$, $p = .02$, $\eta_p^2 = .08$. No other effects were significant. These findings remained consistent regardless of whether the four younger participants were included or excluded from the analyses (age: $F(1, 65) = 11.89$, $p < .01$, $\eta_p^2 = .16$; condition: $F(1, 65) = 4.06$, $p = .05$, $\eta_p^2 = .06$; interaction: $F(1, 65) = 1.37$, $p = .25$, $\eta_p^2 = .02$). Although they reported the phone messages more accurately, participants who could use the pen performed more poorly on the seating plan task. This finding was true for both older and younger participants.

Memory Compensation Questionnaire

Contrary to Study 2, I did not find that older adults reported using more internal memory strategies, exerting more effort, or being more motivated compared with younger adults (all *p*'s > .05) (Table 7). However, older adults did report using external memory aids more often than younger adults did, $F(1, 71) = 44.87$, $p < .01$, $\eta_p^2 = .39$. Younger adults reported relying on others to help them remember everyday memory tasks more often than older adults did, $F(1, 71) = 4.05$, $p = .05$, $\eta_p^2 = .05$. Overall there was no significant age difference in the average number of compensation strategies that participants reported, $F(1, 71) = 0.69$, $p = .41$, $\eta_p^2 = .01$.

Younger adults who reported more use of external memory strategies on the MCQ were also more likely to use a memory aid on the phone message task, $r(36) = .41$, $p = .01$. A similar trend (although not significant) was also apparent in Study 2. For older adults, the extent to which they reported using an external memory aid on the MCQ was not correlated with their actual use of the memory aid in the experiment, $r(37) = .06$, $p = .72$. No other effects were significant. Finally, as in Study 2, there were no significant relations between participants' self-reported use of compensation strategies on the MCQ and the proportion of specific or core details that they recalled from the phone messages in either the memory aid condition or the no memory aid condition (all *p*'s >.05).

Table 7 Memory Compensation Questionnaire for Study 3				
Types of Compensation	**Older Adults**		**Younger Adults**	
	Mean	SD	Mean	SD
External Aids	4.45*	0.35	3.60	0.69
Internal Strategies	3.17	0.64	3.32	0.60
Time	3.24	0.93	3.22	0.77
Effort	3.83	0.74	3.62	0.55
Relying on Others	2.04	0.94	2.48	0.96
Motivation	2.90	0.89	2,82	0,69
Overall Compensation Use	3.34	0.52	3.25	0.49
*p<.05				

Everyday Memory Questionnaire

Higher numbers on the EMQ indicate more frequent memory errors. Older adults (*M* = 2.59, *SD* = 1.22) reported fewer memory errors in everyday life than younger participants did (*M* = 3.54, *SD* = 1.18), $F(1, 70) = 11.28$, $p < .01$, $\eta_p^2 = .14$[7]. This finding is consistent with the daily diary results in Study 1.

Younger participants' scores on the EMQ were not correlated with their use of a memory aid on the experimental task either when the pen was available on the first trial, $r(18) = .33$, $p = .18$, or when it was available on the second trial, $r(18) = -.28$, $p = .27$. Older adults who used the memory aid to write down the phone messages during the experimental task also reported fewer errors on the EMQ. This was true regardless of whether the pen was available on the first trial, $r(17) = -.51$, $p = .04$, or on the second trial, $r(19) = -.55$, $p = .01$. Scores on the EMQ were not related to the number of specific details that either older or younger participants recalled during

[7] One older adult did not complete the EMQ.

the phone message task (all p's > .05). Older adults who reported more frequent errors on the EMQ did report a smaller proportion of core details in the memory aid condition, $r(36) = -.33$, $p = .05$. Younger adults who reported more frequent errors on the EMQ also recalled fewer core details in the memory condition, however, this correlation did not reach significance, $r(32) = -.33$, $p = .07$. Participants' EMQ scores were uncorrelated with the proportion of core details they recalled in the no memory aid condition (all p's > .30).

In sum, similar to Study 2, older adults in Study 3 did not use the external memory aid more frequently than younger adults. Indeed they used the pen slightly less often even though the pen in the current study was placed in plain sight and had to be used in order to complete the written version of the seating plan task. Also consistent with Study 2, when the memory aid was available older and younger adults recalled a similar number of gist details from the phones messages. Age differences remained, however, in participants' recall of specific details. Similar to Einstein and McDaniel (1990), using a memory aid helped both age groups equally to recall the specific details from the phone messages.

There was no evidence in the current study that memory aid use was sensitive to fluctuations in task performance for either age group. Older adults who used the memory aid on the first trial did not perform any worse when that aid was removed on the second trial. Similarly, memory performance on the first trial did not predict memory aid use on the second trial. In sum, there is no evidence that the use of external memory aids is calibrated to fluctuations in performance on the task for either age group.

Chapter 5

General Discussion

According to the SOC model, when faced with declines in a particular domain, individuals may engage in greater use of compensation strategies especially if the strategies are not overly resource demanding. Research on age differences in prospective memory outside of the lab has found a reduction or even a reversal of the usual age deficit found on tasks in the lab. Some researchers (Caprani, Greaney, & Porter, 2006; Vogels, Dekker, Brouwer, & de Jong, 2002) have suggested that this reversal may be due to older adults' greater use of memory compensation strategies on tasks outside of the lab. The goal of the current research was to examine age differences in the use and usefulness of memory compensation strategies on memory tasks inside and outside of the lab. Across three studies, I examined older and younger adults' self-reported use of memory compensation strategies in everyday life and their actual use of an external memory aid on a memory task in the lab. I studied the relation between older and younger adults' use of memory aids and their performance on memory tasks.

Use of Memory Compensation Strategies

Across all three studies, I found that older adults reported using memory compensation strategies, particularly external memory aids, more frequently than younger adults did for memory tasks in everyday life. I found this effect on both my own self-report measure of memory compensation use (Study 1), and on Dixon, de Frias, and Bäckman's (2001) Memory Compensation Questionnaire (Studies 2 and 3). In contrast, when participants were asked to recall phone messages in the lab (Studies 2 and 3), older adults were no more likely to use available memory aids. In Study 2, participants had to search for the memory aid in a drawer. Older adults were no more likely to search for or use the hidden pen. In Study 3, the pen was in plain sight (attached to a clipboard). Older participants were no more likely than younger adults to use the pen tied to the clipboard to write down the phone messages. Indeed, older adults in Study 3 were somewhat less likely to use the pen. Furthermore, I found no correlation between older participants' self-reported use of external memory aids on the MCQ and their actual use of a pen in Studies 2 and 3. In contrast, younger adults' scores on the MCQ in Study 3 were correlated with their use of the pen on the lab task. Participants who reported using a memory aid more frequently in everyday life were also more likely to use a pen on the phone message recall task. A similar correlation was present in Study 2, although the results did not reach significance ($p = 0.16$), perhaps due to the small sample size.

Direct observation yielded different findings than the MCQ regarding age differences in the use of external memory aids, but the observational findings are consistent with past research. In several studies of prospective memory in the field, researchers questioned their participants at the end of the study regarding use of external aids (Cavanaugh, Grady, & Perlmutter, 1983; Dobbs & Rule, 1987; d'Ydewalle & Brunfaut, 1996; Moscovitch, 1982; Patton & Meit, 1993; Rendell & Thomson, 1999). The self-report data from these studies provided no evidence that older adults systematically reported greater use of external memory aids. Studies that examined participants' self-reported memory aid use on a specific type of task (e.g., remembering to send postcards on specific days) found either no age differences (Patton & Meit, 1983; Rendell &

Craik, 2000) or an age reversal (Rendell & Thomson, 1999) in compensation use. In the one previous lab study that experimentally varied the availability of external aids (Einstein & McDaniel, 1990), older adults were no more likely than younger adults to use aids in a prospective memory task. Similarly, Morrow et al. (1999) found no age differences in older and younger adults' note taking on an appointment recall task. It appears that when participants are asked about their general use of external strategies across a number of memory tasks age differences emerge. In contrast, when participants are asked about a specific task or when their use of aids on a single task is directly observed, age differences disappear. This is a provocative finding.

SOC theory suggests that, when faced with a decline, individuals will be more likely to adopt compensation strategies. If that is the case, then one might expect that people's use of memory aids would be calibrated with fluctuations in their performance. People (particularly older adults) who perform more poorly on an initial trial would be expected to be particularly likely to take advantage of a memory aid when it is subsequently available. Similarly, individuals whose memory aids are taken away ought to perform particularly poorly, consistent with the idea that the people who use a memory aid are those who need it—and know that they need it. Alternatively, it is possible that individuals' use compensation strategies is not sensitive to their level of performance. People are not always aware of their own lack of competency (Kruger & Dunning, 1999). If individuals are not aware that they are performing poorly on a task, there may be little motivation to use a memory aid on a subsequent trial.

I found little evidence of calibration in Study 3 of the current research. Participants who performed more poorly in the first session when the pen was unavailable were no more likely to write down the phone messages on the second trial when they were allowed to do so. Indeed the opposite was true: Participants who performed well on the first trial were more likely to use the memory on the second trial. This was true for both age groups. Moreover, whether or not participants used a memory aid when one was available on the first trial was unrelated to their performance on the second trial. Older adults who used a pen on the phone message task did report fewer errors on the EMQ. The same was not true for younger adults. However, this finding does not support a calibration account. Participants did not use compensation strategies in response to declines in performance. Rather, it suggests that older adults who are more successful on everyday memory tasks may also be more willing to adopt a compensation strategy on a task when they are permitted to do so. In contrast, younger adults' use of a pen on the task was unrelated to their scores on the EMQ. Strategy use may be less of a predictor of performance on everyday tasks for younger adults. It is also unclear in the current research how participants perceived their own performances on the phone message task. Compensation use may not be sensitive to objective performance on a memory task if individuals are bad at evaluating their own level of performance. More research is needed to investigate these possibilities.

Why was there such a discrepancy between older participants' self-reported use of compensation strategies in general and their actual use of a memory aid in the lab? There are several possible explanations. It is possible that questionnaires such as the MCQ, although reliable (Dixon & de Frias, 2004; de Frias & Dixon, 2005) are not valid predictors of memory compensation use. People are not always accurate when recalling the frequency of their own behaviors across time and tasks and such estimates can be influenced by beliefs about what they should do (Bradburn, Rips, & Shevel, 1987; Ross, 1989; Ross, McFarland, Conway, & Zanna, 1983). Older adults' higher ratings on the MCQ (and other measures of memory compensation use) may better reflect their belief that they ought to use memory compensation strategies than their actual use of such strategies.

Alternatively it could be argued that general measure of everyday memory performance such as MCQ may better reflect what goes on in everyday life than the results of isolated experimental studies. For example, older adults may be less likely than "normal" to use aids on a lab task. They may see little benefit to the kinds of tasks conducted in the lab or may be intimidated by lab procedures. Such an argument would be consistent with researchers (e.g., Henry et al, 2004; Maylor, 1990; McFarland & Glisky, 2009; Patton & Meit, 1993; Rendell & Craik, 2000; Rendell & Thomson, 1999) who have proposed that younger adults are less motivated than older adults to perform well on real world memory tasks. Rendell and Thomson (1999) suggested that older adults may approach prospective memory tasks more seriously when the task mirrors everyday life. For example, Kvavilashvili and Fisher (2007) found that, relative to younger adults, older adults reported a greater intrinsic motivation to perform well on a task in which they had to call the experimenter at a specific date and time from home. In contrast, younger adults may be particularly motivated to do well on lab tasks to impress the experimenter. They may treat everyday memory tasks outside of the lab more routinely (Rendell & Craik, 2000) and therefore be less likely to engage in memory compensation.

In Study 2 of the current research, older adults reported on the motivation subscale of the MCQ that they were more motivated to perform well everyday memory tasks compared with younger participants. However, this finding did not replicate in Study 3. I did find that participants in Study 3 who made fewer errors on the first task when no memory aid was available were more likely to use a memory aid on the second task when they were allowed to do so. These results may indicate that some participants are more motivated to perform effectively on the task and will use whatever means are available to do so. However, this pattern of results was present in both older and younger participants.

In the context of the current research, a motivational account seems generally unsatisfying. There is little evidence tying age differences in motivation to age differences in memory performance or compensation use. Nor is there evidence that younger adults are particularly motivated or older adults unmotivated to perform well in the lab. Moreover, a motivational account does not in itself explain why younger adults perform so poorly and older adults so well on prospective memory tasks at home.

Memory Compensation and Perceptions of Control

Although there is little experimental evidence that older adults use memory compensation strategies more frequently, some participants (older and younger) did use memory compensation strategies more frequently than others. Lachman and her colleagues (Lachman & Andreoletti, 2006; Lachman, Andreoletti, & Pearman, 2006) suggest that perceptions of control may influence whether older adults use memory compensation strategies. Lachman et al. found that older and middle-aged participants who felt that they had more control over their outcomes were more likely to categorize a list of words as a strategy to aid recall. They found no relation, however, between a sense of control and strategy use among younger participants.

It is possible that older adults who feel that they have more control over their own memory processes—that they are competent on memory-related tasks and that their effort will lead to competent performance on such tasks—may perceive memory compensation as a more useful strategy and be more likely to adopt strategies when confronted with a cognitively demanding task. Jennings and Darwin (2003) gave older and younger participants a questionnaire in which they were asked to identify the factors they believed were influential to memory performance. They categorized those factors as either controllable (e.g., strategy use) or uncontrollable (e.g., age). Older participants who identified strategy use as being important for memory reported experiencing fewer memory errors in everyday life. Older participants who rated age as the most important influence on memory reported more everyday memory errors. This research suggests that beliefs about aging and control over cognitive processes may affect either the extent to which individuals use memory compensation strategies or how successfully they use such strategies. More research is needed to understand how factors such as feelings of cognitive control are related to age-differences in strategy use and performance on everyday memory tasks.

Effectiveness of Memory Compensation Strategies

An additional goal of the current research was to examine the effectiveness of using memory compensation strategies on older and younger adults' memory performance. According to environmental support theory, age differences in memory performance should be reduced or eliminated if the strong cues are available at the time of recall (Craik, 1986; 1994). In the current study, I found mixed evidence for this hypothesis. In Study 1, I found no relation between participants' self-reported memory use of memory aids and the proportion of memory errors that they reported during the diary week. Older adults reported using memory aids more frequently and making fewer memory errors on everyday tasks. However, the frequency with which participants reported using memory aids did not predict the number of memory errors that they made. In Study 3, participants' self-reported use of compensation strategies on the MCQ was likewise unrelated to the frequency with which they reported making memory errors in everyday life on the EMQ. Self-report measures of memory compensation use did not predict memory errors for either age group.

Using a memory aid helped performance on the phone message recall task in Studies 2 and 3 for both age groups. This finding is consistent with Einstein and McDaniel (1990) and Morrow et al. (1999) who found that using a memory aid improved the performance of participants of all ages. Similar to Burack and Lachman (1996), using the memory aid helped older more than younger adults in Study 2. In contrast, in Study 3, I found that using the memory aid helped both older and younger adults to an equal degree. However, when I coded the messages for just the gist or essential details, I found a significant interaction such that using the memory aid helped older adults recall a greater proportion of essential details but had less impact on younger participants' recall of the messages. This distinction between gist or central details on the one hand and overall details on the other hand may be worthy of further exploration in the context of aging and memory.

Why were the findings about memory aid effectiveness somewhat discrepant between Studies 2 and 3? One possible explanation is that the phone message task in Study 3 was more difficult than the task in Study 2. Although the length of the messages was the same across both studies, the messages in Study 3 were grouped more closely together and required more frequent switching between the recall and the seating plan tasks. Thus perhaps using a memory aid did not help younger participants in Study 2 because they were able to recall a good number of details from the messages without using a memory aid. In the face of increased memory demands in Study 3, younger participants benefitted from writing down the messages. Given that younger participants recalled a similar proportion of gist details in the pen and no pen available condition, using the pen may have particularly helped younger adults recall details that were not essential to the meaning of the message. For older participants, the task may have been sufficiently difficult in both studies for them to benefit from use of the aids.

Regardless of the explanation, it is clear from the current research that using a memory aid benefits people of all ages and that the adoption of compensation strategies may be particularly helpful for older adults. As de Frias and Dixon (2005) and other researchers have suggested, the effective use of memory aids has the potential to reduce or even (on some tasks) to eliminate age differences in memory performance. One of the implications of this finding is that the use of memory compensation strategies should be advocated more broadly in society, particularly in later adulthood. More programs such as the Memory and Aging Program (MAP) at the Baycrest Centre for Geriatric Care in Toronto, Canada are needed. The MAP is an intervention program that teaches information about memory and memory strategies to normal healthy older adults (Troyer, 2001). The current research suggests that such programs should be directed at community dwelling older adults and should promote the effective use of external memory aids.

In the current research, I found no relation between participants' self-reported use of memory compensation strategies in everyday life and the number of memory errors that they reported either on the daily diary (Study 1) or on the EMQ (Study 3). Self-reported memory compensation use was correlated with memory performance on the lab task in Study 3, but only for younger adults. In Study 1, older participants reported a smaller proportion of memory errors than did younger adults on everyday tasks over a five-day period. Although it is possible that older adults in this study reported fewer errors because they forgot what they had forgotten, this explanation seems unlikely. Past studies have consistently found either no age difference or an age advantage on prospective memory tasks outside of the lab (d'Ydewalle & Brunfaut, 1996; Maylor, 1990; Moscovitch, 1982; Patton & Meit, 1993; Poon & Schaffer, 1982; Rendell & Craik, 2000; Rendell & Thomson, 1993; 1999). If older adults' use of memory compensation strategies is not the reason for the age advantage on certain types of memory tasks outside of the lab, how can we account for this finding in this and other studies?

One possible explanation is that older adults are better at prospective memory tasks because they lead simpler lives. Rendell and Craik (2000) argued that older adults lead less busy and more structured lives than younger adults and can use routine to help cue prospective memory tasks (see also Rendell & Thomson, 1999). It is also possible that undergraduate university students, the comparison group typically used in memory studies, may lead particularly chaotic lives and therefore are more impaired on prospective memory tasks outside of the lab. In Study 1 of the current research, I found that, compared with older adults, younger adults did report a greater number of regular events and irregular appointments throughout the week.

It is also possible that older adults may lead more routine lives than younger adults and that this greater structure may help them remember everyday memory tasks. However, there is, thus far, little evidence linking greater routine and better memory for prospective tasks. This explanation, although plausible, may be more rooted in stereotypes about older and younger adults than in any specific body of evidence (Heckhausen, Dixon, & Baltes, 1989; Lineweaver, Berger & Hertzog, 2009). Future research is needed to understand the role of this and alternative accounts in understanding age differences in performance on everyday memory tasks.

Should Memory Researchers Study External Memory Aids?

Hintzman (2011) likens research in psychology to the fable of the three blind philosophers trying to describe an elephant by feeling different parts of the animal. In the case of memory research, however, Hintzman (2011) suggests that all of the blind philosophers are feeling only the elephant's tail. Psychologists are so focused on understanding the cognitive processes involved in understanding lab tasks such as word recognition that we fail to study other kinds of memory tasks in the real world. This metaphor holds even more true for research on memory and aging. By only studying age differences on a limited variety of lab tasks and by restricting participants' access to the kinds of strategies, routines, and tools that they use in everyday life, we are getting a very restricted perspective of the effect of age on memory. To better understand the relation between age and memory in the real world we need to broaden the kinds of methodologies that we use to study memory. We also need to extend our definitions of what memory is.

Most psychologists perceive memory as an internal process that occurs within a single mind. Some researchers have extended the definition of memory to include collaborative memories in which the responsibility for recalling information is divided among several individuals (e.g., Congleton & Rajaram, 2011; Gagnon & Dixon, 2008; Gould, Osborn, Krein & Mortenson, 2002; Harris, Paterson & Kemp, 2008; Ross, Spencer, Blatz & Restorick, 2008; Wegner, 1986). Few psychologists seem willing to conceive of a definition of memory that extends to other kinds of memory transactions in which individuals, groups, and societies shift the burden of information onto non-human sources such as calendars, lists, or books. Writing down information is not considered by psychologists to be an act of memory even though research suggests that writing is the main form of memory compensation strategy reported by individuals in Western societies (Intons-Peterson & Fournier, 1986). This conceptualization of memory as a purely solitary internal process is not one that is held in all disciplines. Historians and sociologists, for example, frequently conceptualize history and written media to be a form of collective or cultural memory (e.g., Olick & Robbins, 1998; Yates, 1966). They point out that human beings are tool-using animals and memory aids are one of the tools that we use to help support processes of memory. If psychologists want to truly understand how memory works in the real world and to elucidate the relation between factors such as aging and memory, then we too need to broaden our definition of memory and examine not only memory as an internal process but as a behavior that is supported by a broad variety of compensatory tools.

Conclusion

The goal of the current research was to examine the role of memory compensation in older and younger adults' performance on common everyday memory tasks. I found that although older adults claimed to use memory compensation strategies more often than younger participants, they were no more likely to use an external memory aid when one was available on a lab task. Using a memory aid helped both younger and older adults to recall the details of phone messages. It was particularly helpful for older adults when the recall task was easier. I did not find that participants' self-reported use of compensation strategies predicted the number of memory errors that they reported in everyday life. Memory compensation strategies, particularly external memory aids, are without a doubt a useful means of improving performance on memory tasks, particularly for older adults. However, I did not find any evidence that age differences in the frequency of strategy use explains discrepant findings in older and younger adults' performance on memory tasks in the lab or the field. Older adults may be more likely than younger adults to show up for appointments (Frankel, Farrow, West, 1989; Gallucci, Swartz, & Hackerman, 2005; Neal et al., 2001), mail postcards (Patton & Meit, 1983), or call the experimenter (d'Ydewalle & Brunfaut, 1996; Maylor, 1990) at the correct time; however, the current research does not support the speculation that these results are due to age differences in the use of external memory aids.

Appendix A
Memory Compensation Questionnaire (Study 1)

Each day we are confronted with different events, appointments, locations and objects that we need to remember. People develop different strategies and use different memory aids to cope with different types of memory tasks. Please describe what kinds of strategies or aids (if any), you use for each memory task.

Keys

1. Do you use a Strategy to keep track of your home, office or car keys?

Often	Sometimes	Rarely	Never

2. What is your Strategy for keeping track of your home, office or car keys? Please describe.

____

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____

____

____

3. Do you rely on your **Memory** to keep track of your home, office or car keys? (Please circle one):

Often	Sometimes	Rarely	Never

4. In the past five days, since ___(e.g. Monday)_________, how many times have you been unable to immediately find your home, office or car keys? (Please circle one):

4 or more times	2 or 3 times	Once	None

Regular Events

1. Do you use a strategy to keep track of regular events – events that you attend at the same time every day, week or month (e.g. classes, work, volunteer or social)? (Please circle one):

Often	Sometimes	Rarely	Never

2. What is your strategy for keeping track of regular events? Please describe.

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____

3. Do you rely solely on your **Memory** to keep track of regular events? (Please circle one):

Often	Sometimes	Rarely	Never

4. In the past five days, since __________________, how many regular events were you late for because you *forgot* the correct time of the event?

4 or More	2 or 3	1	None

5. In the past five days, since __________________, how many regular events have you *missed* because you forgot to go?

4 or More	2 or 3	1	None

Non-Regular Appointments

1. Do you use a strategy to keep track of non-regular appointments that DO NOT take place at the same time regularly (e.g. doctor or dentist's appointments)? (Please circle one):

Often	Sometimes	Rarely	Never

2. What is your strategy for keeping track of non-regular appointments? Please describe:

____

____

____

____

____

3. Do you rely solely on your **Memory** to keep track of non-regular appointments? (Please circle one):

Often	Sometimes	Rarely	Never

4. In the past five days, since __________________, how many non-regular appointments were you late for because you *forgot* the correct time of the appointment? (Please circle one):

4 or More	2 or 3	1	None

5. In the past five days, since __________________, how many non-regular appointments have you *missed* because you forgot to go? (Please circle one):

4 or More	2 or 3	1	None

Medication

1. Do you regularly take any kind of medication or vitamin pills? (Please circle one):

Yes No

*If **No**, skip to the next page.*

2. If **Yes**, do you use a strategy to keep track of your medication or vitamin pills? (Please circle one):

Often	Sometimes	Rarely	Never

3. What is your strategy for keeping track of your medication of vitamin pills? Please describe:

____

____

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____

____

4. Do you rely solely on your **Memory** to keep track of your medication or vitamin pills? (Please circle):

Often	Sometimes	Rarely	Never

5. In the past five days, since _______________, how many times did you take your medication or vitamin pills *late* because you forgot to take them on time? (Please circle):

4 or More times	2 or 3	1	Never

6. In the past five days, since________________, how many times did you *miss* taking your medication or vitamins pills because you forgot to take them? (Please circle):

4 or More times	2 or 3	1	Never

Non-Routine Chores

1. Do you use a strategy to keep track of non-routine chores (e.g. picking up the dry cleaning, bringing the car in for maintenance etc.)? (Please circle one):

Often	Sometimes	Rarely	Never

2. What is your strategy for keeping track of non-routine chores?

____

____

____

____

____

3. Do you rely solely on your **Memory** to keep track of non-routine chores? (Please circle one):

Often	Sometimes	Rarely	Never

4. In the past five days, since_______________, how many non-routine chores have you forgotten to do? (Please circle one):

4 or More	2 or 3	1	None

Appendix B

Daily Recall Questionnaire (Study 1)

Each day we are confronted with different events, appointments, locations and objects that we need to remember. Some memory tasks we deal with every day (e.g. finding your keys) and others are less regular. In this section we ask you about different memory tasks that are common in every day life.

How many times did you use your home, office or car keys today?

[ ] Times

How many times were you unable to immediately find your home, office or car keys today?

[ ] Times

How many regular events – events that you attend at the same time every day, week or month (e.g. classes, work, volunteer or social) – did you have scheduled for today?

[ ] Events

How many regular events were you late for today because you *forgot* the correct time of the event?

[ ]

Events

How many regular events did you miss today because you *forgot* to go?

Events

How many non-regular appointments – appointments that DO NOT take place at the same time regularly (e.g. doctor or dentist's appointments) – did you have scheduled today?

Appointments

How often were you late for non-regular appointments today because you *forgot* the correct time of the appointment?

Appointments

How often did you miss non-regular appointments today because you *forgot* to go?

Appointments

Were you supposed to take any medication today?

Yes

No

If No, skip to the next section

If Yes, how many pills were you supposed to take today?

Number of pills

How many pills did you take *late* today because you forgot to take them on time?

Number of pills

How many pills did you *miss* taking today because you forgot to take them?

Were there any chores or tasks beyond the routine (e.g. picking up dry-cleaning) that you intended to do today?

Yes

No

If No, skip to the next section.

If Yes, how many non-routine chores or tasks did you intend to do today?

Number of chores

How many non-routine chores did you forget to do today?

Number of chores

Appendix C

Background Information (Studies 1, 2, & 3)

This section asks questions about your background and general health. The purpose of this questionnaire is to obtain basic demographic information to give us an idea of the range of participants in our study, and to determine whether participants may have any pre-existing conditions that may contribute to memory problems. Please answer these questions honestly. All of your information will be kept confidential - your name will not be associated with these answers in any way. Also, if you do not wish to answer any of the questions, please feel free to leave them blank.

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1. What is your gender (circle one)?

Male Female

2. What is your age? ____________

3. Is English your first language?

Yes No

4. If English is not your first language, what is your first language? ________________

5. If English is not your first language, at what age did you learn English? _________________

6. In total, how many years of education have you had? ______________________

7. Have you ever had any neurological problems (ie. strokes, seizures)?

Yes No

If yes, please describe:

____

____

8. Have you had a head injury with loss of consciousness greater than five minutes?

Yes No

9. Have you ever been unconscious for more than one hour other than during surgery?

Yes No

10. Have you ever required overnight hospitalization because of a head injury?

Yes No

11. Have you ever had any illness that caused a permanent decrease in memory or other mental functions?

Yes No

Appendix D

Wedding Seating Chart Task (Studies 2 & 3)

For this task, your job is to create a seating plan for a fundraising event/awards ceremony. Using the chart provided, please assign each guest to a seat. You have been provided with information about each guest who is scheduled to come to the event. Please use this information to create the best seating chart possible. There is not one right answer. Here are a few guidelines to help you with the task:

1. **Families should be seated together at the same table.**
2. **Award winners and guest speakers should be seated at one of the 2 tables near the podium.**
3. **When possible, try to assign friends to sit at the same table.**
4. **When possible, do not assign people who don’t get along to sit at the same table.**
5. **Some people have specifically asked sit at the front or the back of the room. Please try to accommodate them when possible.**

Peter Aguilera

Peter Aguilera is married to Viola Aguilera. Peter Aguilera owns a local grocery store. Peter is friends with John Gallagher and he and his wife are the godparents of Callie Gallagher.

Viola Aguilera

Viola Aguilera is married to Peter Aguilera. Viola would like to be seated near her friend Dorothy Rasmussen.

Douglas Barrett

Douglas Barrett is married to Lydia Barrett. Douglas is a child psychologist who owns his own small practice. Douglas is a committee member.

Lydia Barrett

Lydia Barrett is married to Douglas Barrett. Lydia is a reporter for the local newspaper and would like to be seated near the podium so that she can take photographs for her paper. Lydia would like to be seated near her friend Brandi Collier but does not want to be anywhere near Jerry Trujillo.

Jane Boyle

Jane Boyle is married to Gene Boyle and is the mother of Amber Boyle. Jane is a professor of chemical engineering at the university. Jane has served on the Board of Directors for the organization for the past 2 years. Jane is also one of the committee members who helped organize this event.

Gene Boyle

Gene Boyle is married to Jane Boyle and is the father of Amber Boyle. Gene is an accountant with GMA Consulting.

Amber Boyle

Amber Boyle is the 16 year old daughter of Jane and Gene Boyle. In the past year Amber has been heavily involved in volunteering for the organization. Amber is the president of the youth group and helped to organize a very successful car wash fundraiser for the charity last spring. Amber is going to be awarded Excellence in Youth Volunteering award this evening.

Wei Chen

Wei Chen is the featured speaker for the evening. Wei is the president of the National Chapter of the organization and is a close friend of Brandi Collier.

Brandi Collier

Brandi is coming to the event by herself. Brandi will be receiving the Lifetime Volunteerism award.

John Gallagher

John Gallagher is married to Juanita Gallagher and is the father of Callie Gallagher. John is a violinist with the Symphony. John would like to be seated near his friend Peter Aguilera.

Juanita Gallagher

Juanita Gallagher is married to John Gallager and the mother of Callie Gallagher. Juanita is a lawyer. Juanita would like her family to be seated near the back because they have a young child and she would like to be able to slip out the back if her baby becomes disruptive. Juanita does not want to be seated at the same table as either Julio Menez or Angela Vazquez.

<u>Callie Gallagher</u>

Callie Gallager is the daughter of Juanita and John Gallagher. She is 2 years old. Juanita should be seated between her parents at the table.

<u>Brett Hammond</u>

Brett Hammond is married to Hazel Hammond and is the father of Ian Hammond and Charlie Hammond. Brett is a pediatrician at the local hospital. Brett has been a very important consultant for the organization. Brett would like to be seated near the front so that his 2 children can see the podium.

<u>Hazel Hammond</u>

Hazel Hammond is married to Brett Hammond and is the mother of Ian and Charlie Hammond. Hazel works as a physiotherapist at Avery Sports Clinic. Hazel does not want to be seated at the same table as Armando and Faye Page, Feng and Amy Lee or Jerry Trujillo because she knows that they don't like children.

<u>Ian Hammond</u>

Ian Hammond is 8 years old. He is the son of Hazel and Brett Hammond and the brother of Charlie Hammond. Ian is a quiet child and does not generally cause any problems. Ian and Charlie Hammond should not be seated right beside each other because they will inevitably fight.

<u>Charlie Hammond</u>

Charlie Hammond is 6 years old. He is the son of Hazel and Brett Hammond and the brother of Ian Hammond. Charlie's Hammonds parents insist on bringing him and his brother to every social event and he usually gets into trouble of some sort. Charlie Hammond should not be seated near anyone who does not like children.

Karl Howe

Karl Howe is married to Gayle Howe. Karl is a former stockbroker, now retired. Karl is recovering from heart surgery which he had a month ago. He would like to be seated at a table near the exit so that he can leave early if he's not feeling well.

Gayle Howe

Gayle Howe is married to Karl Howe. Gayle is a former highschool teacher, now retired. Gayle is friends with both the Pages and the Lees and would like to be seated near at least one of those couples.

Amy Lee

Amy Lee is married to Feng Lee. Amy is a website developer at GMA consulting. Amy is committee member and would like to sit near one of the doors so that she can show people to their seats.

Feng Lee

Feng Lee is married to Amy Lee. Feng is an architect. Feng would prefer to sit at a table with no children.

Laura Makovich

Laura Makovich is coming to the event by herself. Laura works as a PR consultant for GMA Consulting. Laura is very short and would like to be seated at a table near the front so that she can see the speaker.

Mary McKenzie

Mary McKenzie is married to Milton McKenzie. Mary is a stay-at-home mother. She may have to leave early and would like to be seated near the exit. Mary is willing to sit at a table with anyone except Emma Russo.

Milton McKenzie

Milton McKenzie is married to Mary McKenzie. Milton is a physical education teacher at the local highschool. Milton does not care where he sits or with whom.

Julio Menoz

Julio Menoz is married to Margaret Menoz. Julio is president of GMA Consulting, an important local company. Julio has done a great deal of volunteer work on the steering committee of the organization and will be receiving an award for his hard work sometime during the evening. Julio is friends with Felix Russo. If at all possible, Julio should not be seated near Angela Vazquez, because their two companies are currently involved in a lawsuit.

Margaret Menoz

Margaret Menoz is married to Julio Menoz. Margaret is the principal of Cork Avenue Public School. She has also been heavily involved in fundraising for the organization. Margaret is friends with Mary McKenzie and Emma Russo and would like to be seated at the same table as one of them.

Armando Page

Armando Page is married to Faye Page. Armando is the owner of an auto repair shop. Armando would like to be seated near his friends Karl and Gayle Howe. Armando does not wish to sit at the same table at Jerry Trujillo.

Faye Page

Faye Page is married to Armando Page. Faye works as executive administrative assistant at GMA Consulting. Faye prefers not to be seated at a table with young children. Faye also does not get along with Amy Lee.

Dorothy Rasmussen

Dorothy Rasmussen is coming to the event solo. Dorothy is a committee member and would like to sit in the center back table if possible.

Felix Russo

Felix Russo is married to Emma Russo. Felix Russo is the vice-president of GMA Consulting. Felix is new to the community and does not yet know very many people in the organization.

Emma Russo

Emma Russo is married to Felix Russo. Emma is a stay-at-home mom. She has expressed interest in becoming involved in the organization and has made a very generous contribution to the charity. Emma is friends with Margaret Menoz and if possible would like to be seated near her.

Rochelle Takkar

Rochelle Takkar is a pilot. She is not married but is dating Jerry Trujillo and would like to be seated with him. Rochelle would also like be seated at the same table as her friends Mary and Milton McKenzie. She dislikes and does not want to be seated at the same table as Angela and Dennis Vazquez or Jane and Gene Boyle. Rochelle wishes to be at an adults-only table.

Jerry Trujillo

Jerry does not care where he sits.

Angela Vazquez

Angela Vazquez is married to Dennis Vazquez. Angela is the president of a local cosmetics firm. Anguela should not be seated near Julio Menoz because their companies are currently in litigation. Angela is a committee member.

Dennis Vazquez

Dennis Vazquez is married to Angela Vazquez. Dennis is currently unemployed. He would prefer to sit at a smaller table with adults only.

Appendix E

Banquet Seating Chart Task (Study 3)

For this task, your job is to create a seating plan for Benson Inc.'s annual company banquet. Using the chart provided, please assign each guest with a seat. You have been provided with information about each guest who has indicated they will attend. Please use this information to create the best seating chart possible; there is not one right answer. Here are a few guidelines to help you with the task:

1. The corporate executives must be seated near the podium with the entire room in view.
2. Families (husbands, wives and children) should be seated at the same table.
3. When possible, try to assign friends to sit at the same table.
4. When possible, do not assign people who do not get along at the same time.
5. Some people have specifically asked to sit at the back of the room. Please try to accommodate them when possible.

<u>Alan Benson</u>
Alan Benson is the founder and President of Benson Inc. He is married to Donna Benson and is the father of Sally Benson and Jim Benson. He would like to sit next to Michael Brown.

<u>Alana Rigby</u>
Alana Rigby is the 13-year-old daughter of Rina and Rodney Rigby. She would like to sit with Janice Zapparoli, her friend from school.

<u>Amanda Pinto</u>
Amanda Pinto is married to Andrew Pinto.

<u>Andrew Pinto</u>
Andrew Pinto is married to Amanda Pinto. He would like to sit at an adults only table.

<u>Angel Jarvis</u>
Angel Jarvis is married to Daniel Jarvis. She would prefer to sit near the exit since she knows Daniel will need to leave early.

<u>Beatrice Martey</u>
Beatrice Martey is married to Samuel Martey. She does not like children.

Brett Zapparoli
Brett Zapparoli is married to Megan Zapparoli and is the father of Robert and Janice Zapparoli. Brett would like to be seated near the exit because Janice is very shy and wants little contact with strangers.

Brian Chan
Brian Chan is married to Sabina Chan. Brian would prefer to sit at an adults only table.

Daniel Jarvis
Daniel Jarvis is married to Angel Jarvis. Daniel has to leave early due to his work obligations.

Donna Benson
Donna Benson is married to Alan Benson and is the mother of Sally Benson and Jim Benson.

Doug Brown
Doug Brown is the 15-year-old son of Michael and Rachael Brown.

Ellie O'Sullivan
Ellie O'Sullivan is coming to the banquet by herself. Ellie would like to sit near her friend Paige Richards.

Inka Weber
Inka Weber is married to Mitchell Weber and the mother of Nicole Weber. Inka would like her family to be seated near the exit in case Nicole becomes disruptive.

Janice Zapparoli
Daniel Zapparoli is the 13-year-old daughter of Brett and Megan Zapparoli and the sister of Robert Zapparoli.

Jennifer Trubador
Jennifer Trubador is coming to the banquet by herself. She does not care where she sits and is happy making conversation with anyone.

Jim Benson
Jim Benson is the 12-year-old son of Alan and Donna Benson and the brother of Sally Benson.

Joshua Lobsinger
Joshua Lobsinger is married to Kayla Lobsinger. Joshua is a retired employee and is still good friends with Alan Benson. Joshua would like to sit near Alan.

Kate Morrow
Kate Morrow is coming to the banquet by herself. She does not get along with Sabina Chan or Mitchell Weber. She would not like to sit with them.

Kayla Lobsinger
Kayla Lobsinger is married to Joshua Lobsinger.

Megan Zapparoli
Megan Zapparoli is married to Brett Zapparoli and is the mother of Robert and Janice Zapparoli.

Michael Brown
Michael Brown is the Chief Executive Officer of Benson Inc. He is married to Rachael Brown and is the father of Doug Brown.

Mitchell Weber
Mitchell Weber is married to Inka Weber and is the father of Nicole Weber. Mitchell would like to be seated near his friend Daniel Jarvis.

Nicole Weber
Nicole Weber is the 1-year-old daughter of Mitchell and Inka Weber.

Paige Richards
Paige Richards is coming to the banquet by herself. She would like to be seated at the same table as her friends Ellie O'Sullivan and Sabina Chan. She dislikes and does not want to be seated at the same table as Angel Jarvis. Paige wishes to be at an adults-only table.

Patrick Cassells
Patrick Cassells is the Chief Financial Officer of Benson Inc. He is coming to the banquet by himself. He would like to sit at the head of a table.

Rachael Brown
Rachael Brown is married to Michael Brown and is the mother of Doug Brown.

Rina Rigby
Rina Rigby is married to Rodney Rigby. Mary does not get along with Jennifer Trubador and should not be seated at the same table with her.

Robert Zapparoli

Robert Zapparoli is the 5-year-old son of Brett and Megan Zapparoli and the brother of Janice Zapparoli. Robert Zapparoli should not be seated near anyone who does not like children.

Rodney Rigby

Rodney Rigby is married to Rina Rigby. Rodney is the father of Alana Rigby. Rodney does not care where he sits or with whom.

Sabina Chan

Sabina Chan is married to Brian Chan. Sabina is good friends with Ellie O'Sullivan, Kate Morrow, and Rina Rigby and would really like to sit at the same table with at least one of her friends.

Sally Benson

Sally Benson is the 16-year-old daughter of Alan and Donna Benson and the sister of Jim Benson.

Samuel Martey

Samuel Martey is married to Beatrice Martey. He is good friends with Brett Zapparoli and would like to be seated at the same table as Brett.

Appendix F

Phone Messages (Study 2)

1. This Amanda from the flower shop. Please call me back when you get a chance.
2. Hi. This is a message for Lisa. My name is Andrew, I'm calling from Bertram Rentals. There's a bit of a problem with the centerpieces that you wanted to rent for your event. It looks like we only have 5 of those in stock right now. Please call me so that we can make some other arrangement.
3. Lisa, this is George from LockCo automotive shop. Your car is ready for pick-up. Please pick it up by 6pm.
4. Hey Lisa, it's Amy. I'm calling to set up a lunch. Would Friday at noon be a good time? Thanks!
5. Hi Lisa, this is Callie calling from Wiltshire catering. It looks like the food for your event is going to cost a little more than we had originally thought. The price of seafood has just sky-rocketed this week. Please call me back so that we can figure out payment. Thanks, good-bye.
6. Hi. This is Justin from Doctor Jones' office. I'm just calling to remind you of your appointment tomorrow at 10:30am.

Appendix G

Phone Messages (Study 3)

1. Hi. This is a message for Katie. My name is Andrea, I'm calling from Bertram Rentals. There's a bit of a problem with the centerpieces that you wanted to rent for your event. It looks like we only have 5 of those in stock right now. Please call me so that we can make some other arrangement.
2. Katie, this is George from LockCo automotive shop. Your car is ready for pick-up. Please pick it up by 6pm.
3. Hey Katie, it's Andre. I'm calling to set up a dinner. Would Friday at 6pm be a good time? Thanks!
4. Hi Katie, this is Callie calling from Wiltshire catering. It looks like the food for your event is going to cost a little more than we had originally thought. The price of seafood has just sky-rocketed this week. Please call me back so that we can figure out payment. Thanks, good-bye.
5. Hi. This is Janie from Doctor Jones' office. I'm just calling to remind you of your appointment tomorrow at 10:30am.
6. Hello, this is a message for Katie. This is Paul calling from the Cable Company. There was a mix-up regarding your recent installation of a digital cable receiver. It appears that the device that was installed is the wrong model. Please call us back so that we can make arrangements to replace it.
7. Hi Katie, this is Sally from Speedy Dry Cleaning. I'm calling to let you know that your clothes are ready. Please pick them up by 4:30pm.
8. Hey Katie, it's Sam. I'm calling about the lunch we planned. Is Thursday at 1:00pm still good for you? Thanks.
9. Hi Katie, this is John calling from Clearwater Resorts. Unfortunately, it looks like we will have to move or cancel your room reservations. We overbooked our guests and cannot accommodate you at the previous time. Please call me back with your decision on the matter. Thank you.
10. Hi. This is Amanda from Video Rentals. I am calling to remind you that your rentals are due tomorrow by 9:00pm.

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