

**Everyday Memory Failures and Strategy Use in Healthy Adults Across the Lifespan: A
Mixed Methods Approach**

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Abstract

For several decades, research on cognitive ageing has been using primarily laboratory methods of investigation. However, recent advances in cognitive psychology and related areas have started to emphasise the importance of supplementing laboratory studies with other empirical methods such as experience sampling and diary methods. The development of new tools and combined methodology is necessary for further advancing the understanding of how ageing mind operates both inside and outside the laboratory. For example, results from laboratory research in memory and ageing consistently show fairly large negative age effects, and it is assumed that similar impairments in older adults' memory functioning would be observed in everyday life. However, there is very little research on memory functioning of young and older adults in everyday contexts and several naturalistic studies on participants' ability to remember to carry out simple tasks (e.g., making a phone call) have resulted in the so called age-prospective memory paradox, showing that while younger adults significantly outperform old in the laboratory, older adults often outperform young on remembering to do things in everyday life. Moreover, these counterintuitive findings have been further confirmed by a couple of recent diary studies, which showed that older adults recorded fewer prospective memory failures than younger adults, but no age differences were found in the number of recorded retrospective failures (forgetting past information, for example, people's names, event details, etc.) or more attentionally based absent-minded failures (doing one thing instead another, not completing an action due to distraction, etc.). These initial diary studies cast further doubts on the assumption that laboratory findings will automatically generalise to how memory operates in everyday life and call for more targeted investigation of age-related changes, stability or even benefits in everyday contexts.

Unfortunately, the results from a limited number of structured diary studies of everyday memory failures are often met with scepticism and pessimistic suggestions that the absence of age effects or positive age effects are possibly obtained because of older adults' impaired ability to remember to record what they forget, or their increased use of memory strategies, which may result in them having fewer recorded failures in diaries. Similar explanations are often provided whenever no age effects are obtained in self-reported questionnaire studies of everyday memory.

Based on these explanations and initial results from diary studies of everyday memory failures, the principal aim of the present thesis was to carry out a first systematic investigation

of everyday memory failures and strategy use across the lifespan of healthy adults using a structured diary method and the newly developed questionnaires assessing the frequency of memory failures and strategy use with items empirically validated from structured diary studies of memory failures (Study 1a) and memory strategy use (Study 1b). In addition, questionnaire and laboratory studies to date provide indication that there is a link between memory failures and levels of busyness, mood and procrastination, but no previous diary study has examined this question. Therefore, the second major objective of the present thesis was to investigate the relation between recorded memory failures and these individual difference variables and examine if they moderated the effects of age on the number of recorded prospective memory, retrospective memory and absent-minded failures.

Considering growing evidence which shows that older adults' performance in laboratory studies of memory can be impaired by holding negative stereotypical views on memory in old age, a final aim of this thesis was to systematically investigate the magnitude and direction of stereotypical views that people across the adult lifespan may hold towards memory and ageing.

Overall, results from two diary studies of everyday memory failures suggest that not only is structured diary a reliable method for studying everyday memory failures (Study 2) but that it is able to produce replicable findings by demonstrating no age effects on the overall number of recorded memory failures (Study 1a and Study 2). These results did not change when accounting for differences in participants' mood and the levels of busyness. In addition, diary studies provided further support for the existence of age-prospective memory benefit (Study 1a), with older adults recording fewer prospective memory failures than younger adults. However, this age benefit disappeared once the levels of procrastination were taken into the account (Study 2), indicating that the age-prospective memory paradox reported in the literature could potentially be explained by younger adults' increased levels of procrastination rather than prospective memory forgetting per se. Importantly, the results also showed that young and older adults did not differ in the number of memory strategies that they recorded in a diary (Study 1b), a finding that was further confirmed in a newly developed questionnaire study (Study 4a).

Results from two questionnaire studies also indicate that while participants self-reported strategy use reflects patterns of findings obtained in diary of strategy use (Study 1b), when responding to a questionnaire on everyday memory failures participant's responses were very different from what was found in a diary study of everyday memory failures (Study 3a). Here, only older adults self-reports reflected with some accuracy results from a

diary study, but young adults' ratings of how often they experienced everyday memory failures were in complete contrast to what was found in diary studies (Study 1b and Study 2).

Finally, the results demonstrate the existence of strong negative age stereotypes in both, judging the frequency of everyday memory failures in others (people aged 20s, 40s, 60s and 80s) and when judging the memory strategy use in these target age groups (Studies 3b and 4b). Interestingly, the stereotypes exist in both directions, with young adults thinking that all types of forgetting increase with age, and older adults thinking that young and middle-aged adults have almost perfect memory in everyday life.

Taken together, the results significantly advance existing knowledge on effects of age on everyday memory functioning and provide important methodological tools to launch a more systematic investigation of factors affecting everyday memory functioning and ageing in both healthy and clinical samples (e.g., people with Mild Cognitive Impairment).

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Chapter 1: Theory and Research in the Field of Memory and Ageing

1.1 Introduction

One of the key aspects of the diagnostic procedure for the Alzheimer's disease (AD) and the Mild Cognitive Impairment (MCI) is self-reported memory complaints which are then corroborated by decrements in objective performance on memory tests. However, very little empirical information is available about memory failures in everyday life not only in patients with AD and MCI, but even in young and healthy older adult population.

Although a variety of terms has been used in the literature to denote cognitive complaints such as cognitive failures (Sunderland et al., 1983), memory errors (Haas et al., 2020), everyday memory failures (Niedzwinska & Kvavilashvili, 2019) or simply everyday forgetting (Crovitz et al., 1984), essentially they all refer to the same thing – the forgetting of some type of information. In everyday life, all sorts of information can be forgotten at any given moment throughout adult life. For example, we may forget to buy one or few things at the store, or entirely forget to go to the store in the first place. We may forget to attend a meeting or an appointment and repeatedly fail to ring someone back. We may also forget where we put something a few days ago or misplace an item which is in frequent use (e.g., mobile phone). Likewise, we may walk into a room to get something and once there – not remember what we went there for or end up in a comical situation of looking for glasses while still wearing them. Hence, if self-reports about own memory functioning in everyday life are an important part of a diagnostic process in memory clinics, first and foremost we need to understand the frequency of instances of such forgetting in healthy young and older adults.

It is no secret that people of all ages believe memory to be declining with age (Lineweaver & Hertzog, 1998, 2010). Moreover, adults of all ages tend to explain instances of forgetting differently depending on the age of a person experiencing forgetting. For example, people tend to attribute memory failures in young adults to either lack of effort or lack of attention, but for older adults, memory failures would be viewed as due to lack of cognitive ability (Erber, 1989). If older adults themselves believe that forgetting inevitably becomes more frequent and problematic as they get older, it is not unreasonable to think that this potentially can lead to an increase in cognitive complaints. Considering that everyday memory failures (EMFs) constitute a starting point for the diagnosis of both MCI and AD,

no normative information exists about what sort of memory failures healthy adults commit in everyday life and how frequent they are. Therefore, the main aim of this thesis is to start addressing this gap in the literature by conducting a series of studies using a combined methodology of laboratory assessments together with structured diaries and self-report measures.

This chapter will start with a review of a few major theoretical models. These early theories provided an explanation of how memory changes throughout adult life and why, as we get older, performance on cognitive tasks changes too. While each of the theoretical models suggested a single mechanism, accounting for the decline in cognitive domains, later work showed that they are not mutually exclusive. Despite the emergence of new theoretical models, these early theories remain dominant by providing the bases for further theoretical development.

Following a review of theory, the chapter will move on to the review of research in memory and ageing, first focusing on experimental methods and what they have revealed in terms of age-related losses, maintenance or gains across different memory domains. While these laboratory findings in many ways support earlier theoretical approaches to cognitive ageing, an overview of self-reported memory functioning in everyday life provides a somewhat different picture raising questions about whether cognitive performance in the laboratory settings translates into memory performance in the real world. Especially, findings from research on the so-called age-prospective memory paradox (Rendell & Craik, 2000) have paved the way for a more naturalistic approach to studying memory in everyday life, with diary studies of EMFs further challenging the idea that ageing is followed by the significant decline in prospective memory (Haas et al., 2020; Niedźwieńska et al., 2020).

Finally, a few of the existing explanations for varying results in relation to ageing and memory will be reviewed, identifying a further need for more research in everyday memory outside the laboratory. The chapter will end with a rationale for the studies included in this thesis in terms of how they build on prior work and significantly improve the basic knowledge of everyday cognition across the lifespan.

1.2 Theories of cognitive ageing

There is a long history of theoretical attempts to explain memory changes in ageing which vary from proposing a single mechanism, accounting for the majority of the decline in cognitive functions, to multi-dimensional approaches. By now, there is no doubt that as people age, their cognitive abilities are changing, although not all areas of memory are affected equally, with some showing decline and others, either no decline or an actual improvement. Therefore, theoretical approaches proposing a single mechanism are not always the best fit for explaining memory changes, and drawing upon a few theories of memory and ageing provides a clearer understanding of how different mechanisms of memory interact with each other (Park & Festini, 2017). The three most cited theoretical frameworks for explaining age effects are reviewed below.

Lack of understanding of why human memory seems to be deteriorating with age under some conditions but not others prompted Craik and colleagues to review some of the empirical evidence and propose a theory of *Reduced Processing Resources with increased age* (Craik, 1986). This theoretical approach, first proposed by Craik and Byrd (1982), postulates that as people get older, they have fewer attentional resources for encoding information into memory and later retrieving it. Due to these diminished attentional resources, older adults struggle to use effortful and strategic memory processes in more complex and demanding cognitive tasks, which leads to age-related decrements in these tasks. This theoretical approach gained a lot of support from studies demonstrating large age effects in free recall tasks, which require effortful self-initiated retrieval processes, and small age effects or even no age effects in recognition memory tasks which rely on more automatic familiarity based retrieval processes (Craik & McDowd, 1987; Danckert & Craik, 2013; Rhodes et al., 2019, but see Fraundorf et al., 2019 for different results on recognition).

One of the key suggestions of this theoretical approach is that if older adults are given sufficient environmental support during a particular memory task, this will reduce the amount attentional resources needed for the task (i.e., the amount of self-initiation) and, in turn, improve memory performance. According to Craik (1986), environmental support, in the form of external cues, facilitates the retrieval in recognition memory tasks and explains superior performance in recognition than in free recall tasks.

Perhaps the best demonstration of the importance of available processing resources can be seen in working memory tasks. Here, in simple memory tasks which mostly test the capacity of primary memory, such as forward digit span, older adults are only slightly compromised compared to tasks that require additional cognitive processing, i.e., tasks of

backward or complex digit span, where the age effects are quite large (Bopp & Verhaeghen, 2005). Recently, however, this theoretical approach was called into question by Tagliabue and Mazza (2021). In their review of functional brain imaging studies (i.e., fMRI, M/EEG), they attempted to assess the availability of processing resources in ageing by looking at the relationship between cognitive tasks/behaviour and brain activity reported in the reviewed studies. The authors concluded that there seems to be a lack of consistency in the brain – behaviour patterns reported in these studies and proposed a correction to the reduced processing theory approach. That is, rather than claiming that older adults have limited resources available to them, older adults might use available resources differently than younger adults. Specifically, older adults may be over employing processing resources right at the beginning, when the tasks are easier (lower cognitive load) and hence have fewer resources left when tasks get harder (i.e., when cognitive load is increasing) (Reuter-Lorenz & Cappell, 2008).

Another well-known explanation of age differences in cognitive performance is the *Processing Speed Theory* proposed by Salthouse (1996). According to this theoretical approach, older adults need more time to successfully execute cognitive operations. Salthouse (1996) argues that age-related differences in memory, attention and reasoning skills can be explained by older adults' deficiency in two mechanisms: limited time mechanism and simultaneity mechanism. Limited time mechanism applies due to older adults taking longer time to perform early operations which leads to them having lesser time for higher level operations, required in more difficult tasks. In turn, due to slow processing, the amount of simultaneously available information (i.e., simultaneity mechanism) needed for executing higher level processing is also reduced.

The evidence in support of the processing speed theory comes from a large number of studies examining correlations between age and performance on a wide variety of tasks in which participants are required to perform as quickly as possible. Among these, the most evident age decrements are noted in low level cognitive tasks that require little memory ability and reasoning (Hertzog et al., 2003; Park et al., 1996). For example, in a study by Salthouse and Babcock (1991), participants aged between 18 and 82, were asked to complete a letter comparison and a pattern comparison tasks. In these tasks, they were presented with pairs of strings of letters or patterns and had to decide whether they were “same” or “different” and the time it took for participants to make comparisons was used as a measure

of processing speed. The results clearly demonstrated that with increasing age, participants took a longer time to make comparisons.

Salthouse (2000) noted that many different variables can be used to measure the speed of processing. For example, some researchers assess perceptual speed with the idea that due to the simplicity of the task, without time limitation, all respondents would perform such a task without making any errors. Tasks in which participants are expected to perform with errors even without time limitation, i.e., the content of tasks is more complex, are used to measure decision speed. However, regardless of a variable choice to measure processing speed, the results are consistently showing age decrements in processing speed (Verhaeghen, 2011).

Whilst some age-related decrements in cognitive tasks can be explained by reduced processing speed, Luo and Craik (2008) noted that it is unclear why age-related deficits are found in tasks where there is no time limit (i.e., free recall), or that upon removing the time limit from the tasks, age-related decrements do not disappear in older adults, but the performance improves in younger adults. One of the ways of approaching the processing speed theory is by looking at processing speed not as a single mechanism which can explain all age-related cognitive decline, but as a mediator in a complex cognitive system. A good demonstration of this case was a study by Park et al. (1996) where working memory and speed were used as predictors of memory functioning in four separate tasks: free recall, cued recall, spatial memory and implicit memory. The results demonstrated that speed was the most important construct in explaining age-related variation in cognitive functioning.

Interestingly, the study by Park et al. (1996) not only showed support for the processing speed theory but also demonstrated evidence in support for the reduced processing resource theory. In their model, whilst speed had a direct effect on working memory, spatial recall, cued recall and free recall, working memory directly affected cued and free recall, both of which are more effortful and require a higher level of resources, but the effect on spatial recall (low effort) was moderated by speed. This model clearly demonstrated that both, processing resources and processing speed are important when explaining age-related decrements in cognitive tasks.

Upon reviewing a large diversity of tasks used in cognitive research, Hasher and Zacks (1988) noted that age-related decrements are most noticeable in tasks which require participants to overcome some sort of interference and proposed that older adults may have

impaired *inhibitory functioning*. According to this theoretical view, as people age, inhibitory mechanisms become less efficient. These mechanisms serve two main functions, both of which are very important for memory performance: preventing information that is irrelevant from entering working memory and, disposing of no longer relevant information from working memory. Essentially, based on this view, older people are believed to be more inefficient in dealing with interfering information and distractions as well as more prone to memory intrusions.

Earlier studies looking for support for this theoretical approach provided evidence that successful retrieval of information can be impacted by the level of presented interference. For example, in a study by Gerard et al., (1991) a *fan effect paradigm*¹ was used to investigate age difference in retrieval. In this study, participants were provided with a total of 18 to-be-learned facts about a person (type or profession) and the activity that person performed. Information about nine persons and nine different activities was used to generate to-be-learned facts. Later, participants took part in a recognition task containing a list of 18 facts at the different fan levels with nine of them containing learned facts (target information) and another half “made up” facts (non-target information) created by re-combining people and activities at appropriate fan levels. The results showed that in the speeded recognition task, older adults were much more affected by retrieval interference than younger adults. Especially, the “made up” facts, which require more laborious search of memory, produced large age differences on the speeded recognition test.

In their later work, Hasher et al. (1999) expanded inhibitory theory by proposing that inhibitory mechanisms serve not two but three inhibitory functions. In addition to preventing irrelevant information from becoming a focus of attention (access) and deleting it when it is no longer needed (deletion), the inhibitory mechanism also serves a function of restraint. According to the authors, this latter function allows a person to restrain response tendencies that are inappropriate to the task at hand. A good example of this can be seen in a Stroop task when participants are required to restrain from automatically reading a word in a colour incongruent task.

¹ A “*fan effect*” means that increasing a number of facts associated with presented information leads to a decrease of speed and accuracy when retrieving the relevant information from the memory i.e., retrieval is poorer. Anderson (1974) showed that older adults are more susceptible to this “*fan effect*” indicating that they possess less efficient inhibitory mechanisms needed for screening out nontarget information.

In a recent meta-analysis, Rey-Mermet and Gade (2018) reviewed studies which used tasks commonly known to involve restraint mechanism of inhibitory function (i.e., colour Stroop, flanker task, stop-signal, go/no-go, etc). Authors noted, that whilst age-related impairments were clearly evidenced in go/no-go and stop-signal tasks, surprisingly, such impairments were not always found in colour Stroop and flanker tasks. However, in a recent special issue on ageing and inhibition, Campbell et al. (2020) argued that in some tasks older adults may be able to use compensation or recruit alternative systems which help them to alleviate the age differences. For example, in one of their reviewed studies, older adults made fewer errors than younger adults on the go/no-go task, but this was marked by a slower responding time. The authors concluded that older adults may be prioritising accuracy over speed. The need for extra time to resolve response conflict (i.e., restraint) in older adults was also demonstrated in the study by Erb et al. (2020) where it was evidenced that older adults took longer to initiate the action but not to complete it.

The latter suggestion of the possibility that older adults may be prioritising accuracy over speed is a good example of the importance of choosing the right theoretical approach when explaining the age-related decrements in a laboratory task. If it was the speed that was the main measurement in such study, the results would provide support for the Processing Speed Theory claiming that older adults have slower processing speed compared to younger adults. Nevertheless, upon reviewing these three major theoretical approaches, which have acted as building blocks to the understanding of cognitive ageing today, one can state with confidence that these theories are not mutually exclusive and that processing resources such as speed and working memory, as well as inhibitory functions are all important for successful memory functioning.

1.3. Overview of Memory and Ageing Research

Most, if not all, empirical evidence for what we know today about ageing and memory comes from studies conducted in the laboratory. The results of these studies demonstrate differential age effects with certain components of memory being more affected than others (Drag & Bieliauskas, 2010; Maylor, 2005).

One area of research on memory and ageing that has accumulated the largest evidence for negative age effects is episodic memory. Episodic memory is a memory for personally experienced events which occur in a specific place at a specific time and is tested by asking participants to learn some new material (e.g., a list of words, a short story, or figures) and

later testing them in free recall, cued recall, and/or recognition tasks. Rhodes et al. (2019) conducted a meta-analysis of studies published between 1966 – 2016, which investigated age differences in the recall and recognition memory tasks. A total of 36 studies, directly comparing young and older adults' performance in free recall and recognition tasks, were carefully selected. Additional information regarding eight different variables (learning instructions, used stimuli, mode of presentation, list length, the relatedness of items, order of tests, age of younger group in recognition tasks and age of the older group), that could potentially moderate the overall age differences were also extracted. Unsurprisingly, the results clearly showed that younger adults outperformed older adults in both episodic memory tasks. In addition, further analyses, in line with the existing evidence, demonstrated that the age differences were much larger in free recall tasks than in recognition memory tasks. More importantly, none of the chosen moderators reduced the age effects in the recall and recognition task.

While the age effects between free recall and recognition seem to be generally large, for cued recall tasks the age difference in performance, whilst still present, appears to be somewhat smaller. For example, Perlmutter (1979) conducted two experiments to test age differences in free recall, cued recall and recognition tasks. In Experiment 1, young and older participants completed two learning tasks: an incidental associative task asking participants to generate free associations for a list of 24 words, and an intentional memory task in which participants were given a different list of 24 words and were asked to memorise as many as possible. Later, they completed two recall tasks (incidental and intentional) and one incidental and intentional recognition task. Results showed that older adults recalled significantly fewer words compared to young adults in free recall tasks overall, but no age differences were observed in recognition tasks. In Experiment 2, similar materials were used except that the to-be-remembered list contained 30 words. After familiarising themselves with the lists, participants completed a filler task requiring them to fill in a questionnaire about their thoughts regarding their memory and then completed a cued recall task. Taken together, the results from both experiments indicated that whilst age differences were observed for both, free and cued recall, in the case of the latter, these differences were somewhat attenuated.

Unlike episodic memory, semantic memory, which is a memory for factual knowledge (e.g., for word meaning, historical facts, etc), appears to be spared in healthy ageing. In a study by Park et al. (2002), three verbal ability measures were used in

participants aged 20 – 92. Participants were first presented with 40 target words and four alternatives to each and had to decide which of the four alternative words had a similar meaning to the target word. Two additional tasks were used to check for synonym vocabulary and antonym vocabulary. All tasks were randomised. The results showed no age difference in antonym vocabulary, but positive age effects were observed in both, synonym vocabulary and the similarities test.

Similar results were obtained in a meta-analysis by Verhaeghen (2003), which included 210 studies published in the *Psychology and Aging* journal between 1986 – 2001, examining the effects of age on vocabulary scores. Due to the variability in the test materials used within these studies, authors looked at the effects sizes in the overall performance and then separately for the multiple-choice tests (e.g., the Mill Hill vocabulary test requires a participant to select the most similar alternative to the target word) and for production tests (e.g., Wechsler vocabulary subtest, where a description needs to be provided for a given word). Substantial age effects were found in the overall vocabulary scores favouring older adults, but this advantage was smaller for production tests. This latter finding is not surprising given that multiple-choice tests are somewhat similar to recognition tasks (i.e., a person is provided with more cues), whereas describing a word in a production test may place a higher demand on word-finding that may require more strategic and active search processes.

Given that research in episodic and semantic memory to date demonstrate differential effects of age, it is perhaps unsurprising that studies of autobiographical memory, which consist of remembering episodic and semantic information, produce similarly variable findings with the largest age effects observed in episodic autobiographical memory recall (Levine et al., 2002; Piolino et al., 2002, 2010; St. Jacques & Levine, 2007). Nevertheless, in a recent paper by Mair et al. (2021), it was noted that not all studies show consistent findings regarding the autobiographical memory deficit in older adults and the authors sought to investigate whether the effects of age was dependent on the tasks used. In this study, young (aged 20-31) and older (aged 66-82) adults completed a set of five memory tasks comprising of four measures for event memory (with three autobiographical and one everyday memory) and a laboratory task of episodic memory. Participants completed all tasks in the same order: a free recall task of a word list (assessing episodic memory); recalling one event from when they were aged between 11 to 17; recalling one event from the past year excluding last month; recalling a specific autobiographical event in response to each of the six cue words; finally, in everyday memory task participants were asked to recall four out of 12 events

recorded in detail by participants two weeks prior the testing. The results of the study supported the hypothesis that the effects of age on autobiographical memory can vary depending on the chosen task. For the semantic recall, older adults provided significantly more details compared to young adults in all event recall tasks. However, whilst there was a significant negative age effect for episodic recall in the autobiographical cue-word task and in the task of recalling an event from the age of 11-17, the same effect was not observed in the recall of events from participants' everyday memory or recalling the event from the past year.

Consistent with the negative effects of age on episodic memory, experimental laboratory studies of remembering future intentions or prospective memory (PM) show similar results (Henry et al., 2004; Uttil, 2008). Interestingly though, different tasks used to measure PM are differentially sensitive to age. Within the literature, PM tasks are most commonly separated by the type of PM intentions into the event- and time-based tasks (Einstein & McDaniel, 1990, but see Kvavilashvili & Ellis, 1996 for additional distinction). In time-based PM tasks, participants are asked to perform a specific action at a set time or after a timed interval has passed. For example, in a study by Einstein et al. (1995) young and older adults were asked to press the F8 key every 10 minutes whilst they were taking part in a vocabulary test with words being presented on the computer screen. A digital clock was placed one meter away over the participant's right shoulder which they were advised to use to help monitor the elapsed time. The results from this task showed that younger adults were better than older adults at remembering to perform the PM task on time.

By contrast, event-based tasks are hypothesised to be slightly easier as the requirement for self-initiated retrieval is lower than for the time-based task due to the former containing cues. A good example of such a task is in Experiment 2 of Einstein and McDaniel (1995) study. To test event-based PM, young and older adults, whilst performing a continuous memory span task, were asked to press a key on the keyboard whenever they saw a specific target word. Unlike in the time-based task of Experiment 1, no age differences were observed.

Of course, laboratory research on PM and ageing does not always produce consistent findings with some showing no age effect in event-based tasks (Einstein et al., 1995), others indicating an age-related decline in both, event- and time-based tasks (Park et al., 1997). In seeking to investigate these variable results, Henry et al. (2004) conducted a meta-analysis of studies which directly compared young and older adults' performance in the event- and/or time-based tasks and, in addition, compared such performance in laboratory versus

naturalistic settings. The authors found substantial age-related deficits in the laboratory settings, but this was reversed when participants were tested under naturalistic conditions (i.e., outside the laboratory) with older adults outperforming younger adults in both, time – and event-based tasks. This counterintuitive finding of reversed performance has been termed the “*Age – PM paradox*” and has attracted a lot of interest whilst gaining further support from later studies (Bailey et al., 2010; Kvavilashvili et al., 2013; Schnitzspahn et al., 2020; Uttl, 2008). Nevertheless, in a recent study by Schnitzspahn et al. (2020), the Age-PM paradox, at least partially, has been called into question. The authors found that the age benefit was noted only in those naturalistic tasks, where the self-set intentions of participants were planned with a clear date and time in mind. Schnitzspahn and colleagues noted, that given the fact that prior research mostly used naturalistic tasks with predefined date and time, the age benefits may have been overestimated and proposed to redefine the Age-PM paradox to reflect the lack of negative age effects on the naturalistic tasks, rather than there being a positive age effect. Likewise, Haines et al. (2020) argued that the existence of age benefits is mostly due to the mismatch between the tasks used in the laboratory and naturalistic environments. In two separate Experiments (Experiments 1 and 3), to compare young and older adults’ performance in laboratory and naturalistic PM tasks, the time-based tasks were divided into time-of-day (e.g. an appointment at a specific time) and time-interval (e.g. to open an app after a specified time interval) tasks. Results showed classical negative age effects in the laboratory settings, but no age differences in the naturalistic time-interval tasks. For the naturalistic time-of-day tasks, results varied with age benefit found in Experiment 1, and no age effects were found in Experiment 3.

One possible explanation why older adults may be struggling more during the PM tasks in a laboratory is that in a laboratory task, PM targets are usually embedded in other attention-demanding ongoing tasks. Indeed, studies in cognitive research looking at attention capacity and ageing provided evidence that older adults are particularly impaired in tasks which require divided attention or good task-switching abilities (Fraser & Bherer, 2013; Schnitzspahn et al., 2013). For example, Rendell et al. (2007) noted a large variation in reported age effects in studies using an event-based task (e.g., during an ongoing task, a participant is asked to perform a specific action upon seeing a target cue) and proposed that no age differences are mostly found when the demands on the ongoing tasks are made easier for older adults. To demonstrate this within one experiment, Rendell et al. (2007) exposed participants to pictures of celebrities as part of ongoing task in which they embedded a PM

task of responding to pictures of people with glasses. The ongoing task difficulty was manipulated by giving participants only 10 seconds to name the picture of each celebrity or giving participants 20 seconds. It was expected that if older adults were given more time to recall names (arguably a more difficult task for older people) then their performance on the PM task would improve. In another experimental condition, participants were given 10 seconds to name the profession of the celebrity which was deemed to be an easier task than recalling the names of celebrities. When participants had only 10 seconds to name the pictures, older adults performed significantly worse on PM task than young adults. However, this negative age effect was completely eliminated in the other two conditions in which the demands of the ongoing task were made easier. Moreover, Schnitzspahn et al. (2013) demonstrated that age-related variability in PM performance was largely accounted for by inhibition and switching, both of which are part of the executive functioning, with the inhibition being the strongest predictor.

Studies looking at executive functioning in relation to memory and ageing to date provided evidence for negative age effects beyond the functioning of PM. For example, Treitz et al. (2007) looked at the effect of age on the changes of executive control in adults aged 20 – 75 by separating them into 4 different age groups (i.e., 20-30, 31-45, 46-60 and 61-75) and found a significant reduction in executive function in those over 60 years of age. Specifically, a significant decline in inhibition tasks was found in the oldest group compared to the two youngest groups, as well as the task management (ability to switch between tasks), where the oldest group demonstrated significant disadvantages in relation to divided attention and dual-task costs. Attention, which is required for inhibition and task-switching, is also believed to be closely connected to working memory (see Oberauer, 2019 for a review).

Working memory is responsible for an active manipulation and processing of available information and as such, requires greater demand for cognitive resources, hence it is unsurprising that with the increased ongoing task difficulty, age decrements also increase (Bopp & Verhaeghen, 2005). The importance of both, working memory and executive functioning in age-related declines in episodic memory was further demonstrated by McCabe et al. (2010), who noted that after controlling for working memory and/or executive functioning, the effects of age on episodic memory were either reduced or eliminated completely.

There are, of course, many other aspects of memory which are studied in the laboratory environment and show differential effects of ageing however, these are beyond the

scope of this thesis and hence are not reviewed. Overall, presented evidence in this section indicates that in laboratory studies, many areas of memory, especially episodic and PM, are indeed sensitive to ageing with autobiographical memory only partially spared, and semantic memory maintained or even improving with age. The expectation is, therefore, that these decrements observed in the laboratory would be observed in the natural settings as well, however, research on PM outside the laboratory thus far indicates otherwise, with older adults performing as well or even better than young adults.

1.3.1 Questionnaire studies on memory and ageing

Whilst laboratory testing is designed to target specific memory domains/functions under a highly controlled environment, it may be that in everyday life, where people are surrounded by external cues, and everyday functioning does not require their memory to perform at the highest ability, the age differences observed in the laboratory setting would be diminished. One way of obtaining an understanding of young and older adults' memory functioning in everyday life is by using self-reported memory questionnaires. Over the last five decades, there have been many memory questionnaires developed for assessing memory functioning in everyday life (see reviews by Carrigan & Barkus, 2016; Dixon, 1989; Gilewski & Zelinski, 1986; Herrmann, 1982). A large majority of these are one-dimensional, that is questions included in a memory questionnaire or its subscales, cover broad memory abilities and the memory functioning is judged based on a total score.

One of the most frequently used questionnaires is the *Cognitive Failures Questionnaire* (CFQ, Broadbent et al., 1982). The CFQ contains a total of 25 questions, assessing the frequency of various memory, perception and action failures, over the last six months from never to very often. Despite the wide use of this questionnaire, many studies to date have failed to find strong correlations between CFQ and performance in objective memory tasks (Broadbent et al., 1982; Martin, 1983; Rabbitt, 1990; Rabbitt & Abson, 1990; Reese & Cherry, 2006) with only a few showing a moderate correlation with distractibility during sustained attention tasks (Murphy & Dalton, 2014; Tipper & Baylis, 1987). Moreover, whilst CFQ was mainly used in studies on young adults, those few that did compare the frequency of self-rated cognitive failures in young and older adults produced mixed results: either no age effect in overall scores (Könen & Karbach, 2020; Reese & Cherry, 2006) or negative correlations with age (Mecacci & Righi, 2006), indicating that older adults reported

experiencing fewer cognitive failures than younger adults. In light of these inconsistent findings, de Winter, Dodou and Hancock (2015) proposed the idea that people may simply be unable to genuinely reflect on their everyday forgetting. In particular, authors contemplated the idea that the ability to successfully recall the instances of forgetting is dependent on good cognitive ability. For example, if a person experiences a lot of memory failures due to cognitive decline, then that person is also more likely to forget these failures and believe that they do not commit those failures at all (see Figure 1-1; de Winter et al., 2015).

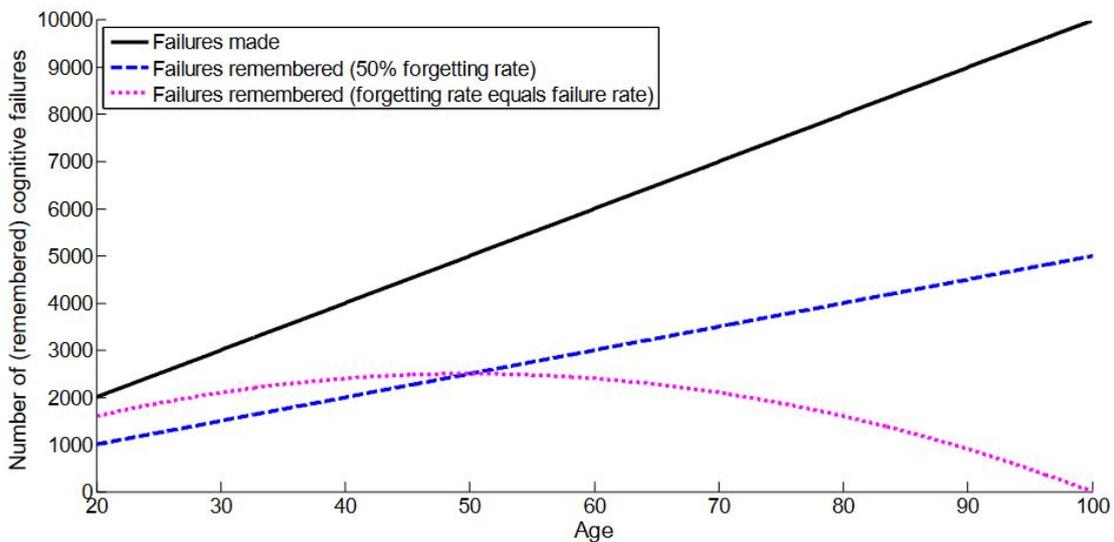


Figure 1 - 1: Visual representation of the predicted number of failures made (solid line) and remembered (dashed and dotted lines) as a function of age (from de Winter, Dodou & Hancock)

It is, however, worth noting, that whilst studies considering a total score of CFQ did not find any difference between young and older adults, different results were obtained when looking at separate items of CFQ. For example, Reese and Cherry (2006) analysed age effects on two CFQ items reflecting PM and two items reflecting retrospective memory (RM) for past events and information and noted that young adults indicated forgetting appointments more often than older adults, while older adults more frequently than young, forgot why they

went from one room to another². Similarly, Martin (1986) found no age differences in the total score of CFQ, but the differences occurred in seven individual items: older people were worse than young in remembering names, phone numbers and sports results, whereas young adults were worse at remembering appointments, colours, paying bills and taking medications. Such results demonstrate that combining questions relating to multiple aspects of memory into one scale and then looking at the age differences in the overall score can be uninformative.

It is interesting, however, that in their second study, Reese and Cherry (2006b) chose a different questionnaire and the prior assumption did not hold. This time, the *Memory Failures Questionnaire* (MFQ, Zelinski et al., 1990) was chosen to be used in a larger sample of young and older participants. MFQ contains 64 items measuring four aspects of memory functioning: general frequency of forgetting, seriousness ratings of forgetting, retrospective functioning, and the use of mnemonics. Using this questionnaire, Reese and Cherry (2006) found no age differences in the total score of the frequency of forgetting scale nor the separate items reflecting appointments or why one went from one room to another. The opposite results, however, were obtained in the study by McAlister and Schmitter-Edgecombe (2016) which showed significant age effects in the total score of the frequency of forgetting subscale with older adults reporting a higher frequency of EMFs overall. In addition, the item-by-item analysis showed that older adults reported more difficulties with names, faces and phone numbers, while younger adults did not have a higher frequency on any individual items.

The need to have more balanced items for prospective and retrospective EMFs was also noted by Smith et al. (2000) who observed that previous questionnaires, such as CFQ, only had very few items reflecting PM. To investigate a difference in the frequency of PM failures and failures of retrospective memory (RM) in a sample of clinical (AD) and healthy populations, Smith et al. (2000) developed a 16-item *Prospective and Retrospective Memory Questionnaire* (PRMQ) with eight items reflecting PM (remembering to do things in future) and eight items reflecting RM failures (remembering past events and information). The PRMQ was administered to four groups of participants: healthy young and older adults, AD patients and their carers acting as informants. Participants were asked to rate the frequency

² It is worth noting that “*forgetting why you went from one room to another*” is indeed an absent-minded failure and is not attributed to a typical retrospective memory failure in everyday life (Kvavilashvili & Ellis, 1996).

with which they (carers rated frequency in their relatives with AD) had experienced each example of PM and RM on a 5-point scale ranging from *Very Often* to *Never*. Contrary to the authors' expectations, no differences were found in (1) the informants' (AD patient carers) ratings of frequency between PM and RM, (2) no difference in PM and RM between healthy young and older adults' ratings, but (3) across all groups PM failures were rated as more frequent than RM. Similar results were found in later studies within healthy populations with no age effects observed in the total score, or separately for PM and RM (Crawford et al., 2003; Piauilino et al., 2010; but see Rönnlund et al., 2008 for higher age being associated with a decrease in PM frequency), or older adults rating PM failures as more frequent than RM (Kliegel & Jäger, 2006).

Upon reviewing existing self-reporting instruments, Troyer and Rich (2002) noted, that there was a need for a multi-factor measure which would be more useful in a clinical setting and proposed a new *Multifactorial Memory Questionnaire* (MMQ). The MMQ contains 3 subscales which are scored independently from each other: *MMQ – Containment* (in later studies renamed to *Satisfaction*) covering items relating to perceptions of, or emotional aspect of own memory ability, *MMQ – Ability* covering the frequency of different EMFs and finally, *MMQ – Strategy* subscale asking participants to rate how often they use different internal and external strategies. Subsequent systemic review and meta-analysis by Troyer et al. (2019) revealed that MMQ has been validated across many countries and consistently maintains high validity and reliability across healthy and clinical populations. However, very few studies compared young and older adults' performance on MMQ and those few that did, showed that with older age, satisfaction with own memory decreases, but so does the frequency of failures and strategy use (Raimo et al., 2016). Similarly, van Der Werf and Vos (2011) found that older age led to a decrease in memory satisfaction and ability ratings, but no significant correlations were obtained with the strategy subscale. Such findings are somewhat contradictory as one would expect that a person who is less satisfied with their memory would indeed be reporting a higher frequency of EMFs and use more strategies to support it.

Interestingly, the decrease in satisfaction in one's own memory ability, as measured by the Satisfaction subscale of MMQ, relates to another important construct in research on cognitive ageing, often referred to as memory or cognitive self-efficacy (Berry & West, 1993). Memory self-efficacy has been defined as one of the key aspects of metamemory that involves beliefs and confidence in one's competency and control in performing memory tasks

in general and in specific memory demanding situations (Berry, West, & Dennehey, 1989; Cavanaugh, 1996). Troyer and Rich (2002) noted the existence of the evidence that people's self-reports of memory functioning can often reveal inaccurate beliefs about memory changes with age and that these beliefs are generally influenced by negative age stereotypes. Authors suggested that such self-efficacy beliefs could lead to viewing own memory as impaired resulting in reduced effort when performing everyday tasks and fewer attempts to use memory strategies to aid one's own memory.

The link between memory self-efficacy and the strategy use has been investigated in a few studies and so far, these studies have produced mixed findings. For example, Wells and Esopenko (2008) investigated a group of healthy older adults aged 65 to 86, and found that whilst increasing age was associated with a decrease in memory self-efficacy, the use of strategies did not increase with age. Nevertheless, Hertzog, Pearman et al. (2021) reviewed available evidence and noted that memory self-efficacy is highly impacted by negative beliefs about memory changes with aging, which can then lead to lower effort to use strategies or abandon them entirely. Indeed, in their paper they presented results from a study by Pearman et al. (2020) where following an intervention comprising of memory strategies and restructuring of memory beliefs, there was a noticeable increase in older adults' memory self-efficacy.

In summary, the literature reviewed in this section clearly demonstrates that there is a limited number of meta-memory questionnaire studies that have compared young and older adults's self-reported frequency of EMFs and many more studies are needed in order to be able to establish self-reported memory changes across the lifespan. Moreover, the results from the questionnaire studies seem to contradict findings from the laboratory studies that have resulted in significant negative age effects. Therefore, one of the suggestions that has been consistently made in the literature is that older adults, due to decline in their memory, are not able to remember what they have forgotten (Rabbitt et al., 1990).

1.3.2 Diary Studies of Everyday Memory failures

Since memory questionnaires heavily rely on a person's ability to retrospectively recall how often they forgot something over the last week, month or more, a good alternative to overcome this is to ask a person to keep a diary. As such, a diary method can capture more

immediate everyday memory failures (EMFs) without depending on people's retrospective estimates of their frequency (Crovitx et al., 1984). Famously termed by Terry (1984) as a "*forgetting journal*", such a diary can indicate different types of memory failures people commit in their day-to-day lives and how often they occur.

To date, two types of diaries have been used for investigating EMFs in a naturalistic setting in both healthy adults and patients: daily checklist diaries, containing a list with examples of EMFs, whereby participants complete the diary page at the end of each day by placing a tick for each experienced EMF, and self-prompted (structured) diaries, where participants have to describe their memory failures and answer several questions about the recorded failure. For example, in a study by Sunderland et al. (1983), in addition to completing a memory questionnaire, participants with and without head injuries aged between 16 and 65, and their relatives (as informants), were given a booklet containing 35 examples of memory failures from an earlier questionnaire in a form of a checklist. They were then asked to complete the checklist at the end of each day for a total of 7 days by ticking memory failures they had experienced that day once. If a specific EMF was experienced more than once that day, participants were asked to indicate this by placing two ticks next to that failure. Interestingly, no general difference in a checklist diary between people with and without brain injury was found, but relatives of both groups indicated a significantly higher frequency of memory failures in patients indicating that informants may be in a better position at noticing their relatives' forgetting instances.

Neupert et al. (2006) used a similar type of diary with healthy older participants by selecting five items from the checklist used in the above study to investigate whether stress had an effect on EMFs. The items in the diary concerned examples of needing to check if something was already done, reading something without realizing that you've already read it before, word-finding difficulties, and difficulty learning new skills and problems recognizing faces. They also included a question about forgetting to take medications. Participants were asked to complete this diary at the end of each day for a total of eight consecutive days. The results showed that higher daily stressors led to a higher frequency of failures on the same day. This finding of a detrimental effect of stress on memory functioning is generally in line with various studies investigating the relationship between negative affect and everyday cognition (Bell et al., 2021; Rickenbach et al., 2014; Rowell et al., 2016).

In order to investigate age effects on daily forgetting, McAlister and Schmitter-Edgecombe (2016) used a different type of diary checklist. In Experiment 1, participants

completed MFQ and kept a diary containing a checklist of 16 items from the MFQ *Frequency of Forgetting* subscale for a total of seven days. The results from this daily diary checklist indicated that whilst young and older adults reported a similar overall frequency of EMFs, older adults were more frequently forgetting names and words, whereas young adults were more frequently forgetting appointments and personal dates. More importantly, whilst the overall frequency of EMFs in a diary checklist did not produce an age effect, the result from the self-reported questionnaire indicated a significant effect of age with older adults endorsing a higher frequency of EMFs compared to young adults indicating that older adults may misjudge their memory functioning when asked to rate it retrospectively. Another interesting result came from Experiment 2 of the same study where older adults were contacted after five years and again kept a checklist diary of their EMFs for seven days. At the follow-up, older adults exhibited an increased frequency of overall EMFs compared to the baseline with a particular increase in the frequency of forgetting names, words and frequently used phone numbers. However, on the retrospective questionnaire, the frequency of EMFs was lower compared to that indicated at the baseline, yet again demonstrating a discrepancy between the questionnaire findings and the data collected by a diary method.

The importance of looking at distinct types of EMFs when using a checklist diary was further demonstrated in a study by Mogle et al. (2019), who noted the lack of separation between failures of PM (i.e., forgetting to do something in the future) and retrospective memory (RM – forgetting information from the past) in studies using a checklist for EMFs. Unlike the studies, discussed earlier, the authors used an 11-item checklist diary reflecting five items representing PM, five items for RM and one item for the “other” category, which was not explained by the authors. To investigate age effects, adults aged 20 – 80 were asked to keep a 7-day diary where they would indicate the frequency of EMFs on the checklist at the end of each day. The results showed that older adults compared to young, reported more EMFs overall and this age difference was even larger for RM failures. This finding is very important as it demonstrates the significance of the types of EMFs included in the checklist diary since many previous questionnaire studies were criticised that the absence of age effects may have been due to them containing general memory complaints rather than specific aspects of it.

It can be argued, however, that incorporating a checklist into a diary partially undermines the idea of diary keeping. Indeed, Bolger et al. (2003) stressed that the most fundamental benefit of using a diary is that it can provide insight into personal experiences in

their natural and spontaneous context. More importantly for the diary design is to consider the research question. Thus, if we are interested in investigating memory failures and their frequency in a natural environment, an alternative and better way to do this would be by asking people to describe them rather than giving them a set of examples of EMFs to choose from. As noted by Crovitz and Daniel (1984), the use of such a diary can enable researchers to obtain a list of EMFs which can later be used for comparison of age differences or even EMFs in typical and atypical ageing. Whilst this type of structured diary has attracted more interest over the last few decades, only a handful of studies using such diaries exist to date. Of these, the majority of studies were conducted with only young adults (Crovitz et al., 1984; Crovitz & Daniel, 1984; Reason, 1979, 1984; Terry, 1988; Unsworth et al., 2012, 2013), one study investigated memory failures at work without specifying the age of participants (Eldridge et al., 1992), another compared older adults with and without cognitive impairment (Niedźwieńska & Kvavilashvili, 2019) and only a few investigated age differences in EMFs (J. C. Cavanaugh et al., 1983; Haas et al., 2020; Jónsdóttir et al., 2007; Niedźwieńska et al., 2020).

Whilst studying EMFs in the young adult population using structured diaries, studies to date have produced somewhat variable results. For example, in both Crovitz et al. (1984) and Terry (1988) studies, young adults reported intentions (PM) as most frequently forgotten, followed by RM failures. However, Unsworth et al. (2013) found no difference between PM and RM in their sample, and it was the attentional failures that were reported most frequently. Interestingly, in later studies by Hass et al., (2020) and Niedźwieńska et al. (2020), attentional failures were the least reported within the young adult samples with an overwhelming majority of reported EMFs belonging to the PM category.

In relation to age differences in the frequency and types of EMFs, results to date are fairly similar across a very limited number of studies. Both Niedźwieńska et al. (2020) and Hass et al. (2020) found that PM failures were most frequently reported across all age groups (but see Cavanaugh et al., 1983 for different results on RM). In addition, younger adults reported significantly more PM failures compared to older adults, but no significant differences were found in relation to RM or attentional/absent-minded failures. The results regarding the absence of age effects in attentional failures are somewhat different to Jónsdóttir et al.'s (2007) findings. In their study, young and older participants, aged 19-60, kept a diary for a week and were given instructions to record everything they did incorrectly

due to attentional failures. Results of this study revealed a negative correlation between the age and the number of slips with older adults recording fewer instances compared to young.

From this limited number of studies, regardless of the type of the diary used, it is not unreasonable to conclude that in everyday life, younger adults seem to be experiencing a lot more PM failures compared to older adults, which in turn provides further support for the age-PM paradox. However, given a limited number of studies to date, more research is needed to strengthen these initial results.

1.4 Possible Explanations for the incongruent laboratory and naturalistic findings

The idea that older adults may not be worse and even better than young adults in some aspects of memory outside the laboratory has attracted quite a lot of attention, especially in relation to the age-PM paradox. In line with Craik's (1986) theory that older adults appear to perform better if they have more environmental support, many studies suggest that older adults may be using more compensatory strategies³ to aid their memory which would explain why in the naturalistic settings they report fewer PM failures than younger adults (Cheyne et al., 2013; Dixon et al., 2001; Haas et al., 2020; Ihle et al., 2012). However, research into strategy use and ageing again provides somewhat inconsistent results, with some indicating increased use of strategies with increased age and others finding the use of strategies between young and older similar (Bouazzaoui et al., 2010; Fabricio & Yassuda, 2011). More importantly, only one diary study to date specifically asked young and older adults to record their daily strategies and despite a marginally significant age effect with older adults recording more strategies, the results are questionable due to small and unequal sample sizes (J. C. Cavanaugh et al., 1983).

Moreover, it has been suggested that younger adults may have a different lifestyle to that of older adults and hence they have more opportunities to forget their intentions (Rendell & Craik, 2000; Rendell & Thomson, 1999). However, one diary study conducted to date has shown that lifestyle did not affect the frequency of EMFs in young and older adults (Niedźwieńska et al., 2020). In addition, there have been some suggestions in the literature that the diary method is not fit for use in older adults because due to declining memory

³ The use of external strategies, for example, reminders, calendars or notes, can provide environmental support.

abilities they may forget to record what they were asked to record (Rabbitt et al., 1990). However, results from naturalistic studies of PM that have consistently demonstrated the existence of the Age-PM paradox (older adults performing as well as or even significantly better on simple everyday PM tasks such as calling a researcher at particular times), do not appear to provide any empirical support for this statement.

On the other hand, there are some suggestions that older adults' performance in the laboratory tasks may be affected by negative age-based stereotype threat. For example, a meta-analysis by Armstrong et al. (2017) showed that age-based stereotype threat can impact older adults' performance in a variety of laboratory episodic and working memory tasks. Moreover, results from other studies have suggested that attitudes towards the self are shaped by the stereotypes and expectations of the society and in turn can make older people's self-rating of memory functioning worse than it actually is (Rabbitt & Abson, 1990). Finally, there is a large amount of evidence for the effects of personality and low mood/stress on self-reported memory functioning (Carrigan & Barkus, 2016; Rickenbach et al., 2014; Rowell et al., 2016).

1.5. Rationale

The brief overview of the literature, presented above, on research in memory and ageing with a particular focus on everyday memory functioning across the lifespan has demonstrated how recent advances in cognitive psychology and related areas have started to emphasise the importance of supplementing laboratory studies with other empirical methods such as experience sampling, diary methods, interviews, etc. The development of new tools and combined methodology is clearly necessary for further advancement of knowledge about how the ageing mind operates both in and outside the laboratory.

Justification of chosen methodology

To address the need for advancing our understanding of memory functioning of young and older adults outside the laboratory environment, a mixed method approach was applied in the current thesis, with semi-structured diaries (Studies 1a, 1b and 2) and self-report questionnaires (Studies 3a, 3b, 4a and 4b) used as the main methods of enquiry. The literature review above showed that, whilst questionnaire studies of EMFs have been around for several decades, research on memory and ageing using diary methods is still relatively young. Iida et al. (2012) has noted that, compared to using questionnaires, a diary method can help

overcome the need to retrospectively recall own experiences since people can record them as soon as they happen. Moreover, everything we know about the memory strategy use in daily life primarily comes from questionnaire studies and hence, studying these using a diary method, just like in the case of memory failures, would provide us with more accurate understanding of their use in everyday live.

It is, however, important to note, that the diary method too is subject to some limitations. For example, a diary can increase participants' burden by requiring them to enter long entries or asking to keep a diary for long periods of time (Bolger et al., 2003; Iida et al., 2012). The diary studies in the current thesis sought to overcome these limitations by first, using semi-structured diaries where recording each of the memory failures/memory strategies took only 1-2 minutes of participants' time. In addition, whilst the majority of previous diary studies of EMFs required participants to keep their diaries at least for a week (e.g., Laughland, 2017; Niedźwieńska et al., 2020, but see Haas et al., 2020 with a 5-day diary), in our studies, the diary keeping period was reduced to 3-days only. This decision was guided by the findings of Laughland (2017) who reported that, the number of EMFs recorded in a 7-day diary was significantly higher than the number of entries in week 1 of the 28-day diary.

Another potential limitation of the diary studies, especially when studying EMFs, is the question of diary compliance and, as suggested by Rabbit et al. (1990), participants and especially older adults, may forget to record in the diaries. However, these were addressed in the present thesis by first, asking participants, both young and older, to wear reminder watches for the duration of the diary keeping period (Studies 1a and 1b). These watches were set to vibrate four times per day with a message “*Diary*” appearing on the screen to remind participants' of their intention to keep a diary and record every memory failure experienced or memory strategy used during the diary keeping period. In addition, all participants completed a diary compliance questionnaire at the end of each diary study, which allowed us to compare the compliance rates between the two age groups. Finally, the participants were also given the opportunity to acknowledge the EMFs or strategies that they did not record on the diary pages by placing a tick in the grid box in the diaries for each of the corresponding diary days.

Due to restrictions on face-to-face recruitment, imposed by Covid-19 pandemic, Studies 3a, 3b, 4a and 4b used a survey/questionnaire methods. Although the questionnaire method has been often used for studying everyday memory functioning outside laboratory, it has been criticised for relying heavily on participants' ability to retrospectively recall past

experiences and some research indicates that people may not be able to provide correct estimates when, for example, rating the frequency of memory failures experienced in the past (de Winter et al., 2015). Whilst this retrospective bias could not be avoided in the present thesis, we hoped that by creating novel questionnaires with empirically validated items, we would potentially reduce this bias. More precisely, two new questionnaires were developed with items representing the most frequently reported memory failures in our diary Study 1a and most frequently reported memory strategies in a diary Study 1b. In doing so, we also addressed another potential limitation of existing questionnaires such as containing questions which (a) may no longer be relevant in today's world (e.g., remembering phone numbers), or (b) does not fully represent the types of memory strategies used by not taking into the account the use of electronic aids (Tomaszewski, Farias et al., 2018).

Lastly, these newly developed questionnaires were also used for investigating stereotypical views of memory and ageing. To date, views on memory and ageing have been mostly explored with surveys focusing on the knowledge of normal versus abnormal ageing (e.g., *KMAQ*, Cherry et al., 2000) or using questionnaires with generic items extracted from existing memory questionnaires (e.g., Lineweaver & Hertzog, 1998). The diary studies, including our Studies 1a, 1b, and 2 in the present thesis provided a good understanding of the specific types of EMFs healthy adults report as well as the types of strategies they use. Therefore, a decision was made to use our newly developed questionnaires to investigate general public's views on the frequency of different types of EMFs and types of strategies in people of different age groups. This novel approach would allow us to obtain a more in depth understanding of stereotypical views people hold in relation to healthy ageing and memory.

Outline of the chapters

The next five empirical chapters will present findings from four separate studies. Chapter two presents data from two related studies (Studies 1a and 1b) using laboratory methods and a semi-structured diary method in which participants completed laboratory tasks of memory and cognition and recorded their EMFs over a 3-day period. The main aim of this study was to investigate the nature and frequency of EMFs in two age groups and further test the age-PM paradox by using a stricter methodology in order to strengthen the diary compliance in both, young and older adults. The second and related aim was to examine the strategy use in everyday memory tasks in young and older adults. Only one study to date has used a semi-structured diary for capturing memory strategy use in everyday life and failed to

produce reliable results in relation to age effects due to very small and unequal sample sizes (J. C. Cavanaugh et al., 1983).

Chapter three presents the results of a longitudinal diary study of EMFs in healthy young and older adults (Study 2). It has been established that a diary method can help researchers to capture the frequency of different experiences and changes over time (Iida et al., 2012). However, as with any measure used in psychological research, the results obtained using a diary method need to be reliable. According to Iida et al. (2012), one way of testing the reliability of a diary method is by using a test-retest design. Unfortunately, to our knowledge, no previous diary studies of EMFs have used this method to assess the consistency of the obtained results over time. Therefore, the main aim of this study was replicate and extend the findings of Study 1a by studying effects of age on the nature and frequency of recorded EMFs and to assess the reliability of recorded EMFs by asking young and old participants to keep a 3-day diary at two different time points.

Chapter four sought to investigate if the general public had an accurate understanding of their EMFs (Study 3a). As noted from the literature review, several previous studies have tried to study everyday memory by using self-report questionnaires of everyday memory functioning. However, the use of such questionnaires poses several problems. For example, sometimes it seems that the items are selected based on purely personal observations and experiences (i.e., CFQ), or on theoretical distinctions made in the literature rather than on what actually happens in real life (e.g., MMQ). Moreover, as these questionnaires were developed quite a long time ago, some items may no longer apply to people's experiences. For example, a question about how often one forgets phone numbers may not apply today as the existence of smartphones and even new landline phones enable people to either allocate a number to a name or a single digit for a quick dial, which eliminates the need for memorising them. Therefore, we developed an Everyday Memory Errors Questionnaire (EMEQ) with empirically verified items, by using the most frequently reported memory failure types and subtypes in our diary Study 1a. The main aim of Study 3a was to investigate self-rated frequency of different types of memory failures/errors across the adult lifespan. It was expected that if adults had a good insight into their everyday memory functioning, then we should obtain the same pattern of results in relation to age effects on different types of EMFs as in our diary Study 1a.

Chapter five present data from an online survey using a newly developed Everyday Memory Strategy Questionnaire (EMSQ) (Study 4a). The need for a new, more accurate

questionnaire of memory strategy use cannot be underestimated. As noted by Tomaszewski Farias et al. (2018), none of the existing strategy questionnaires include external strategies involving the use of emerging technology, such as electronic calendars, electronic notes and reminders and therefore may not fully represent the true frequency of external strategy use. For this reason, the items for EMSQ consisted of the most frequently reported memory strategies in our diary Study 1b, which also included the use of technology assisted strategies. The main aim of this study was to investigate the frequency of self-reported memory strategy use across the adult lifespan, using the newly developed EMSQ.

Chapter six seeks to investigate stereotypical views on memory and ageing using online surveys (Studies 3b and 4b). In Study 3b, adults aged 18+ were asked to rate the frequency of EMEQ items with which they expect people in their 20s, 40s, 60s and 80s to experience specific EMFs. In Study 4b, adults aged 18+ were asked to rate how often they think people in their 20s, 40s, 60s, and 80s use memory strategies included in EMSQ. Based on the reviewed literature on stereotypical views, we predicted that younger adults' ratings of EMFs and strategy use would increase with the increasing age of a target age group.

Finally, chapter seven will summarize the main aims and key findings of the studies reported in this thesis. The discussion of the results will evaluate findings, with a particular focus on how they conform with or move away from the existing literature on everyday memory functioning and strategy use in healthy adult populations, as well as the insights that adults of all ages have about their memory functioning and what this means for future use of metamemory questionnaires in research on ageing and memory. Limitations of included studies and avenues for future research on ageing and everyday memory functioning will also be discussed.

Chapter 2: Everyday Memory Failures and Memory Strategy Use in Young and Older Adults: A Diary Study (Study 1a and 1b)

2.1 Introduction

Most people are experiencing some type of memory failures in their day-to-day life. For example, one may forget someone's name, forget to buy something when they are in a store or even forget an important appointment. Generally, there is little information about how frequently these types of memory failures are experienced in everyday life, because most research in cognitive psychology has focused on participants' performance in laboratory tasks of memory and attention. It is, however, unclear how performance in these tasks translates into participants' everyday activities and cognitive functioning.

A small but growing body of research on everyday memory failures (EMFs) has used questionnaire and diary methods (Crovitz et al., 1984; Niedźwieńska et al., 2020; Unsworth et al., 2012). These studies have shown that people commit three different types of failures, which can be classed into prospective memory (PM), retrospective memory (RM) and attentionally based absent-minded failures (AM). Moreover, the existence of these three types of EMFs were also confirmed in a study by Kvavilashvili et al. (2009), where participants were simply asked to describe their most recently experienced memory failure. Following a bottom-up coding process without having any pre-defined categories of memory failures in mind, all descriptions of EMFs nicely fell into one of the three categories of either PM, RM or AM.

RM refers to our ability to retrieve information from the past (e.g., remembering someone's name), and has been extensively studied in the laboratory using various tasks of episodic memory (e.g., free recall, recognition, etc.). Most research on memory and normal ageing has shown significant impairments in a variety of RM tasks with increased age (Kvavilashvili et al., 2009; Light, 1991; Markostamou & Coventry, 2021). In contrast, PM refers to our ability to remember future intentions (e.g., taking a medication, making a phone call, etc.). Unlike most laboratory research on RM, findings on age effects on PM are mixed with some studies showing significant age effects and others showing no age effects (e.g., Henry et al., 2004; Kvavilashvili, Cockburn, & Kornbrot, 2013; Kvavilashvili, et al., 2009; Maillet & Schacter, 2016; Schnitzspahn, Kvavilashvili, & Altgassen, 2020). Finally, AM failures (e.g., leaving your coffee cup on the top of the car) are based on failures to attend to the task at hand by being preoccupied with internal thoughts or distracted by external stimuli (Reason, 1984; Unsworth et al. 2012).

Of the diary studies reviewed in Chapter 1, those that used a structured diary method to investigate the frequency and types of EMFs are of a particular relevance to the present investigation. It is, however, important to note that the majority of those few studies, that used a structured diary method to record EMFs, were conducted on young adults or other unspecified age groups without specifically examining effects of age on EMFs. For example, in a study by Unsworth et al. (2012) with a sample of 100 young adults, attention failures were the most frequently reported errors, but no differences were found between recorded PM and RM errors. By contrast, Crovitz et al. (1984) and Sellen (1994) found that PM failures were most frequently reported in their samples of young adults. Likewise, Terry (1988) reported PM failures to be most frequent, but the age of the sample was not noted and just stated that the participants were older students. Similarly, Eldridge et al. (1992) used a sample of staff members at work with an undefined age, however here, the RM failures were reported as most frequent. While in the first instance such varying results may seem inconsistent, upon closer inspection of each individual study, a few potential explanations emerge. First, the sample in the Unsworth et al. (2012) study consisted of undergraduate students, while Crovitz et al.'s (1984) and Sellen's (1994) samples had either students and members of community social clubs, or young students (aged 19-25) plus two 52- and 67-year old participants, respectively, and hence the studies may not be entirely comparable. More importantly, it appears that all these studies used somewhat different taxonomies for coding/categorising EMFs descriptions, hence, it is not clear if the results would hold if the coding system used was the same.

Whilst studies of EMFs using single age groups provide interesting and valuable information about memory functioning in day-to-day life, comparing different age groups allows for better understanding of everyday memory changes across adulthood. To date, only four structured diary studies have compared age effects on EMFs (Cavanaugh et al., 1983; Hass et al., 2020; Laughland, 2017; Niedźwieńska et al. 2020) and one study has assessed effects of age on the number of recorded actions slips in everyday life (Jónsdóttir et al., 2007). As noted in Chapter 1, both Hass et al. (2020) and Niedźwieńska et al. (2020) found support for the age-PM paradox noting that young adults reported significantly more PM failures compared to older adults, but no effects of age were found in RM or AM. By contrast, Jónsdóttir et al. (2007), who only studied action slips, found that older adults reported fewer action slips than younger adults. Lastly, an earlier diary study by Cavanaugh et al. (1983) found that older adults (aged 50-76) recorded significantly more RM failures

than younger adults (aged 20-40), but there were no age differences in the number of recorded PM or AM failures. However, this study had a very small sample size (12 participants per age group) raising questions as to the generalizability of the results.

Another important and related question in research on ageing and EMFs, that has received very little attention, refers to the use of memory enhancing or compensatory strategies in everyday life. Although it has been repeatedly suggested in the literature that the reason for older adults reporting fewer PM failures in diary studies is because they might be using more memory strategies to aid remembering of intentions (Haas et al., 2020; Ihle et al., 2012; Niedźwieńska et al., 2020), very few studies have subjected this hypothesis to empirical investigation. For example, to date only one structured diary study has been conducted (Cavanaugh et al., 1983) in which participants recorded not only their EMFs but also memory strategies used over four days (one week apart) and failed to find significant age effects. On the other hand, preliminary findings from research on self-reported strategy use in some memory questionnaires indicate that older people report using a variety of memory strategies, and such strategy use may be increasing with age (Dixon & de Frias, 2007; de Frias, Dixon & Backman, 2003). Consequently, more research is needed to examine age effects using a structured diary method to gain better understanding of rates of strategy use in everyday life as well as to compare memory strategies recorded in diaries to strategies used as assessed via self-report questionnaires within the same samples of young and old participants.

To address these important gaps in the literature a diary study was carried out on young and older adults over a 2-week period in which participants kept a 3-day structured diary of their EMFs in Week 1 of the study, followed by a 3-day diary of memory strategies used in Week 2 of the study. The order of EMF and strategy diaries was not counterbalanced, because focusing on the strategy use in Week 1 could have affected the number of EMFs recorded in Week 2 (e.g., if having kept a strategy diary in Week 1, participants deliberately enhanced their strategy use in Week 2 resulting in fewer recorded EMFs). In addition, all participants completed a battery of cognitive tests as well as several questionnaires measuring the lifestyle (i.e., business and routine), mood (anxiety and depression) as well as the frequency of EMFs and strategy use in everyday life. The results from two diaries will be reported below separately as Study 1a and Study 1b, for EMFs and recorded strategy use, respectively.

The main aim of Study 1a was to capture the nature and frequency of EMFs in young and older adults by asking participants to record them in a paper diary as soon as they happened in their daily life. In line with the age-PM paradox established in PM research and results of previous diary studies of EMFs, it was expected that young adults would record more PM failures than older adults, but there would be no age differences in the number of recorded RM and AM failures. Importantly, to address some of the concerns expressed in the literature on the age-PM paradox that the age-related benefits in everyday PM may occur because older adults tend to forget to record their EMFs in the diary, and to improve compliance with a diary method, all participants were issued with plastic watches that reminded participants to keep recording their EMFs over a 3-day recording period. The watches were set to vibrate four random times per day, followed by a “diary” message displayed on the screen, reminding participants that they were in the diary study and needed to monitor/report their memory failures.

In addition, Study 1a investigated several important individual difference variables which can potentially influence the frequency of EMFs in different age groups but had not properly been addressed in previous diary studies. For example, it has been suggested that the reduced frequency of reported EMFs in older adults can be partially explained by differences in the lifestyle of young and older adults (Rendell & Thomson, 1999). This concern was addressed by Niedźwieńska et al. (2020), who studied age effects on EMFs in young, middle-aged and older adults with more or less routinized lifestyles and found that accounting for these differences did not change the result in relation to age effects. It must be noted, however, that this study did not use a standardized measure for assessing the levels of routine or busyness in different age groups such as for example Martin and Park’s (2003) Environmental Demands (MPED) questionnaire. Another individual difference variable that has not been addressed yet in any prior diary studies of EMFs is potential differences in participants’ mood. A number of previous studies have examined correlations between anxiety, depression and memory complaints using memory questionnaires and found that higher negative affect was associated with more memory complaints across several age groups (Rowell et al., 2016). Based on these findings, we included standardized measures for assessing levels of busyness and routine (MPED, anxiety (GAD-7) and depression (PHQ-9) in order to investigate if they were associated with the number of reported EMFs.

In addition, given that previous diary studies of EMFs have not used standard laboratory tasks to see if the negative age effects observed in the laboratory are indicative of

number of recorded EMFs (Haas et al., 2020; Niedźwieńska et al., 2020, but see Unsworth et al., 2012), participants were also administered several standard cognitive tests measuring RM and executive functioning. In particular, we were interested to see if negative age effects on memory and executive functioning tasks would be reflected in the increased frequency of recorded RM errors in older participants.

The primary goal of Study 1b was to study the strategy use in everyday memory tasks in young and older adults by asking them to keep a diary and record each time they used a strategy to enhance their memory performance or reduce chances of forgetting, whilst again, wearing a plastic reminder watch to improve diary compliance. Based on the currently dominant explanation of the age-PM paradox, we predicted that older adults would report using more memory strategies compared to younger adults, especially those aiding PM. It was also interesting to examine whether there were any age differences in the types of aids used to see if older adults were more likely to record external and younger adults internal strategies as reported by some questionnaire studies of strategy use and ageing (Bouazzaoui et al., 2010; Dixon & Hultsch, 1983; Pizzonia & Suhr, 2022).

Finally, in both Studies 1a and 1b, we also examined the associations between the number of EMFs and memory strategies recorded in diaries with the retrospective self-reports of memory ability and the strategy use. For this purpose, the Multifactorial Memory Questionnaire (MMQ; Troyer & Rich, 2002) was chosen as it contains separate subscales for memory failures and memory strategies.

2.2 Everyday memory failures in young and older adults: A diary study (Study 1a)

2.2.1 Method

2.2.1.1 Research Design

This study used a mixed design with age group (young, older adults) as a between subjects variable and the type of recorded EMFs (PM, RM, AM) as a within subjects factor. The dependent variables were the number of recorded EMFs and their characteristics (e.g., how consequential or how upsetting was the recorded error). Correlations were used to examine the associations between the diary recorded EMFs and EMFs reported in the self-reported memory questionnaire.

2.2.1.2 Participants

A total of 36 healthy young adults and 38 healthy older adults were recruited. One young adult dropped out and 4 older adults were excluded as their neuropsychological testing scores were below the healthy norm. The final sample resulted in 35 young participants aged 18 to 35 years ($M = 22.26$, $SD = 4.01$) and 34 older participants aged 63 to 89 years ($M = 74.29$, $SD = 7.01$). In both groups, the majority of participants were females (71.4% and 91.2%, respectively). A Chi-squared test revealed a significant difference between two age groups in gender balance with more women in the older adults' group, $\chi^2(1, 69) = 4.40$, $p < .05$. Both age groups had similar years of education $F(1, 69) = 1.06$, $p = .31$, $\eta_p^2 = .02$.

All participants in the young adult group were recruited from the University of Hertfordshire. Older participants were recruited through advertising in the local community and the local branches of the University of 3rd Age (U3A). Exclusion criteria for both groups included: (1) head or brain injury, (2) history of stroke, (3) history of alcohol abuse or dependence, (4) recurrent substance abuse or dependence, (5) mental health problems (diagnosed by a doctor for which they are currently taking medication), (6) memory problems (diagnosed by a doctor), (7) scores of neuropsychological tests below the healthy norm.

2.2.1.3 Materials

Questionnaires

The Martin and Park Environmental Demands (MPED, Martin & Park, 2003; Appendix I) questionnaire consists of two subscales. The MPED – Busyness subscale contains seven items assessing feelings of busyness (e.g., *How busy you are during an*

average day? How often do you have too many things to do each day to actually get them all done?). Participants rate their levels of busyness on a 5-point scale (1 = *not busy at all*, 2 = *rarely busy*, 3 = *somewhat busy*, 4 = *very busy*, and 5 = *extremely busy*). The scores range from 7 – 35, with higher score indicated higher levels of busyness.

The MPED-Routine subscale contains four items to assess the levels of routine in a respondent's life (i.e., *How often does your day follow a basic routine? How often do you eat all of your meals at the same time each day and night?*). Responses to these questions are rated on a 5-point scale (1 = *never*, 2 = *rarely*, 3 = *sometimes*, 4 = *often* and 5 = *very often*). The score ranges from 4 to 20, with higher score indicating a more routinised days.

Multifactorial Memory Questionnaire (MMQ, Troyer & Rich, 2002, Appendix II) is used to measure separate aspects of people's memory for their own everyday memory functioning. MMQ has three subscales that measure satisfaction with one's own memory (MMQ – Satisfaction), the perception of one's everyday memory ability (MMQ – Ability) and strategy use to help with memory-related tasks (MMQ – Strategy). *Satisfaction* subscale is comprised of 18 statements where each item is rated based on the degree of agreement. The score range is 0 to 72 where higher scores indicate a higher degree of satisfaction. In the *Ability* subscale, respondents rate how often, over the previous two weeks, they have experienced each of 20 common mistakes. Score here ranges from 0 to 80 with a higher score indicating better self-reported memory ability. *Strategy* subscale measures the use of practical memory strategies and aids in everyday life. Respondents rate how often they use have used each of 19 memory strategies over the last two weeks. The score range is 0 to 76 with higher scores indicating greater use of strategies.

Patient Health Questionnaire (PHQ-9, Kroenke, Spitzer & Williams, 2003, Appendix III) is used to measure depression over the last two weeks through a 9-item scale as well as has an additional item to assess the impact of depression on functioning (e.g., "*Over the last two weeks, how often have you been bothered by any of the following problems: Little interest or pleasure in doing things*"). Each item is scored from 0 (*not at all*) to 3 (*nearly every day*). Scores 0 to 5 represent mild symptoms, 6 to 10 – moderate, 11 to 15 – moderately severe, and 16 to 20 – severe symptom of depression.

Generalized Anxiety Disorder Assessment (GAD-7, Spitzer et al., 2006, Appendix IV) measures anxiety over the last two weeks using a 7-item scale with an additional item to assess the impact of anxiety on functioning (e.g., "*Over the last two weeks, how often have*

you been bothered by the following problems : Feeling nervous, anxious or on edge? ”). Items are scored from 0 (*not at all*) to 3 (*nearly every day*). Scores 0 to 5 represent mild symptoms, 6 to 10 – moderate, 11 to 15 – moderately severe, and 16 to 20 – severe symptoms of anxiety.

Diary

The diary of EMFs was adapted from Laughland, 2017 (see Appendix V for instructions and diary page). This diary is an A5 size booklet containing 32 identical pages where one page is to be completed for each experienced EMF. Each diary page contains the following questions: (1a) Time and date of a memory failure; (1b) Time and date when the record was made in the diary; (2) A brief description of the memory error including what happened, when it happened and where; (3) Rating of mood right before the memory error happened (1 = *very unhappy*, 2 = *unhappy*, 3 = *neutral*, 4 = *happy*, 5 = *very happy*); (4) Rating of how serious/consequential was the memory failure (1 = *not at all serious*, 2 = *slightly serious*, 3 = *somewhat serious*, 4 = *quite serious*, 5 = *very serious*) and (5) Rating of how upset the participant was with the memory failure (1 = *not at all upset*, 2 = *slightly upset*, 3 = *somewhat upset*, 4 = *quite upset*, 5 = *very upset*).

Post Diary Compliance Questionnaire was adapted from Laughland and Kvavilashvili (2018) (see Appendix VI) and was used to collect information about participants' compliance and experience of keeping a diary. Participants had to indicate the number of days they did not keep a diary with them; the reason for not keeping the diary; their experience of keeping the diary at all times rated on a 4-point scale (1 = *very easy*, 2 = *somewhat easy*, 3 = *somewhat difficult*, and 4 = *very difficult*); their opinion of the percentage of errors, out of all the errors experienced over the three days, that they were able to record; and whether keeping a diary had any effect on their mood rated on a 7-point scale (1 = *Made me feel a lot worse*, 4 = *no effect*, 7 = *made me feel a lot better*).

Tests of memory and executive functions

Montreal Cognitive Assessment (MOCA, Nasreddine, 2005, Appendix IX) is a short screening assessment tool for detecting cognitive impairment that takes about 10 minutes to complete. MOCA assesses several cognitive domains. A short-term memory task involves two learning trials of five nouns and a delayed recall after 5 minutes. Visuospatial abilities are assessed using a clock drawing task and copying of a three-dimensional cube. Language abilities are assessed using the 3-item naming task with low-familiarity animals, repetition of two complex sentences and a fluency task. Attention, concentration and working memory are

evaluated using sustained attention task, a serial subtraction task and digits forward and backwards task. Orientation to time and places are also evaluated. Scores range from 0 to 30, where 26 or higher generally is considered normal.

Wechsler Memory Scale Verbal Paired Associates (WMS-IV VPA, Wechsler, 2008). This test is used for distinguishing the earliest stages of memory impairment. It consists of a list of 10-word pairs, learned over four trials of cued recall. *Total learning* is measured as a total number of pairs recalled across four learning trials. *Delayed recall* is measured as a number of pairs recalled following a 20-minute delay. Scaled scores below 5 indicate impairment.

Wechsler Memory Scale (WMS): Logical Memory (Wechsler, 1997). Logical Memory subtest is used to assess narrative memory. A short story is orally presented twice, and participants are asked to recall it from memory immediately after hearing it. To examine delayed recall participants are asked to recall the story again after a 20-minute delay.

The Rey Complex Figure Test (RCFT, Osterrieth, 1944). It is a neuropsychological test that is used to assess the perceptual organization, planning and figural memory. Participants are asked to copy a single complex figure and then draw it from memory after a 20-minute delay.

The Mill Hill Vocabulary Test (Raven, 1994) is designed to assess verbal reasoning ability or “crystallized intelligence” in the general population. It consists of a series of words. The participant must choose a correct synonym for each word out of six options provided.

Verbal fluency test (Letter Fluency and Category Fluency) measures executive functioning and language ability. In the Letter Fluency task, participants are given a letter from the alphabet and asked to name as many different words as possible they can think of that start with that letter in 60 seconds. In the category fluency task, the participant is asked to list all the animals he/she can think of in the next 60 seconds.

The Trail Making Test (TMT): Part A and Part B (Reitan, 1958). This test is used to assess visual attention and task switching. It is comprised of two parts in which participants have to connect a set of 25 dots as quickly as possible while maintaining accuracy. In Part A, participants need to connect numbers (1,2,3, etc) in sequential order. In Part B, participants need to alternate between numbers and letters (1, A, 2, B, etc.).

2.2.1.4 Procedure

Session 1 (Time 1): During the first meeting, all participants completed a series of questionnaires and tasks: The Martin and Park Environmental Demands (MPED); Multifactorial Memory Questionnaire (MMQ); Montreal Cognitive Assessment (MOCA); Patient Health Questionnaire (PHQ-9); Generalized Anxiety Disorder Assessment (GAD-7); Wechsler Memory scales: Logical Memory and Verbal Paired Associates; The Rey Complex Figure Test. After a short break, participants completed tasks assessing vocabulary and executive functioning: Mill Hill Vocabulary test, Verbal Fluency; and Trail Making Test. A & B.

Participants were then given detailed instructions on how to keep a diary of EMFs and received a waterproof wristwatch for them to wear for the duration of the diary-keeping, which acted as a reminder (vibrate) in order to increase diary compliance. Participants were told that they should only record their EMFs between 9 am and 9 pm for the next three days. It was clarified that they did not need to record any failures experienced before 9:00 AM or after 09:00 PM. It was also explained that during the diary-keeping days/time, they were expected to have the diary with them at all times to allow them to record their EMFs as soon as they happened. Nevertheless, participants were advised that sometimes it may not be feasible to record EMFs at the time they were experienced (e.g., experiencing an EMF whilst driving a car). In such cases, they were advised to record those EMFs at the earliest opportunity. If, by the time of such opportunity arose, participants had forgotten some of the details of the experienced EMF, then instead of trying to recreate an event, they were advised to acknowledge the occurrence of that EMF by “ticking” a box on a grid, provided on the inner cover page of the diary.

All participants were called in the morning of the following day, prompting them to start keeping their diary and wear a wristwatch. It was agreed, that after three days, on Day 4, researcher would call the participants to ask them to complete the Post Diary Compliance questionnaire over the phone. The entire Session 1 lasted around 2 hours.

Brief telephone call on Day 4: Participants completed the diary compliance questionnaire over the phone and a new date and time was arranged for the next appointment to commence either at the researcher’s office or participant’s home (Session 2).

Session 2 (Time 2): During the second meeting, which commenced a week after the first session, the diary of EMFs was collected and participants again completed two mood

questionnaires (GAD-7; PHQ-9). Participants were provided with detailed instructions on how to complete a new diary of their memory strategies (Study 1b). They were advised that they would need to keep this diary over the following 3 days. As with the diary of EMFs, participants received a call next morning to reminding them to wear a wristwatch and start recording any memory strategies that they may be using in their daily life. A new appointment was arranged with participants for the last meeting either at the University of Hertfordshire or participant's home. The session lasted around 30-45 minutes.

Brief telephone phone call on Day 4 of the second diary keeping period: This call lasted around 10 minutes, during which participants completed the Post Diary compliance questionnaire in relation to the diary of memory strategies (**Appendix**) and the time was arranged for the next appointment to commence either at the researcher's office or participant's home (Session 3).

Session 3 (Last session): The last meeting commenced around the fifth day of the second diary-keeping. The paper diary of memory strategies and the wristwatches were collected, and participants again completed the Multifactorial Memory Questionnaire (MMQ).

2.2.1.5 Coding of EMFs

A bottom-up coding approach was employed to develop a coding scheme. The coding process was organized hierarchically, with entries of EMFs first classified in three main categories of prospective, retrospective or absent-minded errors using a coding scheme originally developed by Kvavilashvili et al. (2009) and used in diary studies of EMFs by Laughland and Kvavilashvili (2018; Study 3) and Niedźwieńska and Kvavilashvili (2019). Within this coding scheme, a PM error refers to forgetting to perform an intended action at an appropriate moment in the future (e.g., remembering to take medication, post a letter or call someone back in 10 minutes). A RM error refers to the ability to retrieve information from the past (e.g., remembering someone's name, what was said at a meeting or what one did last weekend). Finally, AM errors are based on a failure to attend to a task at hand by being preoccupied with internal thoughts or distracted by external stimuli (e.g., leaving your coffee cup on top of the car, putting a used plate into a fridge or forgetting to turn off the cooker after taking out a cake from an oven). The prospective, retrospective, and absent-minded memory failures were further categorized into numerous subcategories resulting in 9 subcategories for PM (e.g., forgetting appointments, to take medication/food supplements,

etc.), 15 subcategories of RM (e.g., names of people you know, names of celebrities, words, some content of intentions, etc.) and 12 subcategories of AM failures (see Appendix X for a complete coding manual with examples).

Using this coding system, all diary entries were first coded by myself and my principal supervisor (independently) into three EMF categories. Inter-rater reliability between two coders was strong (Cohen's weighted $\kappa = .89$, $SE = .02$), and any disagreements were resolved through discussion. An additional independent coding was conducted by a third independent coder (the second supervisor). The inter-rater reliability between the agreed codes and the third independent coder was again strong (Cohen's weighted $\kappa = .89$, $SE = .02$) and any disagreements were resolved through discussion. The prospective, retrospective, and absent-minded memory failures were further coded by two independent coders into several subcategories within each of the three main categories of PM, RM and AM errors. The inter-rater reliability between the agreed subcategories was strong (Cohen's weighted $\kappa = .86$, $SE = .02$) and any disagreements were resolved through discussion.

2.2.2 Results – Study 1a

Both parametric and non-parametric methods of analysis were conducted depending on the type of independent variable used. The effect size, measured by partial eta-squared (η_p^2), was defined as .01, .06, and .16 for small, medium and large effects respectively (Cohen, 1988). When measured by Cohen's d , the effect size was defined as .2, .5, and .8 for small, medium and large effects, respectively (Cohen, 1988). The analysis of the number of the recorded EMFs was carried out on square-root transformed data to normalize the data (Laughland & Kvavilashvili, 2018), but the tables and figures contain actual raw values. The square-root transformation normalised the data for a total number of EMFs, but not for separate subtypes of PM, RM, and AM because of a substantial proportion of zero values within each subtype. For multiple tests of simple main effects, a Bonferroni correction for multiple comparisons was used.

2.2.2.1 Group differences in the background variables

Table 2.1 shows background characteristics of the sample. Young adults had higher anxiety and depression scores compared to older adults at the start of the study (as indicated

by GAD-7 and PHQ-9, Time 1). At the end of the study, there were no significant age differences in anxiety scores (GAD-7, Time 2), however, young adults' depression scores remained significantly higher than in older adults (PHQ-9, Time 2). Significant age difference was also found in MPED - Routine subscale indicating that older adults had a more routinised life compared to young adults, and in MPED – Busyness subscale, with younger adults indicating being significantly busier than older adults.

Table 2 - 1. Background characteristics (means and SDs) for young and older adults

	Young adults n = 35	Older adults n = 34	F	p	η^2
MPED Busyness	22.89 (5.06)	18.41 (3.40)	18.48	<.001	.22
MPED Routine	11.66 (3.41)	14.44 (2.52)	14.77	<.001	.18
GAD-7 (T1)	5.06 (4.10)	2.68 (4.08)	5.84	<.05	.08
PHQ-9 (T1)	5.26 (4.24)	2.68 (3.06)	8.36	<.01	.11
GAD-7 (T2)	3.57 (3.38)	2.21 (2.75)	3.15	.08	.05
PHQ-9 (T2)	3.49 (3.81)	2.00 (1.95)	4.11	.05	.06
MMQ-Satisfaction (T1)	51.23 (8.91)	51.50 (6.30)	.47	.50	.01
MMQ-Ability (T1)	51.80 (9.34)	50.26 (6.74)	.60	.44	.01
MMQ-Strategy (T1)	51.06 (12.00)	51.09 (7.50)	.00	.99	.00
MMQ-Satisfaction (T2)	53.38 (7.64)	55.10 (7.35)	.87	.36	.01
MMQ-Ability (T2)	51.52 (10.36)	30.73 (6.66)	.14	.71	.00
MMQ-Strategy (T2)	50.11 (11.56)	54.03 (8.26)	2.55	.12	.04

Note. MPED = Martin and Parks Environmental Demands Questionnaire; GAD-7 = General Anxiety Disorder; PHQ-9 = Patient Health Questionnaire; MMQ = Multifactorial Memory Questionnaire; T1 = Time 1; T2 = Time 2.

In addition, young and older adults completed a cognitive screening instrument (MOCA), and several episodic memory and executive functioning tasks (Table 2-1). No age differences were found in the MOCA, category fluency test and Trail Making Test part A. However, young adults performed significantly better than older adults in Logical Memory,

Rey Complex figure, Paired Associates and Trail Making Test Part B. Older adults were significantly better than young adults in Letter Fluency and Mill Hill test for crystallized intelligence.

Table 2 - 2. Performance in laboratory tasks of young and older adults (Means, SD)

	Young adults n = 35	Older adults n = 34	F	p	η^2
MOCA	28.37 (1.14)	28.15 (1.46)	.51	.48	.01
Logical Memory (DL)	20.29 (3.03)	18.53 (3.41)	5.12	.03	.07
Rey Complex Figure (DL)	25.61 (6.05)	18.74 (6.80)	19.72	<.001	.23
Paired Associates (DL)	7.74 (0.51)	7.15 (1.28)	6.52	.01	.09
Letter Fluency	12.66 (4.11)	16.26 (4.88)	11.10	<.01	.14
Category Fluency	22.37 (5.69)	21.21 (5.07)	.81	.37	.01
TMT Part A (Time in sec)	36.89 (10.77)	41.10 (10.71)	2.61	.11	.04
TMT Part B (Time in sec)	67.54 (17.82)	81.10 (28.23)	5.72	.02	.08
Mill Hill	15.34 (4.01)	23.97 (3.49)	90.65	<.001	.58

Note: MOCA = Montreal Cognitive Assessment; TMT = Trail making test; DL = delayed memory

2.2.2.2 Compliance with the EMF diary

There was no significant difference between the two age groups in terms of how many young or older participants kept a diary with them for all three days (97% young and 97% older), $\chi^2(1, N = 69) = .00, p = .98$. In addition, t-tests for independent samples did not reveal group differences in the number of days they kept the diary with them, the difficulty in keeping a diary or the effect of diary on their mood (see Table 2-3).

Table 2 - 3. Mean (Standard Deviation) Days of Keeping the Diary , Percentage of EMFs Recorded, Experience of Recording in a Diary and the effect of diary-keeping on Mood as a Function of Age Group, and Results of Independent Samples T-test.

	Young (n=35)	Older (n=34)	t	df	p	d
Days of keeping a diary ^a	2.97 (0.17)	2.97 (0.17)	.02	67	.98	.17
Percentage of EMFs recoded ^b	85.63 (16.74)	92.47 (19.11)	-1.58	67	.12	.38
Experience of recording in a diary ^c	1.54 (0.70)	1.33 (0.48)	1.47	60.30	.15	.35
Effect of diary-keeping on the mood ^d	4.54 (0.95)	4.82 (0.99)	-1.20	67	.52	.29

Note. ^a How many days did you keep the diary with you at all times (1 = 1 day; 2 = 2 days; 3 = 3 days). ^b What percentage, out of all EMFs, experienced over the 3 days (or days you kept the diary with you), do you think you recorded and acknowledged? ^c How did you find the recording process using the diary provided (1 = Very easy; 2 = Somewhat easy; 3 = Somewhat difficult; 4 = Very difficult); ^d Do you think keeping a diary had any effect on your mood and how you feel (Please rate from 1 to 7, where 1 = Made me feel a lot worse; 4 = No effect; 7 = Made me feel a lot better).

2.2.2.3 Frequency of EMFs in young and older adults

The mean number of EMFs recorded was 6.86 (*SD* = 5.02, range: 1-19) in young and 6.44 in older participants (*SD* = 3.78, range: 0 - 17).⁴ There were no significant group differences in the total number of fully recorded EMFs, or the fully recorded and ticks combined (see Table 2-4). However, young adults acknowledged significantly more EMFs which were not recorded on the diary pages.

⁴ There was only one older participant who did not record any EMFs.

Table 2 - 4. The mean number (SD) of fully recorded and acknowledged (ticks) EMFs in young and older adults across three diary days.

	Young (n = 35)	Older (n = 34)	F	p	η^2
Fully recorded EMFs	6.86 (5.02)	6.44 (3.78)	< 1	.70	.00
Acknowledged EMFs (Ticks)	1.51 (3.34)	0.26 (0.93)	4.43	.04	.06
Fully recorded EMFs plus Ticks	8.37 (7.66)	6.71 (4.03)	1.27	.26	.02

2.2.2.4 Effects of age on type of recorded EMFs

In the young group, coding resulted in 131 PM failures (54%), 38 RM failures (15%), and 76 AM failures (31%) with only one entry being coded as not a memory failure (0.4%). In the old group, there were 48 PM failures (22%), 91 RM failures (41%), and 81 AM failures (36%) with 3 entries coded as not memory failures (1%) (Table 2-5).

Table 2 - 5. Mean (SD) number of everyday memory failures as a function of type of failure (PM, RM, AM) and age group (Young, Older)

	Young n = 35	Older n = 34
PM	3.74 (2.96)	1.41 (1.59)
RM	1.09 (1.31)	2.68 (2.35)
AM	2.17 (2.43)	2.38 (2.09)

To examine the nature of possible age effects on EMFs, the number of EMFs was entered into a 2 (age group: young, older) by 3 (type of failure: PM, RM, AM) mixed ANOVA with repeated measures on the last factor. The results showed that the main effect of age was not significant with both age groups recording a similar number of EMFs ($F < 1$). There was also no significant main effect of type of failure, $F(2, 134) = 2.90, p > .05$. However, there was a significant group by failure-type interaction with a large effect size, $F(2, 134) = 19.37, p < .001, \eta_p^2 = .22$ (see Figure 2.1). Tests of simple main effects showed that

young adults reported significantly more PM failures than older adults, $F(1, 67) = 19.56, p < .001, \eta_p^2 = .22$. By contrast, older adults reported significantly more RM failures than younger, $F(1, 67) = 14.43, p < .01, \eta_p^2 = .18$, but there was no significant difference between the two groups in the frequency of AM failures ($F < 1$).

An additional test of simple main effects showed that the effect of type of EMF was significant in young adult group, $F(2.000, 66.000) = 22.23, p < .001, \eta_p^2 = .40$, and in older adult group, $F(2.000, 66.000) = 4.67, p < .05, \eta_p^2 = .12$. Post hoc tests with alpha level adjusted to 0.0167, showed that young adults reported more PM failures than RM ($p < .001$) or AM failures ($p < .01$), and older adults reported more RM failures than PM failures ($p < .01$), but there was no difference between the number of recorded RM and AM ($p = .48$), or PM and AM failures ($p = .07$).

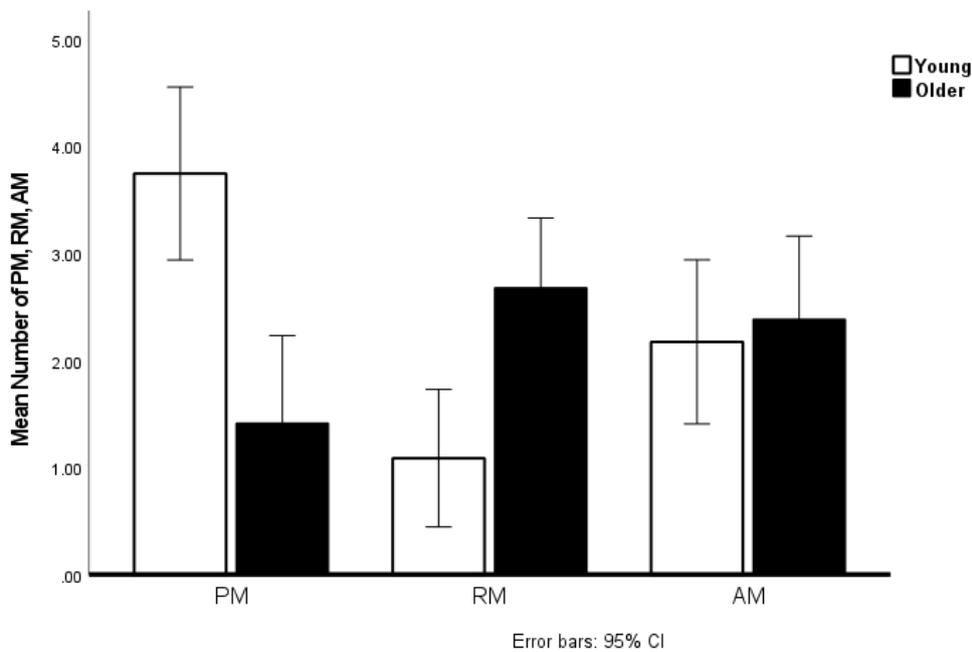


Figure 2 - 1: Mean number of memory failures as a function of type of failure (PM, RM, AM) and age group (Young, Older).

2.2.2.5 Relationship between reported EMFs, MPED and Mood

The data presented in Table 2-1 shows that young and older participants differed significantly in terms of levels of busyness, and levels of anxiety and depression in Time 1. Before repeating the main 2 (age group: young, older) by 3 (EMF type: PM, RM, AM) mixed

ANOVA, with these variables entered as covariates, it was necessary to check if these variables correlated with the number of recorded PM, RM, and AM failures in both age groups. Therefore, Spearman's rank correlations were computed to assess the association between the types of EMFs (PM, RM and AM) and the measures of mood in Time 1, and levels of busyness and routine in young and older adults (Table 2-6). In the young group, the scores on MPED-business subscale had a moderate correlation with PM failures ($r = .48$). No other significant correlations were observed in this age group ($p_s >.05$).

In the older adult group, a moderate correlation was found between anxiety scores (GAD-7) and the number of RM failures ($r = .41$), and a moderate but negative correlation between PM failures and depression scores (PHQ-9) ($r = -.38$). Moreover, levels of busyness significantly correlated with PM failures ($r = .34$), and RM failures ($r = .39$).

Table 2 - 6. Spearman's correlations between total number of EMFs and individual differences variables in young and older adults.

	Young Adults (n=35)			Older Adults (n=34)		
	PM	RM	AM	PM	RM	AM
GAD-7 (T1)	.09	-.11	-.09	-.25	.41*	-.22
PHQ-9 (T1)	.02	-.07	-.08	-.38*	.04	-.26
MPED – Busyness	.48**	-.05	-.06	.34*	.38*	-.04
MPED-Routine	-.08	.13	.05	-.24	-.05	-.10

Note: * Correlation is significant at the 0.05 level. **Correlation is significant at 0.01 level. T1 = Time 1.

2.2.2.6 The impact busyness scores on the frequency of EMFs in young and older adults

The only variable eligible for entering as a covariate in the mixed ANCOVA was busyness. In order to control for the differences in busyness scores in young and older adults,

the number of EMFs was entered into 2 (group: young vs older adults) x 3 (Type of EMFs: PM, RM, AM) mixed ANCOVA with repeated measures on the last factor, whilst controlling for scores on MPED – busyness. Busyness scores showed no significant interaction with age groups ($F < 1$) indicating that the assumption of homogeneity of slopes was satisfied, and the covariate analysis was valid. The main effect of busyness was not significant, $F(1, 66) = 2.102, p = .15, \eta_p^2 = .03$. However, busyness interacted with type of EMF, $F(2, 132) = 4.41, p < .05, \eta_p^2 = .06$ because it primarily affected PM than RM or AM errors.

In line with the results of the main ANOVA, both age groups reported similar number of EMFs ($F < 1$). Although the main effect of EMF type became significant, $F(2, 132) = 3.64, p < .05, \eta_p^2 = .05$, it was qualified by a significant EMF type by age interaction, $F(2, 132) = 11.31, p < .001, \eta_p^2 = .15$. Tests of simple main effects for effects of the age on PM, RM and AM failures showed the same pattern of results obtained without controlling for busyness with younger adults recording higher number of PM errors than older adults, $F(1, 66) = 7.38, p < .01, \eta_p^2 = .10$, and older adults recording higher number of RM errors than younger adults, $F(1, 66) = 12.89, p < .01, \eta_p^2 = .16$. Similarly, no significant age effect was obtained for AM failures, ($F < 1$). Additional test of simple main effects showed that the type of failure was significant in young adult group, $F(2.000, 65.000) = 16.19, p < .001, \eta_p^2 = .33$, with young adults reporting significantly more PM than RM failures ($p < .001$), and more AM than RM failures ($p < .01$), but there was no significant difference between PM and AM ($p = .03$). Importantly, unlike the results of the ANOVA, the type of EMF was no longer significant in older adult group, $F(2.000, 65.000) = 2.33, p = .11, \eta_p^2 = .07$, indicating that the number of recorded RM errors was no longer higher than recorded PM failures.

2.2.2.7 Effects of age and EMF subtypes

To compare young and older adults in the number of memory failures in each of the subcategories (see Table 2-7), a series of Mann-Whitney tests were performed. These tests revealed significant group differences in four subcategories relating to PM, with young adults, compared to older, more often reporting forgetting appointments ($U = 509.5, p = .05$), making a phone call/sending a message/email ($U = 390.0, p < .01$), buying/ordering/collecting something or posting a letter ($U = 441.0, p < .01$), and completing a one-off activity ($U = 442.5, p < .05$). In the RM category, there were significant group differences in three

subcategories, with older adults reporting more often than young, that they forgot names of celebrities, historical figures, book characters, etc ($U = 507.0, p < .05$), names of people they know ($U = 474.0, p < .05$), words and names of objects, animals, plants and places, etc. ($U = 412.0, p < .01$). No significant group differences were observed in the subcategories of AM ($p_s > .05$).

Table 2 - 7. Number of memory failures in each subcategory of prospective, retrospective and absent-minded failures in healthy young and older adults.

Prospective memory failures (young/older)	Retrospective memory failures (young/older)	Absent-minded memory failures (young/older)
<i>Forgetting appointments (8/1)*</i>	<i>Forgetting names of celebrities, historical figures, book characters, etc. (1/6)*</i>	<i>Forgetting what you wanted to say during conversation, what you just thought/wanted to pick up or write down (6/12)</i>
<i>Forgetting to take medications/vitamins/food supplements (5/1)</i>	<i>Forgetting names of people, you know (5/12)*</i>	<i>Forgetting why you came into certain location (6/7)</i>
<i>To make a call/send a message/email (27/6)**</i>	<i>Forgetting words and names of objects, animals, plants and places, etc. (2/22)**</i>	<i>Temporary disorientation in date/time (1/4)</i>
<i>To buy/order/collect something or post a letter (13/1)**</i>	<i>Forgetting passwords, dates, phone numbers (3/1)</i>	<i>Omitting an action in a sequence of actions but NOT the last action (10/10)</i>
<i>To pass on a message or ask a question when you see someone (6/4)</i>	<i>Forgetting entire autobiographical event (0/1)</i>	<i>Not finishing the sequence of actions – forgetting to perform last action (6/4)</i>
<i>Do something after a certain period of time (0/2)</i>	<i>Forgetting where you put away/hid something some time ago (5/13)</i>	<i>Action swap: doing another thing instead of intended action (2/3)</i>
<i>To take something extra from home needed for that day (32/14)</i>	<i>Forgetting some content of intention (8/6)</i>	<i>Distraction: Just before carrying an action or while doing it, being distracted, and forgetting to complete it (12/13)</i>
<i>Completing regular duties (20/10)</i>	<i>Forgetting that a particular intention has been formed (2/0)</i>	<i>Forgetting to take usual things from home which you always take with you (6/5)</i>
<i>Completing one-off activity (34/9)*</i>	<i>Forgetting one or more items when shopping (4/3)</i>	<i>Loosing things that are in constant use at home/office/car or have their usual location (16/17)</i>
	<i>Forgetting content of a book/TV programme or other factual information (0/4)</i>	<i>Leaving something behind that was in sight most of the time (4/1)</i>

Forgetting factual information from well-learned procedures (0/4)
Forgetting actions – Thinking you have not done something, but you had (4/7)
Being unsure whether an action was completed (1/4)
Forgetting some other content/piece of episodic information (3/7)
Forgetting routs and locations (0/2)

Forgetting what you have just said/did (2/2)
Forgetting having already done something moments ago (5/3)

*Note: * indicates significant group differences when $p < .05$, apart from PM “Forgetting appointments” where $p = .05$.*

*** indicates significant group differences when $p < .01$.*

2.2.2.8 Ratings of seriousness and upset levels for everyday memory failures in young and older adults

Several ANOVAs were performed on the mean ratings of participants' mood before any of the three types of memory failures, ratings of consequences and the upset levels (Table 2-8). No significant differences were found either within or between groups on any of these ratings ($p_s > .05$).

Table 2 - 8. Mean (Standard Deviation) Mood before EMF, Consequence of EFM and How upsetting EMF was for young and older adults

	Young Adults (n=15)*			Older Adults (n=16)*		
	PM	RM	AM	PM	RM	AM
Mood Before	3.27 (0.79)	3.51 (0.94)	3.83 (0.73)	3.88 (0.80)	3.92 (0.86)	3.69 (0.72)
Consequence	1.97 (0.92)	1.55 (1.05)	1.45 (0.65)	1.42 (0.59)	1.28 (0.42)	1.40 (0.56)
Levels of Upset	3.21 (3.32)	1.81 (1.05)	1.97 (0.73)	2.00 (1.05)	1.74 (0.80)	1.60 (0.70)

*The comparison was conducted only on those participants who had at least 1 EMF for each of the three types of failures, resulting in a much smaller sample size.

2.2.2.9 Relationship between the total number of recorded EMFs and MMQ-Ability subscale

Several Spearman's rank correlations were computed to assess the association between a total number of reported EMFs in the diary and scores on MMQ-Ability subscales completed in Session 1 and Session 2. No significant correlations were found between the total number of EMFs and the scores of MMQ-Ability subscales at Session 1 or Session 2 for young or older adults ($p_s > .05$). Looking at correlations between MMQ-Ability and different types of recorded EMFs at Session 1, in young adults, a weak negative correlation was found between the scale scores and diary recorded PM failures ($r = -.37, p < .03$), indicating that higher scores on MMQ-Ability subscale were associated with lower frequency of reported

PM in the diary. No correlations were found between MMQ-Ability in Session 1 and diary-recorded AM, or RM failures ($p_s > .05$). In the older adult group, no significant correlations were found between MMQ-Ability score and recorded RM, PM, or AM failures ($p_s > .05$).

Finally, there was a strong positive correlation between MMQ-Ability scores in Session 1 and MMQ-Ability scores in Session 2, in both, young adults' group ($r = .67, p < .001$), and older adults' group ($r = .77, p < .001$) indicating that participants opinions about their everyday memory functioning were fairly stable across the time and were not affected by the experience of recording EMFs in diaries.

2.2.3 Discussion – Study 1a

Several important findings emerged from this study. First, in line with initial findings by Laughland (2017), no significant negative age effect was found in the total number of recorded EMFs. However, an interesting pattern emerged when comparing young and older adults in terms of the frequency of each type of memory errors. In this study, young adults recorded significantly more PM failures than older adults, confirming age-related benefits in everyday PM found in previous diary studies of EMFs (Haas et al., 2020; Niedźwieńska et al., 2020). However, contrary to findings of Haas et al. (2020) and Niedźwieńska et al. (2020), in our study, older adults reported significantly more RM failures than young adults. This is a novel finding, confirming that RM impairments in older adults, observed in laboratory studies, may potentially generalize to everyday life. While discrepant findings regarding the frequency of RM could be potentially explained by differences in the instructions used, length of diary keeping and a different taxonomy used for coding of EMFs in the study by Haas et al. (2020), this was not the case in the study by Niedźwieńska et al. (2020) that was fairly similar to the diary method used in the present study with the exception of reminder watches used in the present study. Therefore, one potential explanation for the age difference in RM failures could be attributed to the fact, that wearing a reminder watch, which acted as a prompt to keep a diary, increased self-monitoring in older adult group. No age differences were found in the frequency of AM failures. However, AM failures were also reported least frequently compared to PM and RM which is in contrast to Unsworth et al. (2012) findings, where they were reported by young adults as most frequent.

When looking at the subtypes of PM, RM and AM, younger adults reported more frequently than older adults forgetting appointments, making a call/sending a text message

and completing one-off activities, whereas older adults reported more often forgetting names of celebrities, names of people they knew and words. These findings are in line with several questionnaire and diary studies conducted to date, demonstrating consistent reports of difficulties with specific types of EMFs in young and older adults (Martin 1986; McAlister & Schmitter-Edgecombe, 2016, but see Niedźwieńska et al., 2020 for slightly different results in the subtypes of PM, RM and AM). Moreover, increased forgetting of names with increasing age has been demonstrated in several laboratory experiments (Maylor, 1997; Rendell et al., 2005).

Importantly, after controlling for levels of busyness, age differences in PM and RM, and the absence of age effects in the total number of reported EMFs still held up. However, whilst PM failures remained the most frequently reported errors in the young adult group, for older adults the frequency of the three types of failures became similar with RM errors no longer being most frequently reported.

When comparing frequency of EMFs recorded in the diary with retrospective self-reports of EMFs using MMQ-Ability subscale, only a weak negative correlation between the self-rated overall ability scores and diary recorded PM failures was observed in young adults, but no correlations were seen in the older adult group. These results indicate that potentially, existing memory questionnaires may not be able to accurately capture everyday memory functioning and signals the need for a new retrospective measure with more empirically validated items.

Finally, it is also interesting that young adults outperformed older adults on the episodic memory tasks which specifically tap into retrospective memory and subsequently, older adults reported experiencing more RM failures compared to young when keeping a diary of their EMFs. These results indicate that well-documented age effects obtained in laboratory tasks of RM can be similarly observed in the everyday RM functioning using a diary data (see also Unsworth et al., 2012 for similar findings with young adults).

2.3 Use of everyday memory strategies in young and older adults: A diary study (Study 1b)

2.3.1 Method

2.3.1.1 Design

This study used a mixed design with age group (young, older adults) as a between subjects variable and the type of recorded memory strategies (with three levels: PM-related, RM-related, AM-related) as a within subjects factor. The dependent variable was the number of recorded PM-related, RM-related and AM-related memory strategies. Correlations were used to examine the associations between the diary recorded memory strategies and strategies reported in the retrospective memory questionnaire.

2.3.1.2 Participants

Participants who completed Study 1a were asked to keep a second diary of everyday memory strategy use in Week 2 of the study, few days after finishing the EMF diary. A total of 35 young adults and 34 older adults kept a diary of everyday strategy use. However, 1 older adult did not return the diary, therefore the final number of young and older adults was 35 and 33, respectively.

2.3.1.3 Materials

The only difference between materials and tasks used in Study 1b was the diary used to record instances of strategy use in everyday life over a 3-day diary keeping period.

Diary of Memory Strategy Use (Appendix VIII) was an A5 size booklet containing 32 identical pages where one page was to be completed for one memory strategy. Each diary page contained the following questions: (1) Time and date of the strategy use; (2) Time and date when the recording was made in the diary; (3) A brief description of what the strategy was used for; (4) A brief description of the used memory strategy; (5) Whether the strategy was effective (participant needs to select an appropriate answer from *Yes, No, I don't know*); and (6) Any additional comments in relation to the strategy used.

2.3.1.4 Procedure

The procedure relating to this diary was described in detail in Study 1a, starting from Session 2. In addition, the instructions for the diary of memory strategies were clarified to participants. They were told that memory strategies can take a variety of forms and may involve using external memory aids (with a few examples given, such as making a list or setting up reminders) as well as internal memory strategies (again few examples were provided, such as going through an alphabet in order to remember the name of the place). It was stressed that it was very important that they always kept their diary with them between 9 am and 9 pm for a total of three days and recorded every strategy immediately after it was used or, immediately after they realised, they forgot to record it. It was also explained that if,

by the time they could record the strategy in the diary, they had forgotten some of the essential details, then they did not need to fill in the diary page and instead had to simply acknowledge the use of that strategy by ticking a box in the grid table on the inner side of the cover page. Participants were also reminded that just as in Study 1a, they had to wear a wristwatch during the diary keeping hours for all three diary-keeping days. At the end of the study participants were asked to complete a Post Diary of Strategy Use Questionnaire (Appendix VIII).

2.3.1.5 Coding of Memory Strategies

The diary entries with descriptions of memory strategies were coded three times to reflect (1) the purpose they served, (2) the type of strategy, and (3) the memory stage when the strategy was employed (Table 2-9). In the first instance, all recorded memory strategies were coded into three broad categories: PM-related, RM-related, and AM-related. For example, PM-related strategies are the type of strategies which help a person to remember his/her future intentions, such as writing in a calendar all upcoming appointments or setting up a reminder to do something at a given time. RM-based strategies are those that help people to recall information from the past, for example, going through an alphabet in order to remember a name of someone or something, making associations, etc. Finally, AM-based strategies help to resolve absent-minded memory failures, like for example, retracing one's steps when walking into a room to get something and not being able to remember what it was. One strategy that people may use in this situation is to go back to the place where they first thought of getting something and that could help them to prompt the recall. Inter-rater reliability between two coders was strong (Cohen's weighted $\kappa = .90$, $SE = .02$), and any disagreements were resolved through discussion.

For more fine-grained analyses, recorded examples of used strategies were further coded by type. Using a bottom-up approach, strategies were coded into *External* (with further subcategories of *portable aids*, *environmental cue*, *reliance on others*), *Internal* (with subcategories of *retracing*, *imagery*, *rehearsal*, *alphabet*, *association/cluster*), *Multiple* strategies (where a person used more than one strategy for one purpose), and *Other* strategies, when a described strategy did not fit into any of mentioned categories. Inter-rater reliability between two coders was very strong (Cohen's weighted $\kappa = .93$, $SE = .01$), and any disagreements were resolved through discussion.

Finally, an additional coding was conducted to separate strategies depending at which stage of memory they were employed. This coding resulted in two categories: *Encoding stage* and *Retrieval stage*. For the encoding stage, the strategy is used during the encoding process with the intention to learn/consolidate/facilitate future retrieval of information, for example, making a shopping list to remember what needs to be bought. For the retrieval stage, strategies are used to retrieve/access a piece of information which cannot be recalled at that instance without using a strategy, for example, when someone cannot remember the exact time of an appointment, they may refer to the appointment letter to check. Inter-rater reliability between two coders was again very strong (Cohen’s weighted $\kappa = .93$, $SE = .02$), and any disagreements were resolved through discussion.

Table 2 - 9. A coding of memory strategies by purpose, type and memory stages with examples taken from the diary data for each category and subcategories, where relevant.

Coding categories	Examples:
Purpose	
PM-related	<i>“To remind myself to take out frozen food out of the freezer before going to the gym I set the alarm on my phone.”</i>
RM-related	<i>“Forgot patient’s name – face was familiar. Tried to remember using an alphabet.”</i>
AM-related	<i>“Walked downstairs to tell my mum something, forgot what. Went back upstairs to recall what I wanted to say – worked.”</i>
Type	
External:	
Portable aids	<i>“To remember to complete the quiz – set a reminder on my phone”</i>
Environmental cue	<i>“To remind me to take my water bottle to the gym – I placed my water bottle next to my gym shoes so that I see it when I pick them up to put them on.”</i>
Reliance on another person	<i>“To hide something valuable in a safe place whilst I am out – Asked my husband to remind me where I had put it in the event I forget.”</i>
Internal:	
Retracing	<i>“To locate a mislaid key – retraced my steps to find it.”</i>
Imagery	<i>“Needed a rubber band to fix something in the car when going to the gym – Visualized a rubber band around my gym bag so I would remember it later.”</i>

Alphabet	<i>“Tried to remember the name of an ex-footballer – went through an alphabet.”</i>
Rehearsal	<i>“Remembering orders for my friends at the bar – Repeating orders to myself constantly until I will order.”</i>
Associations/cluster	<i>“To remember the term “Gift Aid” which I often forget – I thought of the mnemonic – a donation is a synonym of a Gift.”</i>
Multiple	<i>“I was getting ready to go to shops to buy cleaning equipment - I wrote a list down on my phone and put a reminder for me to look at the list when I am in the shop.”</i>
Other	<i>“Remembering keys and wallet – Put them in my hoody pocket the night before.”</i>
Memory stage	
Encoding	<i>“To remember to remove food from the oven, I have set timer on my phone”</i>
Retrieval	<i>“To remember when I had lectures – mentally retraced my weekly routine”</i>

2.3.2 Results – Study 1b

As in Study 1a, both parametric and non-parametric methods of analysis were conducted depending on the type of independent variable involved. Similarly, the analysis on the number of the recorded everyday memory strategies (EMSs) was carried out on square-root transformed data to normalize the data (Laughland & Kvavilashvili, 2018), however the means in tables and figures represent the actual values. The transformation was successful for the total number of recorded EMSs and PM-related strategies but did not change the data distribution for other types of strategies. For multiple tests of simple main effects, a Bonferroni correction for multiple comparisons was used.

2.3.2.1 Diary compliance

There was no significant difference between two groups in terms of how many young or older participants kept the diary of strategy use with them for all 3 days (88.2% young and 97.1% older), $\chi^2(1, N = 68) = 1.94, p = .16$. In addition, t-tests for independent samples did not reveal group differences in the number of days they kept the diary with them, the difficulty in keeping a diary or the effect of diary on their mood, however, young adults felt that they had recorded lower percentages of used strategies compared to the older adults (see Table 2-10).

Table 2 - 10. Mean (Standard Deviation) Days of Keeping Strategy Diary , Percentage of Strategies Recorded, Experience of Recording in a Diary and the effect of diary on Mood as a Function of Age Group, and Results of Independent Samples T-test.

	Young (n=34)	Older (n=34)	<i>t</i>	<i>df</i>	<i>p</i>	<i>d</i>
Days of keeping a diary ^a	2.88 (0.33)	2.97 (0.17)	-1.39	49.87	.17	.34
Percentage of Strategies recorded ^b	85.71 (18.07)	93.24 (11.00)	-2.08	66	.04	.50
Experience of recording in a diary ^c	1.74 (0.71)	1.59 (0.61)	.92	66	.36	.23
The effect of diary-keeping on the mood ^d	4.58 (0.83)	4.68 (0.94)	-.46	65	.65	.11

Note. ^a How many days did you keep the diary with you at all times (1 = 1 day; 2 = 2 days; 3 = 3 days). ^b What percentage, out of all EMSs, experienced over the 3 days (or days you kept the diary with you), do you think you recorded and acknowledged? ^c How did you find the recording process using the diary provided (1 = Very easy; 2 = Somewhat easy; 3 = Somewhat difficult; 4 = Very difficult); ^d Do you think keeping a diary had any effect on your mood and how you feel (Please rate from 1 to 7, where 1 = Made me feel a lot worse; 4 = No effect; 7 = Made me feel a lot better).

2.3.2.2 Frequency of memory strategy use in young and older adults

The mean number of strategies recorded was 6.74 (*SD* = 5.75, range: 1-31) in the young and 8.42 (*SD* = 7.72, range: 0-37) in the older group. There were no significant group differences in a total number of fully recorded strategies, or the fully recorded and ticks combined (see Table 2-11). However, young adults acknowledged significantly more strategies which were not recorded on the diary pages.

Table 2 - 11. The mean number (SD) of fully recorded and acknowledged memory strategies (ticks) in young and older adults.

	Young Adults (n = 35)	Older Adults (n = 33)	F	p	η^2
Fully recorded strategies	6.74 (5.75)	8.42 (7.72)	1.04	.69	.02
Acknowledged Strategies (ticks)	1.14 (2.13)	0.66 (1.67)	6.46	.01	.09
Fully recorded + ticks combined	7.89 (6.59)	8.58 (7.81)	< 1	.69	.00

2.3.2.3 Age effect on the strategy use for a specific purpose

Coding of strategies by their purpose in the young adult group resulted in 126 PM-related strategies (53%), 69 RM-related strategies (29%), and 41 AM-related strategies (17%). In the older adults' group, there were a total of 158 PM-related strategies (57%), 101 RM-related strategies (36%), and 19 AM-related strategies (7%) (for means see Table 2-12).

Table 2 - 12. Mean (SD) number of memory strategies as a function of purpose (Pm-related, RM-related, AM-related) and age group (Young, Older).

	Young (n = 35)	Older (n = 33)
PM-related	3.60 (4.51)	4.79 (4.66)
RM-related	1.97 (1.65)	3.06 (3.90)
AM-related	1.17 (1.67)	0.88 (1.48)

To investigate group differences in the use of memory strategies for a specific purpose, the number of strategies in each category was entered into a 2 (age group: young vs older) by 3 (strategy purpose: PM-related, RM-related, and AM-related) mixed ANOVA with repeated measures on the last factor, using a square-root transformed data. Overall, both age groups recorded a similar number of strategies ($F < 1$). The main effect of strategy purpose was significant, $F(1.742, 11.962) = 35.37, p < .001, \eta_p^2 = .35$, with participants using significantly more memory strategies to aid PM than those related to RM or AM. Importantly, the interaction between strategy purpose and the age group was nearing significance with a medium size effect, $F(1.742, 114.962) = 3.25, p = .049, \eta_p^2 = .06$ (see

Figure 2-2). Tests of simple main effects showed that young adults used more strategies to aid AM ($M = 0.75$, $SD = 0.79$) compared to older adults ($M = 0.56$, $SD = 0.68$), $F(1, 66) = 4.67$, $p < .05$, $\eta_p^2 = .07$. However, there was no age difference in using strategies to aid RM ($F < 1$), or PM ($F(1, 66) = 1.44$, $p = .234$, $\eta_p^2 = .02$).

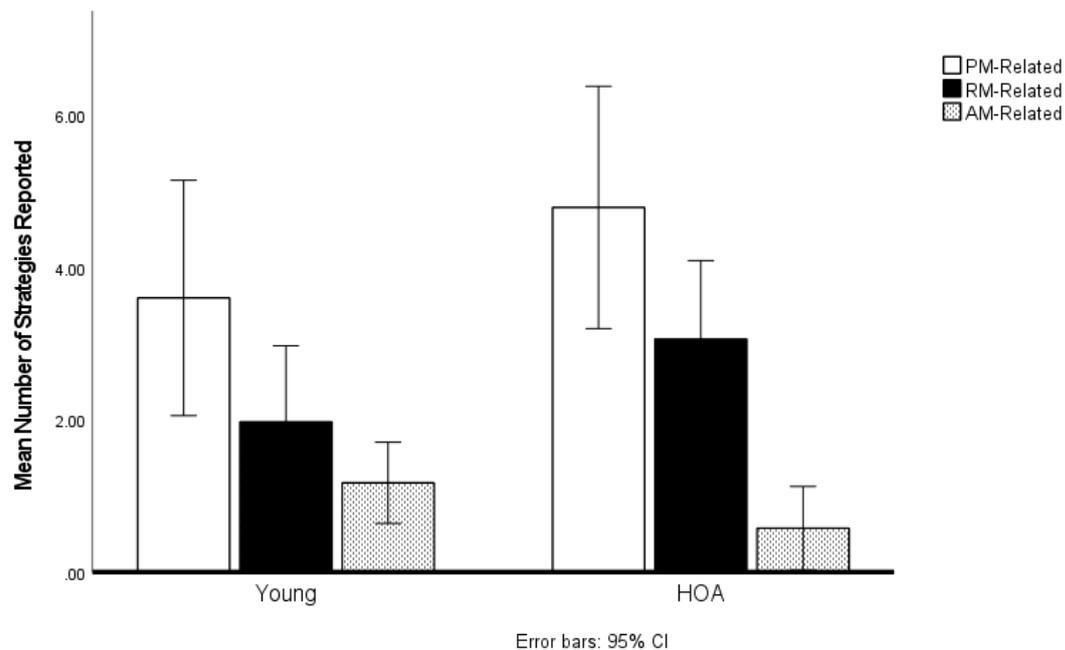


Figure 2 - 2: Mean number of memory strategies as a function of strategy purpose (PM-related, RM-related, AM-related) and age group (Young, Older).

2.3.2.4 Effects of age and memory strategy type

In the young group, coding of strategies by type resulted in 51 internal strategies (22%), 164 external strategies (69%), 14 multiple strategies (6%), and 7 strategies in the “other” category (3%). Older adults recorded a total of 32 internal strategies (12%), 203 external strategies (73%), 28 multiple strategies (10%), and 16 strategies belonging to the “other” category (5%) (for means, see Table 2-13).

Table 2 - 13. Mean (SD) number of memory strategies as a function of type (Internal, External, Multiple, Other) and age group (Young, Older).

	Young	Older
Internal	1.45 (2.32)	0.97 (1.51)
External	4.69 (4.89)	6.15 (5.46)
Multiple	0.40 (0.65)	0.85 (1.17)
Other	0.20 (0.47)	0.48 (1.30)

To further investigate the age differences in the use of different types of memory strategies irrespective of the purpose they serve, the mean number of strategies was entered into a 2 (age group: young, older) by 4 (strategy type: internal, external, multiple, and other) mixed ANOVA with repeated measures on the last factor, using square-root transformed data. The effect of age group was not significant ($F < 1$). The age group by strategy type interaction was also not significant, $F(2.372, 156.582) = 1.87, p = .15, \eta_p^2 = .03$. However, there was a significant and large main effect of strategy type, $F(2.372, 156.582) = 101.08, p < .001, \eta_p^2 = .61$. The post hoc analysis revealed that external strategies were used significantly more in both age groups compared to all other strategy types (see Table 2-13).

To compare young and older adults in the number of strategies within external and internal subcategories (see Table 2-14), since they accounted for the largest proportion of the recorded strategy types, a series of Mann-Whitney tests were performed. These tests revealed significant group differences in two subcategories of internal strategies: with young adults using more internal retracing ($U = 415.0, p = .01$), and older adults using going through an alphabet ($U = 454.0, p = .01$). No significant group differences were observed in any other subcategories of internal or external strategies ($p_s > .05$).

Table 2 - 14. Number of strategies in each subcategory of internal and external strategies in young and older adults.

Internal Strategies (young/older)	External strategies (young/older)
Internal retracing (33/7)*	Portable Aids (107/122)
Use of imagery (6/6)	Environmental Cues (47/76)
Rehearsal 6/3)	Reliance on Others (10/5)
Going through alphabet (1/8)*	
Use of associations/clustering (5/8)	

2.3.2.5 Effects of age in using strategies at different memory stages

Coding strategies according to the memory stage at which they were used in young adults resulted in 157 strategies (67%) that were used during encoding stage ($M = 4.49$, $SD = 4.51$) and 79 strategies (33%) that were used at the retrieval stage ($M = 2.26$, $SD = 2.86$). Older adults reported using 205 (73%) strategies during encoding stage ($M = 6.21$, $SD = 5.88$) and 75 strategies (27%) at the retrieval stage ($M = 2.24$, $SD = 3.76$).

The number of strategies used at different memory stages was entered into a 2 (age group: young, older) by 2 (memory stage: encoding, retrieval) ANOVA with repeated measures on the last factor, using square root transformed data. Overall, there was no significant effect of age group ($F < 1$) or age group by memory stage interaction, $F(1.000, 66.000) = 2.041$, $p = .168$, $\eta_p^2 = .03$. However, a significant effect of memory stage was found, $F(1.000, 66.000) = 30.568$, $p < .001$, $\eta_p^2 = .32$ with significantly more strategies being used by both age groups at the encoding stage than at retrieval (see Figure 2-3).

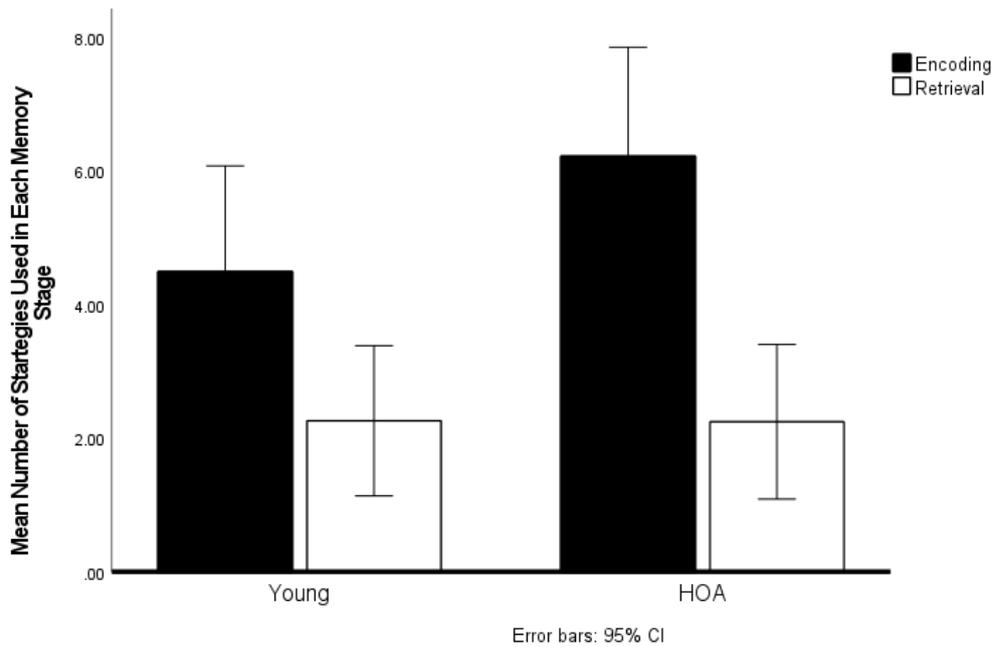


Figure 2 - 3: Mean number of memory strategies as a function of memory stage (Encoding, Retrieval) and age group (Young, Older).

2.3.2.6 Relationship between recorded EMFs (Study 1a) and EMSs (Study 1b)

The associations between the number of recorded PM, RM and AM failures in Study 1a and recorded PM-, RM-, and AM-related strategies reported in Study 1b was investigated using Spearman’s correlation coefficient (see Table 2-15). These correlations were run using square root transformed data. Moderate positive correlations were obtained in both groups between the total number of recorded strategies and the total number of recorded EMFs, indicating that participants who recorded higher number of EMFs were also reporting using higher number of strategies in an attempt to compensate for memory failures. PM-related strategies moderately correlated with PM failures in older group, but not in young. Finally, RM-related strategies were similarly correlated with RM failures in both groups.

Table 2 - 15. Spearman's correlations between total number of PM, RM, AM and overall EMFs and memory strategy use in young and older adults.

	Young Adults				Older Adults			
	Types of memory failures recorded in diary							
	PM	RM	AM	Total EMFs	PM	RM	AM	Total EMFs
PM-strategies	.21	.20	.20	.33*	.55**	.16	.30	.35*
RM-strategies	.28	.36*	-.10	.28	.22	.36*	.44*	.53**
AM-strategies	.36*	.14	.19	.42*	.08	.02	.27	.23
Total Strategies	.41*	.37*	.20	.55**	.61**	.31	.44*	.59**

Note. *Correlation is significant at the 0.05 level; **Correlation is significant at the 0.01 level.

2.3.2.7 Correlations between recorded strategy use and MMQ – Strategy subscale

Finally, Spearman's rank correlations were computed to assess the relation between the total number of recorded strategies used and the MMQ-Strategy subscale completed in Session 2. No significant correlations were found in both groups between the total number of strategies recorded in the diary and the mean score of MMQ-Strategy subscale ($p_s > .05$). Moreover, no significant correlations were obtained between the mean score of MMQ-Strategy subscale and PM-, RM-, and AM-related strategies in young adults ($p_s > .13$). In older adult group, MMQ-Strategy subscale scores positively correlated with RM-related strategies ($r = .58, p < .001$), but not PM- or AM-related strategies ($p_s > .05$)

2.3.3 Discussion – Study 1b

The present study resulted in significant findings in relation to the patterns of memory strategy use and their association with everyday memory failures. First, contrary to popular statements in the literature⁵, young and older adults did not differ in the total number of memory strategies reported in the diaries. More importantly, no significant age differences were found in the use of memory strategies to aid either PM or RM, suggesting that the ageing-related PM benefit found in Study 1a was not due to older adults using more PM-related memory strategies. This finding is particularly important since many prior studies implied that the age-PM paradox may be due to older adults using more aids to help them with remembering intentions (Cheyne et al., 2006; Dixon et al., 2001; Haas et al., 2020; Ihle et al., 2012; Niedźwieńska et al., 2020).

In addition, while both young and older adults reported using external strategies most frequently, there were no age differences in the use of external, internal, multiple, or other types of strategies. However, when looking at the subtypes of specific strategies, younger adults reported higher use of internal retracing strategy, while older adults reported more often going through the alphabet. No differences were observed in the subtypes of external, multiple or other strategies. The lack of age differences in external or internal strategy use is somewhat surprising, given that most studies in the literature to date have reported that younger adults tend to report using more internal strategies, while older adults are more reliant of external strategies (e.g., Bouazzaoui et al., 2010). In addition, no age differences were found in reported strategies relating to the encoding or retrieval stages of memory, but both groups reported using strategies at the encoding stage more frequently. These results are unsurprising given that strategies used at the encoding stage were closely related to PM-related strategies, which both age groups reported using more frequently compared to RM- or AM-related strategies.

Finally, no significant associations were found for both age groups between a total number of reported strategies in a diary and the retrospective self-reports in MMQ-Strategy subscale. This potentially indicates that the diary method is superior to the retrospective questionnaire as it allows for a collection of more various categories of strategies. In contrast, in the MMQ-Strategy subscale, 12 out of 19 items relate mostly to internal or other types of strategies which were not reported in the diary study, and since participants in our sample

⁵ But see Cavanaugh et al. (1983) where they reported marginally significant age difference with $p < .11$.

reported using more external strategies than internal, multiple, or other strategies, it is perhaps unsurprising that no correlation was found between a total number of strategies and the MMQ-Strategy subscale. However, in older adults, higher score on MMQ-Strategy subscale was moderately associated with higher frequency of RM -related strategy use.

2.4 General Discussion

Studies 1a and 1b, described in this chapter, demonstrate the first attempt in the last four decades at examining the frequency of experienced EMFs and the memory strategy use in everyday life within the same sample, using an improved structured diary method that incorporated electronic daily reminders to increase diary compliance rates and ensure that participants stayed on track with their task of noticing and recording their errors and strategy use. Study 1a showed that even when the diary keeping time is shortened to 3 days, as compared to a 5-day diary study by Haas et al. (2020), or a 7-day diary study by Niedźwieńska et al. (2020), and when participants had to wear reminder watches for the duration on the diary-keeping period, the age-related PM benefit was still obtained. Moreover, in line with the evidence from laboratory studies of memory and ageing (Kvavilashvili et al., 2009; Markostamou & Coventry, 2021), older adults, compared to young, reported experiencing significantly more RM failures.

Importantly, results of Study 1b provided first diary evidence that, contrary to popular assumption, older adults do not use more memory strategies to help their PM as both young and older adults reported using more PM-related strategies than RM- or AM-related, and no age differences observed in the use of PM- or RM-related strategies. In addition, no age differences were observed in the frequency of using external, internal, multiple, or other strategy types. Finally, the total number of EMFs and reported strategies did not correlate with retrospective self-reports on MMQ-Ability and MMQ-Strategy subscales, respectively, which suggests, that the MMQ may not reflect accurately the true frequency of EMFs as well as the use of strategies in day-to-day lives.

2.4.1 Age effects on the frequency and types of EMFs

A limited, but nevertheless growing number of studies, using a diary method have demonstrated that PM failures are most frequent type of EMFs reported by both, young and older adults, and that young adults, compared to older, report experiencing significantly more PM failures (Haas et al., 2020; Niedźwieńska et al., 2020). The results from Study 1a confirm

these prior findings, however, in contrast to these studies, they also showed that older adults reported significantly more RM failures than young adults. The finding that older adults reported higher frequency of RM failures compared to young adults is significant for several reasons. First, it goes against the argument that the age-PM benefit in diary studies is purely due to older adults forgetting that they had experienced a memory failure, because if that were true, they would not have reported more RM failures than younger adults. Second, it provides further evidence that the findings from the experimental studies in episodic memory relating to RM may translate into day-to-day life. It is worth noting, however, that the higher frequency of RM failures in older adults was found in only one other study, using a similar type of diary (J. C. Cavanaugh et al., 1983). One potential explanation why this age difference did not appear in studies by Haas et al., (2020) and Niedźwieńska et al., (2020), could be that the reminder watches somehow increased self-monitoring for RM failures, resulting in more accurate recording of the EMFs, allowing for this age difference to appear.

2.4.2. Effects of mood and lifestyle on everyday memory failures

There is plenty of evidence to date indicating that negative affect correlates positively with cognitive failures (Payne & Schnapp, 2014). Moreover, studies have shown that anxiety and depression symptoms are related to impairments in PM (Bowman et al., 2019; Zhou et al., 2017). In the present study, young and older participants significantly differed in symptoms of anxiety and depression, with young adults reporting higher symptoms for both at the start of Study 1a. Therefore, it may be argued that the lower mood in young adults may have led to higher frequency of PM failures. However, the results of Study 1a provided no evidence of correlation between mood measures and the frequency of any type of EMFs in the young adult group. In the older adult group, whilst positive and moderate correlation was observed between anxiety and the reported number of RM, a weak correlation in the opposite direction was observed between low mood and PM.

Another well-known suggestion for explaining the age-PM benefit in the naturalistic settings, is one of the differences in lifestyle between young and older adults, arguing that young adults lead busier lives making it easier for them to forget their intentions (Rendell & Craik, 2000; Rendell & Thomson, 1999). However, a recent diary study by Niedźwieńska et al., (2020) found no indication that lifestyle differences explained differences in PM failures. Study 1a replicated and extended these findings by using a self-reported and validated measure of busyness. Despite young adults reporting being much busier than older adults,

these differences did not change the overall results of the study, indicating that differences in lifestyle do not explain the age benefit in PM.

2.4.3 Age effects on the frequency and types of memory strategy use

Following on Craik's (1986) theory, which proposed that older adults perform better if provided with environmental support, many studies to date suggested that the lower frequency of PM failures in older adults, compared to young, can be potentially explained by the increased use of memory strategies (Dixon et al., 2001; Haas et al., 2020; Ihle et al., 2012; Niedźwieńska et al., 2020). The evidence from Study 1b, however, speaks against this suggestion. Young and older adults in Study 1b not only did not differ in a total number of strategies reported, but there were also no age differences in the use of strategies to specifically aid PM, or RM. Likewise, no age differences were observed in the use of four categories of strategies: external, internal, multiple or other, or when strategies were grouped depending on the memory stage i.e., used at encoding or retrieval. In contrast to Bouazzaoui et al., (2010) findings, in Study 1b both young and older participants reported higher use of external strategies. Moreover, both age groups reported higher frequency of strategies used to aid PM, and during the memory encoding stage. In fact, the only age difference appeared when looking at different subtypes of strategies, with young adults reporting more frequent use of "internal retracing", and older adults reporting more frequent use of "going through an alphabet" to retrieve information. Overall, these findings are in stark contrast to numerous studies comparing young and older adults' use of strategies in metamemory questionnaires and offer initial evidence that the diary of strategy use may provide a more accurate reflection of strategy use in day-to-day life.

2.4.4. Correlation between recorded EMFs and the use of memory strategies

To further explore the idea that there is a link between reported EMFs and the use of memory strategies in young and older adults, correlations were computed between the number of EMFs recorded in Study 1a and the number of memory strategies recorded in Study 1b. A moderate positive correlations were found for both age groups between a total number of strategies and the total number of EMFs, indicating that higher frequency of EMFs was associated with a higher use of memory strategies. More importantly, correlation between PM and PM-related strategies was found in older adult group, suggesting that the higher frequency in PM failures was associated with higher frequency of PM-related strategies. In contrast, there was no significant correlation between PM failures and PM-

related strategies in young adults. This finding is somewhat counterintuitive given that in both groups, PM failures were reported as the most frequent yet, young adults did not seem to be trying to overcome these by relying on memory aids. One possible explanation for this could be that younger adults are less likely to use strategies for the PM tasks that they see as less important, or which carry lower consequences (Penningroth & Scott, 2013). However, more research in naturalistic settings is needed to understand this phenomenon.

In addition, a moderate and positive correlation was observed between RM and RM-related strategies in both age groups, indicating that the higher frequency of RM failures was associated with more frequent use of RM-related strategies. This finding is unsurprising given that retrospective memory failures can only be resolved or attempted to be resolved by consciously employing various strategies to retrieve forgotten information. Interestingly, in older adult group a weak but positive correlation was observed between RM-related strategies and AM failures, which demonstrates that similar strategies are used for both types of failures.

2.4.5. Correlation between self-reports using metamemory questionnaire and the diary records of EMFs and Strategy use

In Study 1a, no correlation was found in both age groups between the total number of EMFs and self-rated frequency of memory failures on MMQ-Ability subscale. As noted in Chapter 1, metamemory questionnaires require a person to retrospectively rate the frequency of forgetting, whereas the diary method used in Study 1a eliminated the need for retrospective recall by asking participants to record each EMF as soon as they had been experienced. Therefore, the lack of correlation between the total EMFs in the diary and MMQ-Ability subscale is not unexpected. Moreover, two out of 20 items in the MMQ-Ability subscale relate to instances of forgetting phone numbers but none of the participants in Study 1a reported such failures, providing evidence that metamemory questionnaire may not be fully representative of memory failures experienced in everyday life.

The lack of correlation between MMQ-Strategy subscale and the number of strategies reported in the diary was also observed in Study 1b, providing further support for incongruity between retrospective and instantaneous reports. Interestingly, unlike Study 1a, the MMQ-Strategy subscale was completed after participants finished their 3-day diary of strategy use, hence one would expect that this would have increased an awareness of what strategies were used most commonly. However, it must be noted that in the MMQ-Strategy

subscale, only seven out of 19 items represent external strategies, whereas participants' diary records indicate a strong preference for external strategies by both young and older adults, hence, any significant correlations here would be somewhat counterintuitive. Nevertheless, a positive and moderate correlation between MMQ-Ability subscale and RM-related strategies in older adults indicate that at least for older adults some items on MMQ-Ability subscale do reflect the reported use of RM-related strategies in real life.

2.4.6. Conclusions

Study 1a provides further support for the age-PM benefit. Moreover, the finding that older adults experience more RM failures demonstrates that the age-PM benefit is not obtained due to older adults forgetting to record their failures. Moreover, findings of the current study also demonstrate that the negative age effects on the laboratory RM tasks are reflected in the day-to-day lives of older adults. Most importantly, Study 1b offers first empirical evidence using a self-prompted diary method, that the strategy use in day-to-day life does not explain the age differences in PM. Given that lifestyle too had no effect on the frequency of EMFs, future research applying similar methodology is needed to explore other potential individual differences (e.g., procrastination), that could explain age effects on everyday PM.

2.4.7. Limitations

Just like in previous self-prompted (structured) diary studies, the present study showed a high within-subject variability in the total number of recorded EMFs. This potentially highlights the need for the future studies to include additional measures which could help explain why some adults, regardless of age, report only a few EMFs and others report much higher numbers.

Chapter 3: The Stability of Everyday Memory Failures in Young and Older Adults: A Longitudinal Diary Study (Study 2)

3.1 Introduction

Results from diary studies, including Studies 1a and 1b reported in Chapter 2, demonstrate that a diary is an effective tool for capturing everyday memory functioning outside the laboratory and provides information that may be difficult to obtain with traditional experimental methods. For example, unlike questionnaires, a diary method allows the reduction of retrospective biases, as recording entries usually happens very close to the experienced event. Moreover, a diary can help researchers to capture the frequency of different experiences and the changes that may occur over time (Iida et al., 2012). Nevertheless, the limited number of existing diary studies, including Study 1a, has demonstrated some variability in their findings. For example, in a study by Haas et al. (2020), young adults reported significantly more EMFs overall, compared to young adults. However, in Study 1a, as well as in Niedźwieńska et al. (2020), no age differences were found in the total number of recorded EMFs. Moreover, in Study 1a older adults reported significantly more RM failures compared to young, but this age difference in RM failures was not found in the other two studies. Such variability across some of the findings raises questions about the stability and reliability of a diary method. As with any measure used in psychological research, the results obtained using diary methods need to be reliable. According to Iida et al. (2012), one way to test the reliability of structured diaries is by using a test-retest method. Unfortunately, to our knowledge, no previous diary study of EMFs has assessed the consistency of the obtained results over time.

Another important aspect of a structured diary method that needs to be explored is the question about individual differences and how these differences affect, if at all, the frequency of EMFs, and especially the frequency of PM failures. For example, Niedźwieńska et al. (2020) tested a potential role of lifestyle on the frequency of reported EMFs in young, middle-aged and older adults by examining the patterns of everyday activities. To achieve this aim, they recruited two groups of young adults where one group were students and another – young workers, with the assumption that young workers would have more routinized lives. In addition to middle-aged adults, they also recruited two groups of older adults, with one group comprising of retired adults belonging to social clubs (i.e., participating in frequent activities), and another group consisting of retired adults who were

not members of any social club. It was found that the patterns for the age-PM benefit were similar regardless of whether the lifestyle was matched or not (i.e., even when lifestyle differences were accounted for, the age-PM benefit did not disappear). Likewise, when in Study 1a we controlled for levels of busyness and routine (measured by a standardised questionnaire), we found that this did not influence the pattern of results obtained. Together, these findings provide initial evidence that the age-PM paradox cannot be explained by differences in the lifestyle in younger and older adults (Rendell & Craik, 2000; Rendell & Thomson, 1999).

Study 1b examined another potential explanation, often suggested in the literature on the age-PM paradox, that older adults may be using more memory strategies than younger adults resulting in their superior performance on everyday PM tasks, and a smaller number of recorded PM failures in diary studies of EMFs (Haas et al., 2020; Ihle et al., 2012; Niedźwieńska et al., 2020). The results of Study 1b provided the first empirical evidence that strategy use does not explain the age-PM paradox. Hence, to date, diary studies have not been able to provide any valid suggestion as to why the age-PM paradox may exist.

Given these important gaps in the literature, the main aim of the present study was to investigate the reliability of the EMFs diary method by asking participants to keep a 3-day diary at two different time points, and to further investigate the frequency and types of EMFs in healthy young and healthy older adults. In addition, we wanted to replicate the pattern of findings from Study 1a, by showing that not only do older adults experience fewer PM failures, but that they also experience more RM failures than young adults.

The second and equally important aim of this study was to explore the associations between the frequency of experiencing different types of EMFs and individual differences variables. In particular, we wanted to see if the results from Study 1a in relation to differences in the lifestyle, anxiety and depression would be replicated. Therefore, we used the same measures as in Study 1a to account for differences in busyness, routine, anxiety and depression. In addition, we assessed levels of perceived stress because previous research has shown that higher levels of stress can lead to more memory complaints. For example, Bell et al. (2021) found that older adults who had higher levels of perceived stress were more likely to complain about their memory, and Molina-Rodriguez et al. (2016) reported that the perceived stress in young adults also contributed to significant variance in memory complaints.

Another potentially very important individual difference variable to consider when studying EMFs in general, and especially PM failures, is procrastination (Zuber & Kliegel, 2020). Indeed, Zuber et al. (2021) conducted a study with young adults seeking to examine if procrastination contributed to PM failures using a naturalistic “send-back” task (i.e., participants had to remember to send a text message with specific words to the experimenter at pre-arranged times). The levels of procrastination were assessed using a self-report procrastination questionnaire and a behavioural procrastination task, whereby participants were asked to perform a specific task before a set deadline. It was found that both the self-reported procrastination and the behavioural procrastination scores predicted the number of PM failures. Given this initial evidence, we predicted that procrastination would be associated with the frequency of recorded PM failures but not with RM and AM failures.

In addition, we wanted to replicate findings obtained in Study 1a (Chapter 2), by examining correlations between self-reported frequency of everyday forgetting, as assessed by the Multifactorial Memory Questionnaire (MMQ) - Ability subscale and the number of EMFs recorded in the diaries. Finally, we also wanted to investigate whether performance on standard cognitive tests as assessed by the Cognitive Telephone screening instrument (COGTEL) would be associated with the reported frequency of EMFs.

3.2 Method

The method of this study was identical to the one used in Study 1a except that the participants in this study kept a 3-day diary of EMFs twice, with a 3-4 week delay between the two diary-keeping periods. Given that this study was conducted remotely, no episodic memory or executive functioning tests were completed. As in Study 1a, participants completed the following questionnaires which will not be described here again: PHQ-9, GAD-7, MPED, MMQ. The Diary of EMFs and the Post Diary Compliance Questionnaire used in the current study were also identical to those used in Study 1a. Any new materials that were not used in the Study 1a, are described in the materials section of the present study. Finally, unlike in Study 1a, due to the remote nature of the current study, the reminder watches were not used.

3.2.1 Design

This study employed a mixed design with three independent variables. Participants' age group (two levels: young, older) was a between subjects variable, while diary-keeping period (two levels: Period 1, Period 2) and type of recorded errors (with three levels: PM, RM, AM) were within subjects variables. The dependent variable was the number of different types of EMFs recorded by participants. Correlational design was used to assess the reliability of the diary method (in terms of the number of recorded PM, RM and AM errors in Periods 1 and 2) as well as associations between the number of recorded EMFs and several other variables such as procrastination, business, and mood.

3.2.2 Participants

A total of 43 young and 42 older adults were recruited to take part in this study.

Of these, two young adults and two older adults withdrew from the study before keeping a second diary. The final sample consisted of 41 young adults aged 19 to 34 years ($M = 24.78$, $SD = 5.18$) and 40 older adults aged 60 to 86 years ($M = 69.85$, $SD = 6.19$). In both groups, the majority of participants were female (82.9% and 67.5%, in young and old, respectively). A Chi-squared test did not reveal a significant difference between age groups in gender balance, $\chi^2(1, 81) = 2.60$, $p = .11$. Young participants were recruited from the University of Hertfordshire and by advertising on the Nextdoor website for local communities. Older adults were mainly recruited via the Nextdoor website and local branches of the University of Third Age (U3A). Exclusion criteria for both groups included: (1) head or brain injury, (2) history of stroke, (3) history of alcohol abuse or dependence, (4) recurrent substance abuse or dependence, (5) mental health problems (diagnosed by a doctor for which they are currently taking medication), (6) memory problems (diagnosed by a doctor). Of note, a total of four young adults and one older adult scored in the severe range for Anxiety (GAD-7) and/or depression (PHQ-9). All data analyses were run with and without these participants and showed no difference in any of the main results, therefore, the decision was made not to exclude them.

Table 3-1 shows participants' demographic characteristics such as years of education, and ratings for health and memory. Results on one-way ANOVAs on these variables with age group as a between subjects variable showed that there were no significant age differences in

years spent in education, self-rated health, health in comparison to peers as well as self-rated memory functioning, memory in comparison to peers and memory before COVID-19 pandemic.

Table 3 - 1. Demographic characteristics (means and standard deviations) of young and older adults and results of one-way ANOVAs with age group as a between subjects variable

	Young adults n = 41	Older adults n = 40	F	p	η^2
Education (in years)	15.44 (1.83)	16.48 (3.79)	2.47	.12	.03
Self-rated health ^a	3.90 (0.54)	3.85 (1.03)	< 1	.77	.00
Health compared to peers ^a	4.00 (0.84)	4.05 (0.85)	< 1	.79	.00
Self-rated memory ^a	3.54 (0.67)	3.58 (0.71)	< 1	.80	.00
Memory compared to peers ^a	3.49 (0.90)	3.60 (0.67)	< 1	.40	.01
Memory compared to before the pandemic ^b	2.88 (0.84)	2.73 (0.60)	< 1	.35	.01

Note. ^a1 = Poor, 2 = Below Average, 3 = Average, 4 = Good, 5 = Excellent; ^b1 = Worse, 2 = Slightly worse, 3 = About the same, 4 = Slightly better, 5 = Much better.

3.2.3 Materials

The Cognitive Telephone Screening Instrument (COGTEL, Kliegel et al., 2007; Appendix XI) is conducted over the phone and consists of several brief tests assessing cognitive function across six domains: prospective memory (PM), short-term memory (STM), long-term memory (LTM), working memory (WM), verbal fluency (VF, combined by adding a test for letter fluency and a test for category fluency), and inductive reasoning (IR). PM is assessed with a simple event-based task. In particular, at the beginning of COGTEL administration, participants are given an instruction to remember to tell the researcher their year of birth when later on in the screening session the researcher asks them to complete a category fluency task.

The STM is assessed by using eight word pairs (four of them are semantically related and the other four are not). Participants are asked to remember the word pairs read out by the

researcher for later recall. After a short break, the researcher reads out the first word from any random pair and the participant is asked to recall the second word from that pair. The maximum score for STM is 8. The LTM is assessed using the same list of word pairs after a delay period filled in by completing several tasks assessing WM, VF and IR. The maximum score for LTM is again 8.

The WM is assessed with a backward digit-span test. Participants listen and immediately recall in reverse order sequences of single-digit numbers, which get progressively longer with each new sequence. Each sequence length has two trials, and the test is stopped once participants fail to correctly recall both sequences of the same length. The maximum score for WM test is 12.

Verbal fluency test contains two tasks: letter fluency and category fluency. In the letter fluency task, participants are asked to name as many words beginning with the letter “a” as they can within 60 seconds, but they are instructed not to use any proper words and to avoid repetitions. In the category fluency test, participants are asked to name as many professions as possible (without altering the word) within 60 seconds. The total score for the verbal fluency is the sum of the letter fluency and category fluency scores.

Finally, in the inductive reasoning task, participants are presented with sequences composed of five numbers which are constructed following a specific mathematical rule. Participants are asked to state the sixth number based on the rule they have observed in each specific sequence. The maximum score for this task is 8.

In addition to scores for each of the six domains individually, an overall score is calculated using the following formula: $7.2 \times \text{PM} + 1.0 \times \text{STM} + 0.9 \times \text{LTM} + 0.8 \times \text{WM} + 0.2 \times \text{VF} + 1.7 \times \text{IR}$. The COGTEL takes about 10-15 minutes to complete, and the total score indicates general cognitive functioning.

Perceived Stress Scale (PSS, Cohen et al., 1983; Appendix XII) is a brief, 10-item scale measuring the perception of stress. This measure provides an understanding of how different situations affect a person’s feelings (e.g., “*In the last month, how often have you been upset because of something that happened unexpectedly?*”; or “*In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?*”). The respondent is asked about their feelings and thoughts over the last month. Response options to questions ranges from 0 to 4 (0 = *never*, 1 = *almost never*, 2 = *sometimes*, 3 = *fairly often* and 4 = *very often*). The higher scores indicate higher perceived stress.

Irrational Procrastination Scale (IRS, Steel, 2010; Appendix XIII) is a brief instrument consisting of nine items which focus on attributes of procrastination with an emphasis on irrational delay, where “irrational” refers to a voluntary delay despite expecting it to be disadvantageous (e.g., “*There are aspects of my life that I put off, though I know I shouldn’t*”; “*I delay tasks beyond what is reasonable*”). Each item is scored from 1 (*very seldom or not true of me*) to 5 (*very often true, or true of me*). A higher score on the scale indicates higher levels of procrastination.

3.2.4 Procedure

Step 1: Telephone interview: Before this interview, all interested volunteers received the Participant Information Sheet by email. Eligibility for the study was confirmed by asking about any medical conditions that could affect their everyday memory. After confirming the eligibility for the study, participants were asked few demographic and health questions (Appendix VIX). Participants then completed the Cognitive Telephone Screening Instrument (COGTEL) and received a link to Qualtrics (by email) to complete the following questionnaires online: (1) The Martin and Park environmental Demands (MPED); (2) Multifactorial Memory Questionnaire (MMQ); (3) Perceived Stress Scale (PSS); (4) Patient Health Questionnaire (PHQ-9); (5) Generalized Anxiety Disorder Assessment (GAD-7) and (6) Irrational Procrastination scale. Participants were asked to complete these questionnaires over the next 2-3 days.

At the end of this call, participants were advised that the researcher would send them two diaries by post, together with the pre-paid return envelopes, and that they should let the researcher know when they arrived.

Step 2: Once the participants received the diaries, the researcher briefed the participants over the telephone on how to complete the diary over the next 3 days and advised them to start keeping the first diary on the following morning at 09:00 AM. It was also explained that participants should keep their diaries with them at all times and record their failures as soon as they happen between 09:00 AM and 09:00 PM. It was agreed that the researcher would call the participants on the 4th day and ask them to complete a diary compliance questionnaire over the phone.

Step 3: Telephone call (on or around Day 4 of the first Diary). Participants completed the diary compliance questionnaire (Appendix VI) and were asked to post the completed diary back to the researcher as soon as it was convenient. The date and time was agreed for the researcher to call in 3-4 weeks when the participants would be due to start their second diary.

Step 4: Telephone call: Around 3-4 weeks after completing the first diary, participants received a phone call from the researcher and were asked to complete questionnaires about mood and memory (a new Qualtrics link was sent to them by email). At the end of the call, they were advised to start keeping the second 3-day diary of EMFs on the following morning at 09:00 AM with all the instructions relating to diary-keeping times reiterated once more.

Step 5: Telephone call: During this last telephone call, commencing on or around Day 4 of the second diary, participants completed the diary compliance questionnaire (Appendix VI) and were asked to post the completed diary using a prepaid envelope back to the researcher as soon as it was convenient.

3.2.5 Coding process for EMFs

The coding process of recorded EMFs was completed using our newly developed coding system as described in Study 1a of Chapter 2 (for a full coding manual refer to Appendix x). First, all diary entries from both time periods were coded independently by myself and my principal supervisor into three main categories of PM, RM and AM failures. The inter-rater reliability between the two coders was excellent (Cohen's weighted $\kappa = .86$, $SE = .02$) and any disagreements were resolved through discussion. These three types of EMFs were further coded by the same independent coders into further subcategories within each main category. The inter-rater reliability between the agreed subcategories was again very high (Cohen's weighted $\kappa = .90$, $SE = .01$) and any disagreements were resolved through discussion.

3.3 Results

Like in Studies 1a and 1b, reported in Chapter 2, both parametric and non-parametric analyses were conducted depending on the type of independent variable used, and the effect

sizes were measured by partial eta-squared (η_p^2), and by Cohen's d , depending on the type of statistical test used (Cohen, 1988). To normalise the data, the analysis on the number of the recorded EMFs was carried out on square-root transformed data (Laughland & Kvavilashvili, 2018). Similarly to Study 1a, the square-root transformation helped to normalize the data for the total number of EMFs, but not the separate types of PM, RM and AM failures because of a number of zero values in each of the three error category. First, groups were compared in the background characteristics. The diary compliance was checked for Period 1 and Period 2. Next, age groups were compared in the number of EMFs recorded over both periods, followed by subsequent comparison of young and older adults in the number of different subcategories of recorded EMFs. Because significant group differences were found in some background variables, correlation analyses were conducted to see if these variables correlated with the number of recorded PM, RM and AM failures. A subsequent mixed ANCOVA was run to see if a specific variable which correlated similarly in both age groups was influencing the results of the initial ANOVA. Following this, a correlation analyses between the recorded PM, RM, and AM in Period 1 and Period 2 were conducted to check the reliability of the diary method. Additional correlation analyses were conducted between the COGTEL and its subtest scores and recorded EMFs, as well as reported EMFs and scores on MMQ-Ability subscale. As a final step, several ANOVAs were conducted to check if groups differed in their ratings of mood before each type of recorded EMF, their ratings of seriousness of each type of EMF and how upset they were with the specific types of EMFs.

3.3.1 Group differences in background characteristics

Table 3-2 shows the background characteristics of a sample. In terms of performance on standard cognitive tests using COGTEL, no significant group differences were observed in a total COGTEL score, working memory or category fluency tasks ($p_s > .08$). However, younger adults outperformed older adults on tasks for PM ($p < .01$), verbal short-term memory ($p < .05$), verbal long-term memory ($p < .01$), and older adults performed better than young on verbal fluency-total ($p < .05$), letter fluency ($p < .05$), and inductive reasoning ($p = .048$).

For self-reported measures obtained before participants started to keep their first diary of EMFs in Period 1, young adults reported being significantly busier than older adults ($p < .001$), as well as having higher levels of anxiety ($p < .001$), depression ($p < .01$), stress ($p < .001$) and procrastination scores ($p < .01$). In Period 2, before starting their second diary,

Table 3 - 2. Means (standard deviations) for background variables in young and older adults and results of one-way ANOVA

	Young	Older	<i>F</i>	<i>p</i>	η^2
<i>COGTEL Scores</i>^a					
COGTEL Total Score	40.60 (6.56)	38.86 (8.25)	1.12	.293	.01
Prospective memory	0.93 (0.26)	0.65 (0.48)	10.32	.002	.12
Verbal Short-term	5.71 (1.37)	5.00 (1.87)	3.86	.053	.05
Verbal Long-term	6.37 (1.26)	5.25 (1.93)	9.53	.003	.11
Working memory	8.83 (2.21)	8.80 (2.17)	< 1	.952	.00
Verbal fluency total	30.93 (6.62)	34.78 (9.85)	4.28	.042	.05
Letter fluency	12.95 (4.35)	15.80 (5.60)	6.55	.012	.08
Category fluency	17.98 (3.81)	18.98 (5.51)	< 1	.344	.01
Inductive reasoning	5.44 (1.73)	6.15 (1.55)	4.02	.048	.05
<i>Questionnaires</i>					
Busyness (MPED) P1 ^b	22.54 (4.30)	16.48 (5.18)	32.90	.000	.30
Routine (MPED) P1	12.56 (2.72)	13.68 (3.03)	3.03	.086	.04
Anxiety (GAD-7) P1	7.08 (4.73)	2.35 (2.99)	28.50	.000	.27
Depression (PHQ-9) P1	6.08 (4.91)	3.40 (0.54)	8.94	.004	.10
Procrastination (IPS) P1	27.25 (5.99)	23.18 (6.31)	8.77	.004	.10
Perceived stress (PSS) P1	20.18 (6.77)	13.08 (7.65)	19.30	.000	.20
MMQ-Satisfaction P1	52.07 (7.77)	54.03 (9.24)	1.06	.306	.01
MMQ-Ability P1	48.49 (10.99)	51.20 (8.86)	1.49	.226	.02
MMQ-Strategy P1	50.27 (8.64)	48.18 (11.31)	< 1	.351	.01
Busyness (MPED) P2 ^c	22.76 (4.39)	16.33 (5.66)	32.71	.000	.29
Routine (MPED) P2	11.80 (3.03)	13.60 (2.26)	9.07	.003	.10
Anxiety (GAD-7) P2	7.22 (5.63)	2.63 (3.29)	20.00	.000	.20
Depression (PHQ-9) P2	7.02 (6.24)	3.28 (3.95)	10.38	.002	.12
Procrastination (IPS) P2	27.66 (5.32)	23.48 (6.20)	10.63	.002	.12
Perceived stress (PSS) P2	21.25 (7.12)	11.78 (6.86)	36.40	.000	.32
MMQ-Satisfaction P2	48.88 (7.42)	49.83 (8.26)	< 1	.589	.00
MMQ-Ability P2	48.15 (12.48)	50.45 (9.38)	< 1	.352	.01
MMQ-Strategy P2	49.27 (9.66)	47.60 (10.99)	< 1	.527	.01

Note. ^a Telephone Interview for Cognitive Status (Kliegel et al., 2007); ^b P1 – Period one; ^c P2 – Period two.

younger adults again reported being busier than older adults ($p < .001$) and having higher levels of anxiety ($p < .001$), depression ($p < .01$), stress ($p < .001$), and procrastination ($p < .01$). In turn, older adults reported having a more routinized lifestyle than younger adults ($p < .01$). No other significant differences on self-reported measures were observed ($p_s > .22$).

3.3.2 Diary compliance in Period 1 and Period 2

During the first diary keeping period, there was no significant group difference in terms of how many young and older adults kept the diary with them for all 3 days (95% young and 95% older), $\chi^2(1, N = 81) = .00, p = .98$. There were also no group differences in the number of days participants kept a diary with them $t(79) = 0.03, p = .96, d = .22$, the percentage of EMFs they thought they were able to record, $t(79) = -0.73, p = .87, d = 12.31$, and self-rated difficulty of keeping a diary with them at all times, $t(79) = 1.74, p = .38, d = .60$, and recording their errors in the diary, $t(78) = -0.57, p = .34, d = .51$. Finally, groups also did not differ in their ratings of what effect, if any, diary-keeping had on their mood, $t(78) = -0.93, p = .67, d = .83$ (Table 3-3).

During the second diary-keeping period, no significant group differences were observed in terms of how many participants kept the diary with them for all 3 days (85% young and 90% older), $\chi^2(2, N = 81) = 1.11, p = .57$. T-tests for independent samples again did not reveal significant group differences in the number of days participants kept the diary with them, $t(79) = -0.84, p = .09, d = .38$, and how they had rated their experience of keeping the diary with them at all times, $t(79) = 0.46, p = .33, d = .60$. However, young adults indicated recording fewer errors, out of all they had experienced, $t(79) = -2.30, p < .05, d = 21.12$, compared to older adults, who found recording their EMEs in the diary slightly more difficult than the young group, $t(78) = -0.99, p < .05, d = .45$. In addition, older adults indicated that the diary-keeping made them feel slightly better, than young, $t(79) = -3.02, p < .01, d = .75$. Taken together, these findings show excellent compliance rates in both young and old participants across both diary keeping periods.

Table 3 - 3. Mean (Standard Deviation) Days of Keeping DEME Diary, Percentage of EMEs Recorded, Difficulty of Recording in a Diary/keeping a diary and the Effect of Diary-keeping on Mood during Periods 1 and 2, as a Function of Age Group, and Results of Independent Samples T-test.

	Young (n=41)		Older (n=40)	
	Period 1	Period 2	Period 1	Period 2
Days of keeping a diary ^a	2.95 (0.22)	2.83 (0.44)	2.95 (0.22)	2.90 (0.30)
Percentage of EMFs recorded ^b	91.32 (11.82)	81.07 (24.36)	93.33 (12.81)	91.88 (17.16)
Experience of keeping a diary ^c	1.68 (0.65)	1.59 (0.63)	1.45 (0.55)	1.53 (0.55)
Experience of recording in a diary ^d	1.24 (0.49)	1.18 (0.39)	1.31 (0.52)	1.27 (0.51)
Effect of diary-keeping on the mood ^e	4.37 (0.92)	4.17 (0.59)	4.54 (0.72)	4.68 (0.89)

Note. ^a How many days did you keep the diary with you at all times (1 = 1 day; 2 = 2 days; 3 + 3days). ^b What percentage, out of all EMEs, experienced over the 3 days (or days you kept the diary with you), do you think you recorded and acknowledged? ^c How did you find keeping your diary with you at all times (1 = Very easy; 2 = Somewhat easy; 3 = Somewhat difficult; 4 = Very difficult); ^d How did you find the recording process using the diary provided (1 = Very easy; 2 = Somewhat easy; 3 = Somewhat difficult; 4 = Very difficult); ^e Do you think keeping a diary had any effect on your mood and how you feel (Please rate from 1 to 7, where 1 = Made me feel a lot worse; 4 = No effect; 7 = Made me feel a lot better).

3.3.3. Number of EMFs in young and older adults for Period 1 and Period 2

In Period 1, a total of 479 EMFs were recorded, with 244 recorded by young adults and 235 by older adults. As a result of coding, a small number of errors (four in young and eight in older adults) were excluded from the analyses, because they were coded as “not a memory error”. After the removal of these errors, the final dataset in Period 1 consisted of a total of 467 EMFs, of which 240 were recorded by young adults (range: 1 – 18) and a total of 227 EMFs were recorded by older adults (range: 0 – 13).

In Period 2, a total of 365 EMEs were recorded (178 by young and 187 by older adults). As in Period 1, a small number of error descriptions (five in young and two in old group) were coded as “not a memory error” and were excluded from analyses. Therefore, the final dataset for Period 2 consisted of a total of 358 EMFs, of which 173 were recorded by young adults (*range*: 0 – 16) and a 185 EMFs were recorded by older adults (*range*: 0 – 19).

There were no significant group differences in any periods, in the total number of recorded EMFs entries, or the number of acknowledged EMFs (ticks), or the fully recorded EMFs and ticks combined ($F_s < 1$) (see table 3-4).

Table 3 - 4. The mean number (SD) of fully recorded and acknowledged (Ticks) EMFs in young and older adults, across three days for Period 1 and Period 2.

	Young (n = 41)	Older (n = 40)	F	p	η^2
Period 1					
Fully recorded EMFs	5.85 (3.87)	5.65 (3.42)	< 1	.80	.00
Acknowledged EMFs (Ticks)	0.98 (2.67)	0.82 (2.01)	< 1	.08	.00
Fully recorded EMFs plus Ticks	6.83 (5.22)	6.65 (5.04)	< 1	.10	.00
Period 2					
Fully recorded EMFs	4.20 (3.63)	4.65 (4.19)	< 1	.60	.00
Acknowledged EMFs (Ticks)	1.15 (2.84)	0.75 (1.95)	< 1	.47	.01
Fully recorded EMFs plus Ticks	5.45 (4.91)	5.40 (4.83)	< 1	.96	.00

3.3.4 Effects of age on the number of recorded EMFs in Period 1 and Period 2

In the young group for Period 1, coding resulted in 119 (50%) PM errors, 58 (24%) RM errors, and 63 (26%) AM errors. In the older adult group, there were 71 (31%) PM errors, 81 (36%) RM errors, and 75 (33%) AM errors. In Period 2, for young adult group coding resulted in 98 (57%) PM, 41 (24%) RM, and 34 (20%) AM errors. For older adult group, coding resulted in 76 (41%) PM, 55 (30%) RM, and 54 (29%) AM errors.

To examine age effects on EMFs, the number of EMFs was entered into a 2 (age group: young, older) by 3 (EMF type: PM, RM, AM) by 2 (Time: Period 1, Period 2) mixed ANOVA with repeated measures on the last two factors (see Table 3-5). The main effect of age group was not significant, $F < 1$. The main effect of EMF type was significant, $F(2, 158) = 9.46, p < .001, \eta_p^2 = .11$, with more PM errors reported compared to RM ($p < .01$), or AM ($p < .01$), and no difference between RM and AM ($p = 1$). The main effect of Time was also significant, $F(1, 79) = 20.13, p < .001, \eta_p^2 = .20$, with more EMFs recorded overall in Period 1 of the diary-keeping ($M = 5.75, SD = 3.63$) than in Period 2 ($M = 4.42, SD = 3.90$). Importantly, in line with the results of Study 1a, there was a significant EMF type by age group interaction, $F(2, 158) = 6.89, p < .01, \eta_p^2 = .08$ (Figure 3-1).

Table 3 - 5. Mean (standard deviation) number of EMDs as a function of type of error (PM, RM, AM) and age group (young, older) in Periods 1 and 2.

	Young (n = 41)			Older (n = 40)		
	PM	RM	AM	PM	RM	AM
Period 1	2.90 (2.39)	1.42 (1.66)	1.54 (1.79)	1.78 (1.90)	2.00 (1.84)	1.95 (1.96)
Period 2	2.39 (2.25)	0.98 (1.33)	0.93 (1.12)	1.90 (2.28)	1.35 (1.46)	1.25 (2.18)

Tests of simple main effects showed that the groups significantly differed in the number of PM errors, $F(1, 79) = 4.93, p < .03, \eta_p^2 = .06$, with younger adults reporting overall higher number of PM failures ($M = 2.65, SD = 2.04$) than older adults ($M = 1.84, SD = 1.79$). However, although older adults reported nominally higher number of RM errors ($M = 1.69, SD = 1.38$) than younger adults ($M = 1.20, SD = 1.28$) this difference approached but did not reach the accepted level of statistical significance, $F(1, 79) = 3.37, p = .07, \eta_p^2 = .04$. Finally, younger and older adults did not differ in terms of the number of recorded AM errors, $F(1, 79) = 1.99, p = .16, \eta_p^2 = .03$ (young: $M = 1.18, SD = 1.28$; old: $M = 1.65, SD = 1.89$). An additional set of tests of simple main effects showed that the main effect of type of error was significant in young adults, $F(2.000, 78.000) = 14.95, p < .001, \eta_p^2 = .28$, but not in older adult group, $F < 1$. Young adults reported significantly more PM errors than RM and

AM errors ($p_s < .001$), but there was no difference between the number of RM and AM errors ($p_s > .54$).

Finally, there was no significant time by age group ($F < 1$) or time by EMF type interactions, $F(2, 158) = 1.91, p = .15, \eta_p^2 = .02$. A 3-way interaction between the independent variables of age, type of EMF and time period was also not significant ($F < 1$).

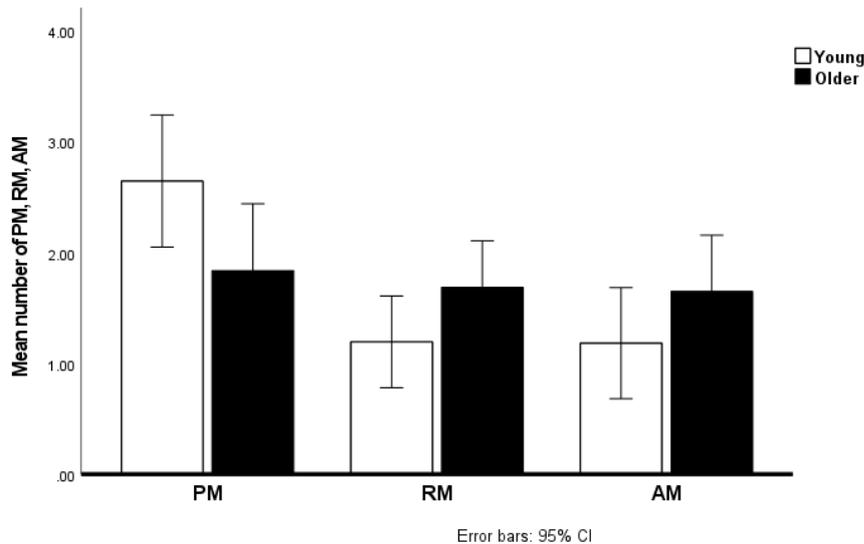


Figure 3 - 1: Mean number of EMFs (pooled across the two diary keeping periods) as a function of type of error (PM, RM, AM) and age group (Young, Older).

3.3.5 Associations between recorded EMFs in Period 1 and Period 2

To check whether the total number of recorded EMFs and the different types of EMFs were correlating between two different diary-keeping periods, Spearman's rank correlations were calculated (see Table 3-6). Overall, correlations in both groups were moderate to strong, with somewhat weaker correlations in older group. Nevertheless, moderate to strong correlations were noted in both groups between the total number of EMFs in Period 1 and 2.

Table 3 - 6. Spearman's rank correlations between total EMEs, PM, RM, AM as recorded in Period 1 (P1) and Period 2 (P2) by young and older adults.

	Young Adults (n=41)				Older Adults (n=40)			
	PM	RM	AM	Total	PM	RM	AM	Total
	P1	P1	P1	P1	P1	P1	P1	P1
PM P2	.603**				.360*			
RM P2		.379*				.332*		
AM P2			.633**				.411**	
Total P2				.664**				.526**

Note. * Correlation is significant at 0.05; ** Correlation is significant at 0.01.

3.3.6 Effects of age on EMF subtypes in Period 1 and Period 2

To compare young and older adults in the number of memory errors in each of the subcategories for Period 1 and Period 2 of diary-keeping, a series of Mann-Whitney tests were performed (see Table 3-7). In Period 1, significant age differences were noted in the number of reported EMFs in some RM subcategories, with older adults reporting more often forgetting names of celebrities/historical figures/book characters, etc., ($U = 717.50, p < .05$), and forgetting words ($U = 607.50, p < .01$), but young adults reported more frequently forgetting that a particular intention had been formed ($U = 740.00, p < .05$).

In Period 2 of diary-keeping, no age differences were observed in the frequency of RM subcategories. In PM subcategories, young adults reported more often forgetting to take something extra from home, needed for that day ($U = 631.50, p < .05$). In the AM subcategory, older adults reported more often forgetting why they went into a certain location ($U = 695.50, p < .05$), and forgetting to take usual things from home ($U = 680.00, p < .01$).

Table 3 - 7. Number of memory errors in each subcategory of PM, RM, and AM in young and older adults, as recorded during Period 1(P1) and Period 2(P2) of diary keeping.

Prospective memory failures (P1:young/older)(P2:young, older)	Retrospective memory failures (P1:young/older)(P2:young/older)	Absent-minded memory failures (P1:young/older)(P2:young/older)
Forgetting appointments (7/2)(6/3)	Forgetting names of celebrities, historical figures, book characters, etc. (0/7)*(3/2)	Forgetting what you wanted to say during conversation, what you just thought/wanted to pick up or write down (9/10)(3/9)
Forgetting to take medications/vitamins/food supplements (6/2)(4/3)	Forgetting names of people, you know (3/5)(3/8)	Forgetting why you came into certain location (5/9)(1/12)*
To make a call/send a message/email (24/19)(20/17)	Forgetting words and names of objects, animals, plants and places, etc. (3/19)**(4/11)	Temporary disorientation in date/time (1/4)(3/4)
To buy/order/collect something or post a letter (13/7)(9/12)	Forgetting passwords, dates, phone numbers (3/1)(4/1)	Omitting an action in a sequence of actions but NOT the last action (1/5)(2/5)
To pass on a message or ask a question when you see someone (8/6)(2/1)	Forgetting entire autobiographical event (1/2)(0/0)	Not finishing the sequence of actions – forgetting to perform last action (5/6)(1/4)
Do something after a certain period of time (2/4)(4/2)	Forgetting where you put away/hid something some time ago (8/6)(4/4)	Action swap: doing another thing instead of intended action (7/15)(3/3)
To take something extra from home needed for that day (22/10) (24/10)*	Forgetting some content of intention (4/9)(7/4)	Distraction: Just before carrying an action or while doing it, being distracted, and forgetting to complete it (12/11)(4/11)
Completing regular duties (17/11)(17/11)	Forgetting that a particular intention has been formed (5/0)*(0/0)	Forgetting to take usual things from home which you always take with you (5/3) (9/0)**
Completing one-off activity (32/15)(14/16)	Forgetting one or more items when shopping (6/3)(6/5)	Loosing things that are in constant use at home/office/car or have their usual location (11/7)(4/2)
	Forgetting content of a book/TV programme or other factual information (6/8)(1/2)	Leaving something behind that was in sight most of the time (5/2)(3/5)
	Forgetting factual information from well-learned procedures (1/2)(0/1)	Forgetting what you have just said/did (2/2)(1/0)
	Forgetting actions – Thinking you have not done something, but you had (3/6)(3/4)	
	Being unsure whether an action was completed (2/3)(1/1)	

Forgetting some other content/piece of episodic information
(12/9)(3/10)
Forgetting routs and locations (1/0)(1/3)

3.3.7 Relationship between individual differences variables and recorded EMFs in Period 1 and Period 2

The data presented in Table 3-2 shows that young and older participants differed in terms of self-reported ratings for busyness, procrastination, stress, anxiety and depression. Before repeating the main 2 (age group: young, older) by 3 (EMF type: PM, RM, AM) by Time (Time 1, Time 2) mixed ANOVA, it was necessary to check if these variables correlated with the number of recorded PM, RM, and AM failures in both, young and older adult groups. Therefore, Spearman's rank correlations were computed to assess the association between the total number of EMFs, as well as separate types of EMFs (PM, RM, AM) with measures of these background variables in young and older adults for both diary-keeping periods (see Table 3-8). In Period 1, in young participants, significant positive correlations were found only between PM errors and procrastination ($r = .32, p < .05$), and AM errors and depression ($r = .33, p < .05$). In older participants, significant and positive correlations were found between PM errors and scores on anxiety ($r = .33, p < .05$), depression ($r = .59, p < .01$), perceived stress ($r = .33, p < .05$) as well as levels of busyness ($r = .41, p < .01$) and procrastination ($r = .57, p < .05$). In addition, PM errors correlated negatively with scores on the routine sub-scale ($r = -.35, p < .05$), indicating that lower levels of routine were associated with the higher number of PM errors. Finally, AM errors were positively correlated with anxiety ($r = .37, p < .05$)

In Period 2, no significant correlations were found in the young adult group ($p_s > .13$). In the older adult group, higher number of PM errors was associated with higher levels of depression ($r = .44, p < .01$) and busyness ($r = .35, p < .05$), and lower levels of routine ($r = -.34, p < .05$). No other correlations were significant ($p_s > .06$).

3.3.8 The effect of individual difference variables on the EMFs in young and older adults

The only variable eligible for entering as a covariate in the mixed ANOVA was procrastination. In order to control for the differences in the levels of procrastination in young and older adults, the number of EMFs was entered into a 2 (Age group: young, older) by 3 (EMF type: PM, RM, AM) by 2 (Time: Period 1, Period 2) mixed ANCOVA, with the score of Procrastination at Time 1 as a covariate.

Table 3 - 8. Spearman's rank correlations between the PM, RM, AM, and individual differences variables as a function of diary-keeping time period.

	Young Adults (n=41)			Older Adults (n=40)		
	PM	RM	AM	PM	RM	AM
TIME 1						
Anxiety (GAD-7)	.13	.01	.26	.33*	.11	.37*
Depression (PHQ-9)	.11	.14	.33*	.59**	.13	.17
Busyness (MPED)	-.10	.19	.07	.41**	.28	.13
Routine (MPED)	-.05	-.15	-.05	-.35*	-.20	-.18
Procrastination (IPS)	.32*	.29	.16	.57*	-.12	.11
Perceived Stress (PSS)	-.06	.07	.23	.38*	-.12	.17
TIME 2						
Anxiety (GAD-7)	.07	-.10	.10	.29	.10	.17
Depression (PHQ-9)	.24	-.16	.14	.44**	.14	.01
Busyness (MPED)	.15	-.02	-.01	.35*	-.01	.21
Routine (MPED)	-.09	.20	.20	-.34*	-.12	-.11
Procrastination (IPS)	.18	.12	.15	.06	-.12	.19
Perceived Stress (PSS)	.06	-.14	-.05	.27	.07	.16

Note. * Alpha level significant at 0.05; ** alpha level significant at 0.01.

The decision to control for Time 1 Procrastination score was made because Procrastination scores did not change from Time 1 to Time 2 (see Table 3-2). The procrastination scores did not interact with age group ($F < 1$) indicating that the assumption of homogeneity of regression slopes was met and the ANCOVA analysis was valid. In line with the original analysis without controlling for procrastination, there was no significant main effect of Age, $F < 1$. However, the main effects of EMF type ($F < 1$), and Time ($F(1, 77) = 2.82, p = .10, \eta_p^2 = .04$) were no longer significant. Importantly, in line with previous analysis, there was a significant age by EMF type interaction, $F(2, 154) = 4.54, p = .012, \eta_p^2 = .07$.

Tests of simple main effects showed that the two age groups did not differ in the frequency of PM errors, $F(1, 77) = 2.19, p = .14, \eta_p^2 = .03$, RM errors $F(1, 77) = 2.71, p = .10, \eta_p^2 = .03$, or AM errors $F(1, 77) = 2.99, p = .09, \eta_p^2 = .04$. An additional set of simple

main effects showed that the main effect of type of error was significant in young adults $F(2.000, 76.000) = 12.87, p = .001, \eta_p^2 = .25$, but not in older adult group, $F < 1$. A post hoc test revealed that in young adult group, the number of PM errors was significantly higher than RM or AM ($p_s < .001$), but there was no difference between RM and AM ($p = .87$) (see Figure 3-2). None of the other interaction effects between independent variables were significant ($F_s < 2.62$).

Finally, the main effect of Procrastination was only approaching conventional levels of significance, $F(1, 77) = 3.40, p = .07, \eta_p^2 = .04$, and it did not interact with the EMF type, $F(2, 154) = 2.45, p = .11, \eta_p^2 = .03$, except for with Time period, $F(1, 77) = 8.02, p < .01, \eta_p^2 = .09$. The three-way interaction between procrastination, time and age group was did not reach the level of significance, ($F < 1$).

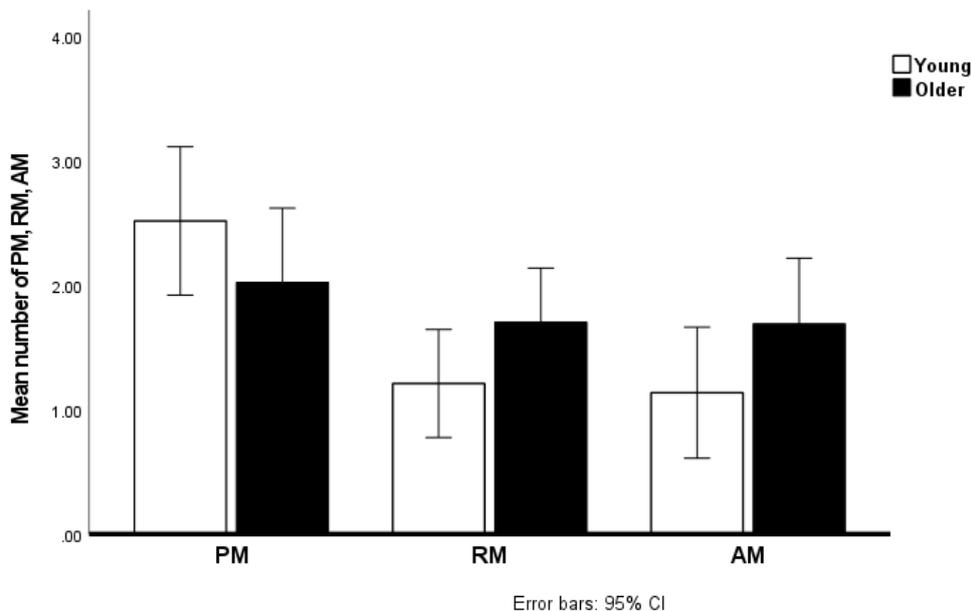


Figure 3 - 2: Mean number of EMFs (pooled across two diaries) as a function of type of error (PM, RM, AM) and age group (Young, Older) whilst controlling for procrastination.

3.3.9 Relationship between reported EMFs during Period 1 and Period 2, and cognitive test scores (COGTEL)

To examine the relationship between young and older adults' scores on the objective cognitive tests and the total number of recorded EMFs, and different types of EMFs (PM, RM, AM) in Period 1 and Period 2 of diary-keeping, Spearman's rank correlations were

calculated between these variables. Somewhat contrasting patterns of correlations were found in Period 1 and Period 2 for young and older adults. In young adults, no significant correlations were found in Period 1 ($p_s > .08$). However, several significant negative correlations emerged in Period 2 indicating that higher scores on COGTEL tests were associated lower number of different types of recorded EMFs. In particular, COGTEL working memory task correlated with total EMFs ($r = -.38, p < .05$), RM failures ($r = -.37, p < .05$) and AM failures ($r = -.37, p < .05$). In addition, AM failures correlated with COGTEL total score ($r = -.39, p < .05$), COGTEL PM task ($r = -.32, p < .05$), COGTEL WM task ($r = -.37, p < .05$), and verbal fluency task scores ($r = -.39, p < .05$). By contrast, no significant correlations were found in older adults in Period 2 ($p_s > .05$), but several significant and positive correlations emerged in Period 1 between total EMFs and COGTEL PM task ($r = .32, p < .05$), PM failures and COGTEL PM task ($r = .47, p < .01$) and COGTEL total score ($r = .44, p < .01$). Positive correlations are somewhat counterintuitive because they indicate that participants who remembered a COGTEL PM task and with higher total COGTEL scores recorded higher number of PM failures and total number of EMFs.

3.3.10 Relationship between reported EMFs in Period 1 and Period 2, and self-reported memory functioning on MMQ-Ability subscale

In order to examine the relationship between the number of recorded EMFs in Period 1 and Period 2, and self-reported memory failures on MMQ-Ability subscale at Time 1 and Time 2, Spearman's rank correlations were calculated between these variables. In Time 1, there were no significant correlations between the MMQ-Ability score and the total number of EMFs, PM, RM, or AM ($p_s > .08$) in the young adult group. In the older adult group, MMQ-Ability scores significantly and negatively correlated with PM ($r = -.35, p < .05$), and the total number of EMFs ($r = -.47, p < .05$), indicating that a better self-reported memory ability was associated with lower frequency of PM and overall EMFs.

In Time 2, however, there were no significant correlations between the self-rated memory ability and the EMFs (total and separate types) in young adult group ($p_s > .06$), nor older ($p_s > .08$).

3.3.11. Ratings of the mood before experiencing EMFs, seriousness and upset levels for EMFs in young and older adults

In addition to recording their EMFs, for each experienced EMF participants were asked to rate their mood before that failure, how serious it was and how upset they were with that particular failure. Therefore, it was important to check whether young and older adults differed in their ratings, especially seriousness and the levels of upset. However, it is important to note, that this analysis included only those participants, who had experienced each of the three types of EMFs at least once, resulting in much smaller sample sizes.

A series of ANOVAs were conducted on the mean ratings of mood before a specific type of EMF, how serious a particular type of failure was and how upset the participant was with that specific failure. The mean ratings of these were entered into a 2 (age group: young, older) by 3 (EMF type: PM, RM, AM) mixed ANOVAs for each diary-keeping period separately (see Table 3-9). In Period 1, no significant main or interaction effects were obtained for ratings of mood ($F_s < 1$). For ratings of seriousness of EMF, the main effect of age was not significant ($F < 1$), but the main effect of type of EMF was significant, $F(2, 66) = 7.47, p < .01, \eta_p^2 = .19$. Post hoc tests revealed that both groups rated PM failures as more serious ($M = 1.65, SD = 0.61$) than AM failures ($p < .01, M = 1.23, SD = 0.46$), but there were no differences between PM and RM failures ($M = 1.37, SD = 0.48$), or RM and AM failures ($p_s > .06$). No significant main or interaction effects were obtained for the levels of upset ($F_s < 1.32$). No significant main or interaction effects were obtained in Period 2 for any of the three dependent variables (i.e., ratings of mood, seriousness and levels of upset) ($F_s < 1.57$).

3.4 Discussion

The main aim of the current study was to investigate, for the first time, how reliable a diary method of everyday memory failures is, and also to further investigate the frequency and the types of EMFs experienced by young and older adults. The second and related aim was to explore the associations between everyday forgetting and mood, lifestyle and procrastination. An additional aim of this study was to check if the number and types of recorded EMFs in Period 1 and Period 2 correlated with standard laboratory measures of memory and cognition as assessed by COGTEL, on the one hand, and with self-reported memory ability scores on the MMQ-Ability subscale on the other.

Several interesting and important findings emerged from this study. First, there were more EMFs recorded in the first diary compared to the second. While this diary entry

Table 3 - 9. Mean (Standard Deviation) of ratings of mood before EMEs, consequence of EMEs and how upsetting each type of EME was for young and older adults.

	Young Adults n = 14 ^a			Older Adults n = 21 ^a		
	PM	RM	AM	PM	RM	AM
TIME 1						
Mood Before ^c	3.27 (0.76)	3.37 (0.65)	3.34 (0.71)	3.60 (0.91)	3.38 (0.81)	3.57 (0.69)
Consequence ^d	1.69 (0.55)	1.36 (0.54)	1.43 (0.54)	1.62 (0.66)	1.38 (0.45)	1.13 (0.29)
Levels of Upset ^e	1.93 (0.50)	1.76 (0.70)	1.88 (1.08)	1.93 (0.79)	1.95 (0.81)	1.56 (0.56)
TIME 2						
		n = 13 ^b			n = 13 ^b	
Mood Before ^c	3.14 (0.86)	2.96 (1.06)	3.28 (0.66)	3.23 (0.72)	3.69 (0.47)	3.38 (0.66)
Consequence ^d	1.59 (0.60)	1.58 (0.47)	1.47 (0.62)	1.58 (0.60)	1.26 (0.46)	1.29 (0.59)
Levels of Upset ^e	2.18 (1.11)	2.23 (1.03)	1.77 (0.90)	2.18 (1.10)	2.01 (0.87)	1.10 (1.06)

Note. ^{a,b} The comparison was conducted only on those participants who had at least 1 EME recorded/rated for each of the three types of memory errors, resulting in a much smaller sample sizes. ^c What was your mood immediately before the error: 1 = Very unhappy; 2 = Somewhat unhappy; 3 = Neutral; 4 = Somewhat happy; 5 = Very happy. ^d How serious/consequential was the memory error: 1 = Not at all; 2 = Slightly serious; 3 = Somewhat serious; 4 = Quite serious; 5 = Very serious. ^e How upset are you with the memory error: 1 = Not at all upset; 2 = Slightly upset; 3 = Somewhat upset; 4 = Quite upset; 5 = Very upset.

reduction effect has been studied and demonstrated in a previous diary study of EMFs with a 28-day diary recording period (Laughland, 2017), it does not seem that this reduction could be explained by high participant burden of keeping a diary for a long period of time. Bolger et al. (2003) noted that the knowledge about the effects of diary keeping on participants' experiences is still fairly limited and discussed several possible effects, including habituation. It may well be, that in Period 1, participants found diary keeping to be somewhat novel and a self-exploratory experience making them more committed to reporting their EMFs, whereas

in Period 2, this feeling of novelty disappeared resulting in reduced commitment. Another possible explanation could be that keeping the first diary increased self-monitoring in both groups, leading to fewer EMFs reported. However, more importantly, the patterns in EMF frequency in both age groups remained the same regardless of a diary-keeping period. Most importantly, a total number of EMFs, and separately PM and AM errors, recorded in the first diary, correlated significantly with the total number of EMFs, and PM and AM errors, recorded in the second diary. This provided the first evidence that the diary of everyday memory errors has a good test-retest reliability.

Another finding was that no age differences were found in the overall number of recorded everyday memory errors. This is particularly important, as the lack of age affect, demonstrated in Study 1a (Chapter 2), as well as previous diary studies (Laughland, 2017; Niedźwieńska et al., 2020) remained consistent even when participants kept diaries twice across an extended time delay. In line with previous diary studies, in both age groups, PM errors were more frequent than any other type of errors, and young adults reported more PM errors than older adults (Haas et al., 2020; Niedźwieńska et al., 2020). Whilst in Study 1a, older adults reported more RM errors than young adults and there were no age differences in AM errors, in this study, the effect of age on RM errors was in the same direction but did not reach the conventional level of statistical significance even though we had slightly larger sample sizes than in Study 1a (for similar results, see Niedźwieńska et al., 2020). One possible explanation for this could be that in Study 1a, participants were wearing reminder watches which could have prompted more accurate reporting of EMFs, however, an additional study/analyses would be needed to test this hypothesis.

Perhaps the most interesting finding of Study 2 was that the pattern of findings (i.e., the higher number of recorded PM errors) changed when controlling for differences in procrastination levels. Whilst the initial results of no age differences in the overall number of EMFs still held up, and in young adults PM errors were still most frequent when compared to RM and AM, overall, PM errors were no longer most frequently reported by both groups, in fact, the types of EMFs did not differ from one another in the mean reported frequency. Moreover, accounting for the differences in procrastination resulted in the absence of the age-PM benefit. This finding is very important as there is some, but limited evidence to date suggesting, that higher procrastination levels in young adults are associated with more PM errors (Zuber et al., 2021). It also raises a question that the age-PM paradox may be due to younger adults choose to delay the execution of their intentions, rather than simply forget to

carry them out. If procrastination truly moderates the frequency of PM errors, this can have a crucial impact for the age-PM paradox.

When looking at age effects on different subtypes of PM, RM, and AM errors, somewhat different patterns emerged compared to the results of Study 1a. Indeed, out of all the PM error sub-types recorded in Period 1, young adults reported more frequent errors than old participants only in forgetting that a particular intention had been formed. For RM errors, older adults reported more frequently forgetting the names of celebrities, historical figures, and book characters and forgetting words and names of objects, animals, plants and places, etc. (see Table 3-5). In Period 2, the pattern changed, with no age differences observed in RM subtypes, but young adults reported more frequently forgetting to take something extra from home, needed for that day, and older adults reported more frequently forgetting why they came into a certain location, and forgetting to take the usual things from home. Whilst in Study 1a, young adults reported more often forgetting appointments, to make a phone call and completing one-off activities (similarly see Niedźwieńska et al., 2020), no age differences were observed in AM subcategories. One reason why these differences were not found in the current study may be, that due to Covid-19 pandemic, people had fewer commitments and spent more time either working from, or just being at home, which would alter the age differences in these subcategories.

When comparing EMFs recorded in a diary with retrospective self-reports of memory ability on the MMQ – Ability subscale, there were no associations between the number of recorded EMFs and MMQ-ability scores in young adults, but for older adults, MMQ-Ability score was negatively associated with PM errors and total number of EMFs, but only in Period 1. These results, combined with similar results from Study 1a suggest that the MMQ-Ability subscale may not be accurately capturing everyday memory functioning. Finally, when comparing cognitive performance on COGTEL and the reported EMFs, different patterns were obtained for Period 1 and Period 2. In Period 1, no significant associations were found between COGTEL scores and EMFs in young adults, but in older adult group higher scores on the COGTEL total score and COGTEL PM were associated with higher overall number of EMFs and higher number of PM failures. However, in Period 2, it was the older adult group who had no significant correlations between COGTEL total score and its subtests and EMFs, but in young adult group higher total score of COGTEL was associated with lower number of AM failures, higher score on COGTEL WM was associated with a lower number of total EMFs, AM failures, and RM failures. Moreover, lower number of AM failures was also

associated with a higher score on COGTEL PM task and verbal fluency task. These findings are in contrast to those found in a study by Schnitzspahn et al. (2016) which showed, for example, that better inhibition, short-term and long-term memory was associated with better PM performance.

3.4.1 Limitations

This study was conducted between December 2020 and November 2021 during the varying levels of Covid-19 related restrictions. On 21st December 2020, UK entered a Tier 4 restrictions, which started to ease only around April 2021, meaning that participants in this study did not have a “normal” lifestyle, and may have been experiencing higher levels of distress than those who took part in Study 1a or in any other previous diary studies. For example, restricted movement could have resulted in fewer PM errors, as people had fewer appointments to attend. Likewise, lack of socialising could have prevented people from experiencing or noticing instances of forgetting names of other people, etc. For this reason, the results should be interpreted with caution.

3.4.2 Conclusions

The current study provides first empirical evidence that the use of structured diaries for examining everyday memory functioning can be a reliable method of studying EMFs. It also demonstrates that procrastination can moderate the frequency of PM errors in everyday life, which can potentially finally help to explain the age-PM paradox. Finally, this study provides further evidence that diaries provide more accurate reflection of everyday memory functioning compared to retrospective memory questionnaires.

Chapter 4: Everyday Memory Errors in Healthy Adults Across the Lifespan: An Online Survey (Study 3a)

4.1. Introduction

The findings from diary studies of EMFs demonstrate significant gaps in our knowledge about how normal ageing affects memory processes in everyday life. A number of previous studies have studied everyday memory by using self-report questionnaires of everyday memory functioning, such as Everyday Memory Questionnaire (EMQ), Cognitive Failure Questionnaire (CFQ), Memory Functioning Questionnaire (MFQ), to name a few (Carrigan & Barkus, 2016; Dixon, 1989; Gilewski & Zelinski, 1986; Herrmann, 1982). However, the use of such questionnaires poses several questions. For example, sometimes it seems that the items are selected based on purely personal observations and experiences (i.e., CFQ) or on theoretical distinctions made in the literature rather than on what actually happens in real life (MMQ, Troyer & Rich, 2002). Moreover, as these questionnaires were developed quite a long time ago, some items may no longer be applicable to people's experiences. For example, a question about how often one forgets phone numbers may not apply today as the existence of smart phones and even new landline phones enables people to either allocate number to a name or a single digit for a quick dial which eliminates the need to memorize them.

Another problem with these existing questionnaires is that the items that are included, usually tap into many aspects of memory, but often a single overall score is calculated. For example, as noted in Chapter 1, the CFQ covers memory, perception and action failures (Broadbent et al., 1982), but later studies found four, or even five internally-consistent factors, indicating a wide range of cognition and action-based failures (Pollina et al., 1992; Wallace et al., 2002). Hence, if the CFQ covers so many aspects of memory, then calculating a single overall score may not be useful for investigating age differences, and perhaps that is why many studies to date have failed to find age differences using this questionnaire (de Winter et al., 2015; Könen & Karbach, 2020; Reese & Cherry, 2006). Similar to this, de Winter, Dodou and Hancock (2015) upon reviewing existing literature, proposed that the absence of age effects, or a decrease in total CFQ scores may be due to several reasons. For example, older adults lead less busy lives hence they are at lower risk of committing cognitive failures, or they may be using more memory strategies as a way of self-regulation.

Moreover, the results of few existing diary studies of EMFs have shown that people report three types of memory failures in their daily lives: prospective memory (PM), retrospective memory (RM) and absent-minded failures (AM), with the latter sometimes reported as lapses of attention or attentional failures (Haas et al., 2020; Niedźwieńska et al., 2020; Niedźwieńska & Kvavilashvili, 2019; Unsworth et al., 2012). Moreover, when young and older adults are asked, with a single question, to report their most recent memory failures, their reports also fell nicely into one of the three categories of PM, RM, or AM failures (Kvavilashvili et al., 2009). Therefore, the expectation would be for the everyday memory questionnaires to similarly reflect these three types of failures. Interestingly, when Reese and Cherry (2006) picked few items from the CFQ specifically reflecting PM and RM failures, the age effect was obtained for these two types of forgetting, but not for the overall CFQ score, highlighting the importance of differentiating between these two types of failures.

Smith et al. (2000) noted that previous experimental studies investigating memory changes in healthy ageing had focused on retrospective and prospective memory, yet no self-reported instrument was available to assess both, PM and RM failures. Authors developed a new 16-item *Prospective and Retrospective Memory Questionnaire* (PRMQ), with eight items representing PM failures and eight items representing RM failures. The PRMQ was used in a large sample comprising of five groups: people with Alzheimer's disease (AD), their carers who acted as informants, healthy young and older adults, and married couples (where each person completed the questionnaire on behalf of themselves and another person). The results in relation to healthy controls are of particular interest, as no age differences were found between young and older healthy adults for PM, or RM failures, and all groups except for AD patients, consistently reported PM failures as more frequent. Moreover, no significant age effects on PRMQ were found in subsequent studies (Crawford et al., 2003; Papaliagkas et al., 2017; Piaulino et al., 2010), with one study reporting a negative correlation between age and PM subscale (Rönnlund et al., 2008).

The absence of age effects in PRMQ scores contradict findings from diary studies, including the results in Study 1a, which generally show that younger adults record significantly more PM failures than older adults (Haas et al., 2020; Niedźwieńska et al., 2020). While it is unclear how the PRMQ items were selected (i.e., whether they were empirically verified), it is possible that they do not fully represent the most frequent failures in day-to-day lives of healthy adults and therefore no age effects are obtained.

Moreover, participants in a study by Kvavilashvili et al. (2009) spontaneously reported committing absent-minded failures, alongside the PM and RM failures, and subsequent diary studies also have clearly shown the existence of AM failures in daily lives of healthy adults. Whilst some of the AM failures are just an inconvenience, such as walking into a room and forgetting why you came in there, others can carry more severe consequences, for example, forgetting to lock the door of your car or home may result in things being stolen. As noted by Cheyne et al. (2006), despite being so prevalent in everyday life, not much work has been done in trying to directly measure differences in memory errors, which are directly caused by failures in attention. This comes as a surprise given that experimental studies indicate significant age differences in attention capacity (Fraser & Bherer, 2013). Moreover, the evidence from the diary studies demonstrate that lower attentional control is associated with the higher number of attentional failures (Unsworth et al., 2012). Yet, the existing memory questionnaires do not seem to be including many items to reflect this type of failure. For example, in the MMQ-Ability subscale (Troyer & Rich, 2002), only three out of 20 items reflect AM failures (Items 2, 7 and 14).

The importance of including attentional failures when investigating everyday memory problems was further highlighted in a study by Cheyne et al. (2013). In this study, participants from the two separate samples (age ranges 14-85, and 18-89, respectively) completed two questionnaires assessing (1) attention lapses and (2) everyday memory failures. The results showed that self-reported memory failures did not differ with age, but the reports of attentional failures decreased with advanced age. However, after controlling for attention lapses, results changed indicating significant positive correlation between age and memory failures leading to a cautious conclusion by authors that age differences in attentional failures may be masking age differences in EMFs. These results demonstrate the need to have a questionnaire that can obtain reports of EMFs which clearly fall into either PM, RM or AM failure categories.

In summary, the review of the existing literature on EMFs using retrospective self-reports highlights several areas in need of improvement. The first issue, as mentioned above, is the absence of a self-reported measure that contains empirically valid items, accounting for all three types of EMFs, typically reported by participants in diary studies of EMFs. Therefore, the current study is the first of its kind, moving away from generally established examples of EMFs that are often used in the existing meta-memory questionnaires. Using the data from Study 1a, the most frequently reported EMFs within each of the three major types

of failures (PM, RM, AM) were chosen to be included in the new Everyday Memory Errors Questionnaire (EMEQ), resulting in a total of eight items covering PM, 12 items covering RM and 12 items covering AM failures. The main aim of the present study was to investigate age differences in self-rated frequency of PM, RM and AM failures. If adults have a good insight into their everyday memory functioning, then by using empirically verified items in the newly developed EMEQ, we should obtain the same pattern as in Study 1a: (1) no main age effect in the overall mean frequency of EMFs; (2) main effect of type of EMF with PM reported more frequently than RM and AM; (3) and a significant age by type of EMF interaction showing that young adults report higher frequency of PM failures, older adults report higher frequency of RM failures, with no age differences in AM failures.

The second aim of Study 3a was to explore the associations between individual difference variables such as mood and lifestyle (business and routine), and the frequency of self-reported EMFs. Several, albeit a small number of studies, suggested that the decreased frequency of EMFs in older adults can be potentially explained by the fact that there are significant differences in the lifestyle between young and older adults, which can protect older adults from experiencing higher number of EMFs (de Winter et al., 2015; Rabbitt & Abson, 1990; Rendell & Thomson, 1999). Moreover, several studies looked at the associations between anxiety, depression, and cognitive complaints and found that negative mood can contribute towards negative self-reports of memory functioning. For example, Rowell et al. (2016) conducted a large study with young, middle-aged, young-old, old-old and oldest-old participants using subscales of MFQ and measures of anxiety and depression. Authors found that higher negative affect was associated with more memory complaints in each age group. Whilst in Study 1a, we did not find any significant associations between anxiety, depression and EMFs in young adult group, higher levels of anxiety and depression were associated with higher number of EMFs in older participants. Moreover, higher levels of busyness (one measure of lifestyle) were associated with the number of EMFs reported by both age groups. Considering the findings of Study 1a and the suggestions made by few studies relating to the associations between mood, lifestyle and EMFs, we used the same measures as in Study 1a, mainly Martin and Parks Environmental Demands (MPED) questionnaire for assessing levels of busyness and routine, GAD-7 for assessing levels of anxiety and PHQ-9 for assessing symptoms of depression.

4.2 Method

4.2.1 Design

The study used a between-subjects design with five groups of participants: young, middle-aged, young-old, old-old and very old adults. The dependent variables were the three types of everyday memory failures (PM, RM and AM).

4.2.2 Participants and data screening

A total of 1024 participants completed a memory survey during a period between July 2020 and April 2021. The data set was screened for any missing/invalid responses (Figure 4-1). From the initial dataset, 4 (0.4%) participants were removed due to not indicating their age. A further 14 (1.4%) participants were removed due to completing the survey in less than 9 minutes. Next, the dataset was screened to see how many participants omitted more than 2 answers on the Everyday Memory Errors Questionnaire (EMEQ), resulting in exclusion of another 94 (9.2%) participants. Finally, 139 (10.3%) participants were excluded due to scoring above the cut-off point of 15 for symptoms of anxiety (GAD-7) and/or Depression (PHQ-9), which indicates severe anxiety and depression, respectively.

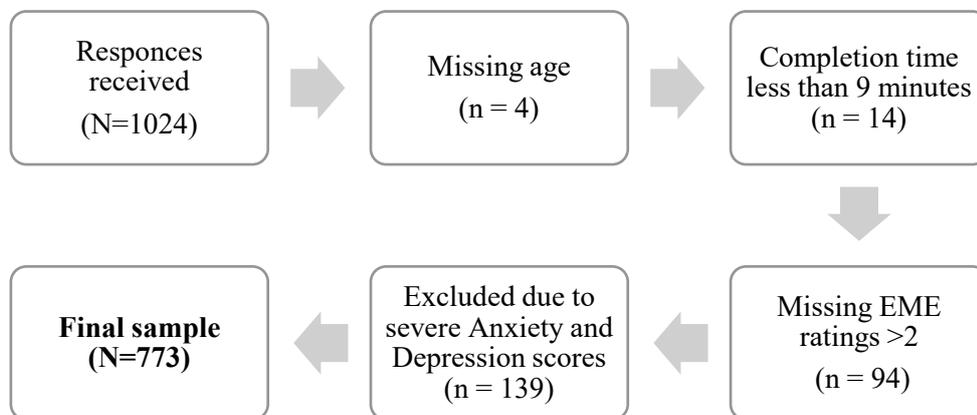


Figure 4 - 1: Data cleaning process.

The final dataset included a total of 773 participants, aged between 18 - 96, of whom 580 (75%) were females, 189 (24.5%) were males, and 4 (0.5%) participants did not disclose their gender. For the purposes of later analyses, the sample was divided into five age groups representing young (aged 18 to 39, $M = 23.15$, $n = 194$), middle- aged (aged 40 to 59, $M =$

50.42, $n = 100$), young-old (aged 60 to 69, $M = 65.56$, $n = 158$), old-old (aged 70 to 79, $M = 73.96$, $n = 248$), and very old (aged 80 to 96, $M = 82.82$, $n = 73$) groups. In each of these age groups, there were more females than males (84%, 74%, 75%, 72%, and 64%, respectively). Majority of young adults (58%) achieved at least the further education level (e.g., A-levels, BTEC, NVQ, College). Whereas more middle-aged, young-old, old-old, and very old adults indicated achieving undergraduate degree or above (68%, 58.9%, 48.8% and 41.1%, respectively). In addition, majority of young adults were students (66%), majority of middle-aged adults were in employment (61%), whereas adults in the three older groups were mostly retired (82.8%, 96.4% and 98.6% for young old, old-old and very old, respectively).

4.2.3 Materials

Everyday Memory Errors Questionnaire (EMEQ) (Appendix XV) was developed using the data collected in a diary Study 1a, where healthy young and old participants recorded their everyday memory errors as they happened over the 3-day recording period. The initial diary records were coded into 3 major categories: PM, RM and AM by 3 independent coders. To make sure that we had the most representative memory errors, an additional coding of these errors into smaller subcategories was also carried out following our newly developed coding scheme (Appendix). This additional coding allowed for more precise comparisons of types of EMFs experienced by healthy young and older adults. For example, within PM category, younger adults reported over two times more instances of forgetting to take something extra from home, compared to older adults. Following this additional coding, PM category resulted in a total of 10 subcategories, RM category resulted in 15 subcategories and AM category resulted in a total of 12 subcategories. At the final stage, the most frequent EMF subcategories (recorded at least 4 times) within PM, RM and AM categories were chosen to be used as items in the EMEQ. This resulted in a total of 8, 12 and 12 items for PM, RM and AM categories, respectively. The survey items were presented in 3 blocks representing each of the three main EMF categories (PM, RM, and AM). For each item in the EMEQ, participants had to rate how often they had experienced a particular prospective, retrospective, or absent-minded memory failure in a typical month using a 5-point Likert scale with the following response options: 1 = *Never*; 2 = *Rarely (once or twice per month)*; 3 = *Sometimes (Once a week)*; 4 = *Often (2-4 times per week)*; 5 = *Very Often (almost daily)*.

In addition, participants were also asked to rate the frequency of these memory failures for several age groups (people in their 20s, 40s, 60s, and 80s) in order to examine

potential stereotypical views that participants may hold. The same answer options were used with an additional option “Don’t Know”. However, the data in relation to ratings for others will be presented and discussed in Chapter 6 as part of Study 3b.

4.2.4 Procedure

The survey was presented to participants using the Qualtrics Survey software and circulated on a variety of social media platforms such as Facebook, Twitter, and by contacting many branches of the University of 3rd Age (U3A). The participation in this study was not restricted to UK only and was available to anyone online who was either native or fluent English speaker and was aged 18 and older. After reading the Participant Information Sheet and giving consent, participants completed a survey consisting of the EMEQ, the three questionnaires measuring anxiety (GAD-7), depression (PHQ-9) and levels of business and routine (MPED) and filled in their demographic details. At the end, participants were provided with the Study Debrief and thanked for taking part. The entire study took approximately 30-40 minutes to complete.

4.3 Results

Both parametric and non-parametric methods of analysis were conducted depending on the type of independent variable used. The effect size, measured by partial eta-squared (η_p^2), was defined as .01, .06, and .16 for small, medium and large effects respectively (Cohen, 1988). When measured by Cohen’s *d*, the effect size was defined as .2, .5, and .8 for small, medium and large effects, respectively (Cohen, 1988). For multiple tests of simple main effects, a Bonferroni and Games-Howell corrections for multiple comparisons was used.

4.3.1 Group differences in background characteristics

Table 4-1 shows background characteristic of the sample. Significant group differences emerged in the level of the education, with young adults having lower levels of education compared to middle-aged and young-old ($p_s < .001$), but no difference between young and old-old and very old ($p_s > .05$). Middle-aged adults had higher level of education than old-old ($p < .001$), but did not differ from young-old or very old ($p_s > .06$). Participants

in the young-old group had higher levels of education than old-old ($p < .01$). However, very old did not differ in the level of education from young-old or old-old ($p_s > .33$).

In addition, significant group differences emerged also in lifestyle, with young and middle-aged participants having a similar levels of busyness ($p = .07$) but both indicated higher levels of busyness than the three older groups ($p_s < .001$), who did not differ from each other ($p_s > .26$). Significant age differences were also found on MPED – Routine ratings, with very old adults reporting highest levels of routine in their lives, compared to all other groups ($p_s < .05$), whereas middle-aged, young-old and old-old did not differ from each other ($p_s > .12$), and young adults reported having the least routinized lives compared to the other groups ($p_s < .05$).

Significant age differences were also observed in the ratings of mood, with young and middle-aged adults reporting highest levels of anxiety, compared to the three older groups ($p_s < .001$), who did not differ from each other ($p_s > .33$). There was no significant difference in anxiety ratings between young and middle-aged ($p = .20$). In addition, young adults reported experiencing significantly higher levels of depression, compared to the rest of the four groups ($p_s < .001$). Middle-aged adults reported higher levels of depression compared to the three older groups ($p_s < .05$), who again, did not differ from each other ($p_s > .80$).

Table 4 - 1. Background characteristics of participants across all age groups (Means, SD)

	Young	Middle- Aged	Young- Old	Old- Old	Very Old	<i>F</i>	<i>p</i>	η_p^2
Education ¹ (Level)	3.50 (0.76)	4.07 (1.01)	3.95 (1.06)	3.56 (1.04)	3.63 (1.10)	8.851	< .000	.05 ²
Busyness (MPED)	20.58 (4.74)	22.28 (5.53)	15.82 (4.62)	14.96 (4.19)	14.59 (4.11)	80.89	<.001	.30
Routine (MPED)	12.21 (3.19)	13.55 (3.53)	14.59 (3.10)	14.48 (3.27)	15.85 (3.10)	23.93	<.001	.11
Anxiety (GAD-7)	6.27 (4.01)	5.17 (4.22)	3.16 (3.23)	3.02 (3.31)	2.30 (2.67)	33.44	<.001	.15
Depression (PHQ-9)	7.29 (4.43)	4.75 (4.07)	3.23 (3.26)	3.34 (3.15)	2.88 (3.08)	43.03	<.001	.18

Note. ¹ Education: means are based on the number assigned to each response option (1 = Secondary school/High school (up to 16 years); 2 = Further education (A-levels, BTEC, NVQ, College); 3 = Undergraduate degree (BA, BSc); 4 = Master's degree (MA, MSc, Med); 5 = Doctorate (PhD, EdD).

MPED = Martin and Parks Environmental Demands Questionnaire; GAD-7 = General Anxiety Disorder; PHQ-9 = Patient Health Questionnaire.

4.3.2 Effects of age and EMF type

To examine age effects on the frequency of EMFs, the frequency ratings of EMFs were entered into a 5 (age group: young, middle-aged, young-old, old-old, very old) by 3 (type of EMF: PM, RM, AM) mixed ANOVA with repeated measures on the last factor (Table 4-2). The main effect of age was significant, $F(4, 768) = 15.41, p < .001, \eta_p^2 = .07$, with young adults reporting a similar frequency of EMFs overall as middle-aged ($p = .32$), but higher frequency than the three older groups ($p_s < .001$), and middle-aged adults' reporting higher overall frequency of forgetting, compared young-old ($p < .05$), old-old ($p < .01$), but did not differ from very old ($p = .26$). Three older groups did not differ from each other ($p_s > .82$). The main effect of EMF type was also significant, $F(1.930, 1493.96) = 516.92, p < .001, \eta_p^2 = .40$, with RM failures receiving a highest rating of frequency ($M = 2.30, SD = 0.68$), followed by AM ($M = 1.95, SD = 0.62$), and PM failures ($M = 1.70, SD = 0.60$). Finally, there was a significant error type by age group interaction with a medium effect size, $F(7.722, 1482.55) = 22.29, p < .001, \eta_p^2 = .10$ (See Figure 4-2).

Tests of simple main effects with alpha level adjusted to 0.0167, showed that there was a significant main effect of age group on PM failures $F(4, 768) = 50.01, p < .001, \eta_p^2 = .21$, with young adults reporting significantly higher frequency of PM errors compared to middle-aged ($p < .01$), young-old, old-old and very old participants ($p_s < .001$), and middle-aged adults reporting significantly higher frequency of PM failures than the three older groups ($p_s < .001$), but the three older groups did not differ from each other ($p_s > .22$). By contrast, there were no age group differences in the frequency of RM failures, $F(4, 768) = 2.26, p = .06, \eta_p^2 = .01$. Finally, significant group differences emerged for AM failures frequency, $F(4, 768) = 9.13, p < .001, \eta_p^2 = .05$, with young adults indicating significantly higher frequency of AM compared the three older groups ($p_s < .001$), but no difference between young and middle-aged ($p = .05$). Middle-aged adults and the three older age groups did not differ from each other ($p_s > .03$).

Table 4 - 2. Mean (Standard Deviation) number of EMFs as a function of type of failure (PM, RM, AM) and age group (Young, Middle-aged, Young – old, Old-old, Very old).

	Young (n = 194)	Middle-aged (n = 100)	Young-old (n = 158)	Old-Old (n = 248)	Very old (n = 73)
PM	2.11 (0.64)	1.90 (0.59)	1.53 (0.49)	1.49 (0.47)	1.48 (0.42)
RM	2.37 (0.61)	2.33 (0.69)	2.24 (0.70)	2.22 (0.69)	2.42 (0.68)
AM	2.17 (0.65)	2.02 (0.60)	1.86 (0.59)	1.85 (0.61)	1.86 (0.55)

An additional set of tests of simple main effects revealed that the main effect of type of EMF was significant in all age groups (all $p_s < .001$), with medium to large effect sizes (η_p^2) varying between .07 and .27). Post hoc tests showed that young adults reported significantly higher frequency of RM than PM ($p < .001$), and AM errors ($p < .001$), but there was no difference between PM and AM errors ($p = .10$). Middle-aged adults reported significantly higher frequency of RM than PM ($p < .001$), or AM errors ($p < .001$), and higher frequency of AM than PM errors ($p < .01$). Young-old, old-old and very old adults reported significantly higher frequency of RM than PM or AM errors ($p_s < .001$), and higher frequency of AM than PM errors ($p < .001$).

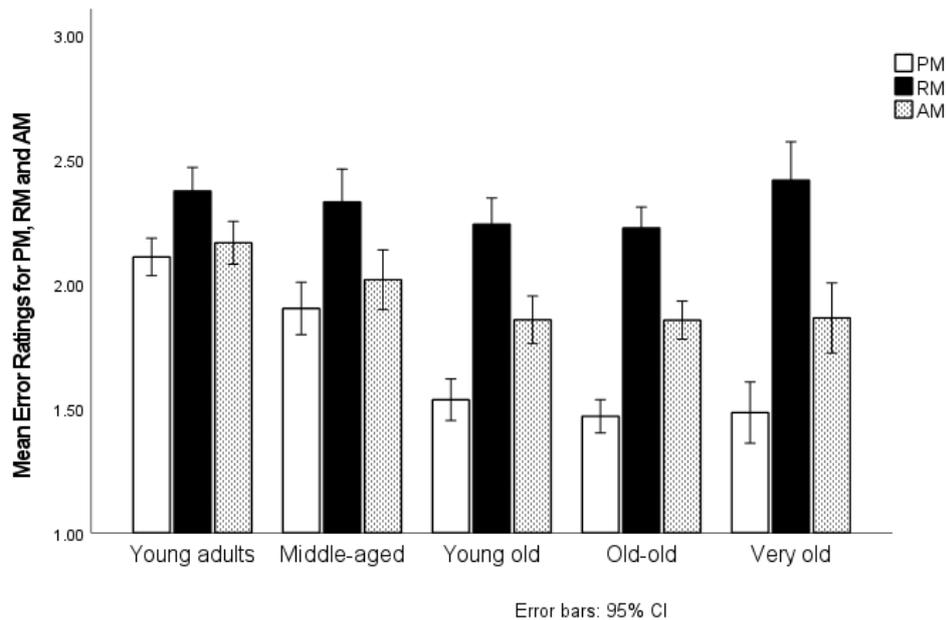


Figure 4 - 2: Mean Frequency of EMEs as a Function of Type of Error (PM, RM, AM) and Age Group (Young, Middle-aged, Young-old, Old-old, Very Old).

4.3.3 Correlations between individual difference variables and the frequency of EMEs

The data presented in Table 4-1 showed that there were significant group differences in the ratings of busyness, routine, anxiety and depression. Before repeating the main 5 (age group: young, middle-aged, young-old, old-old, very old) by 3 (EMF type: PM, RM, AM) ANOVA with added co-variates, it was necessary to check if these variables correlated with the number of recorded PM, RM and AM failures in all age groups. Spearman's rank correlations were computed to assess the relationship between the types of EMFs and the measures of busyness (MPED-Busyness), routine (MPED-Routine), anxiety (GAD-7) and symptoms of depression (PHQ-9) (Table 4-3). In the young adult group, no significant correlations were observed between busyness and routine scores and any type of EMF ($p_s > .05$). However, significant positive correlations were obtained between scores of anxiety and PM errors ($r = .15, p < .05$), RM errors ($r = .17, p < .05$), and AM errors ($r = .17, p < .05$). Moreover, depression scores correlated significantly and positively with PM errors ($r = .24, p < .001$), RM errors ($r = .17, p < .05$), and AM errors ($r = .20, p < .05$).

In the middle-aged group, scores of busyness significantly and positively correlated with PM ($r = .26, p < .05$), RM ($r = .25, p < .05$), and AM errors ($r = .27, p < .001$), but no significant correlations were obtained between the routine scores and any of the three types of EMFs ($p_s > .05$). The anxiety scores significantly and positively correlated with PM ($r = .24, p$

< .05) and AM ($r = .32, p < .001$), but not RM errors ($p > .05$). A similar pattern was observed for depression scores, which significantly and positively correlated with PM ($r = .28, p < .001$) and AM ($r = .23, p < .05$), but not RM errors ($p > .05$).

In the young-old adult group, no significant correlations were obtained between busyness or routine scores and three types of EMFs ($p_s > .05$). The anxiety scores significantly and positively correlated with RM ($r = .23, p < .001$) and AM ($r = .20, p < .05$), but not PM ($p > .05$). A significant and positive correlations were also obtained between the scores for depression and PM ($r = .22, p < .001$), RM ($r = .26, p < .001$), and AM errors ($r = .25, p < .001$).

In the old-old group, scores of busyness significantly and positively correlated with PM ($r = .18, p < .05$), RM ($r = .13, p < .05$), and AM errors ($r = .13, p < .05$), but no significant correlations were observed between the routine scores and either of the EMF type ($p_s > .05$). The anxiety scores significantly and positively correlated with PM ($r = .24, p < .001$), RM ($r = .33, p < .001$), and AM errors ($r = .28, p < .001$). Likewise, the scores of depression significantly and positively correlated with PM ($r = .25, p < .001$), RM ($r = .30, p < .001$), and AM errors ($r = .32, p < .001$).

Finally, in the very old adult group, a significant and positive correlation was obtained between busyness and PM errors ($r = .27, p < .05$), but not RM or AM errors ($p_s > .05$). No significant correlations were observed between the scores of routine, or anxiety and the three types of EMF ($p_s > .05$). However, depression scores were significantly and positively correlated with PM ($r = .25, p < .05$), RM ($r = .35, p < .001$), and AM ($r = .43, p < .001$).

Table 4 - 3. Spearman's correlations between EMEs and individual difference variables in five age groups

	Young (n=194)		
	PM Errors	RM Errors	AM Errors
MPED-Busyness	.11	.14	.13
MPED-Routine	-.07	.01	-.06
GAD-7 (Anxiety)	.15*	.17*	.17*
PHQ-9 (Depression)	.24**	.17*	.20*
	Middle-aged (n=100)		
MPED-Busyness	.26*	.25*	.27**
MPED-Routine	-.04	.00	-.01
GAD-7 (Anxiety)	.24*	.23*	.32**
PHQ-9 (Depression)	.27**	.19	.23*

	Young-old (n=158)		
MPED-Busyness	.00	-.02	.07
MPED-Routine	-.04	-.09	-.07
GAD-7 (Anxiety)	.14	.26**	.20*
PHQ-9 (Depression)	.22**	.26**	.25**
	Old-old (n=248)		
MPED-Busyness	.18*	.13*	.13*
MPED-Routine	-.06	-.01	-.05
GAD-7 (Anxiety)	.24**	.33**	.28**
PHQ-9 (Depression)	.25**	.30**	.32**
	Very-old (n=73)		
MPED-Busyness	.27*	.16	.20
MPED-Routine	-.09	.13	.11
GAD-7 (Anxiety)	.20	.18	.23
PHQ-9 (Depression)	.25*	.35**	.43**

Note. * $p < .05$, ** $p < .001$.

4.3.4 The impact of individual difference variables on the frequency of EMEs in young, middle-aged, young-old, old-old and very old adults

The ratings for anxiety, depression and busyness met the criteria for inclusion into the ANCOVA. To control for differences in mood and busyness in five age groups, the mean frequency ratings of memory failures was entered into 5 (group: young, middle-aged, young-old, old-old, very old) x 3 (type of EMF: PM, RM, AM) mixed ANCOVA with repeated measures on the last factor, whilst controlling for the scores of MPED-busyness, anxiety (GAD-7) and depression (PHQ-9). There was no significant interaction between busyness scores and age group ($F(4, 761) = 1.56, p > .05, \eta_p^2 = .01$), anxiety and age group ($F(4, 763) = 1.04, p > .05, \eta_p^2 = .01$), or depression scores and age group ($F(4, 763) = 2.17, p > .05, \eta_p^2 = .01$), indicating that the assumption of homogeneity of slopes was met and ANCOVA analysis was valid. Apart from anxiety, all main effects of covariates were significant, and they also entered in some interactions.⁶

⁶ The main effect of anxiety was also not significant, $F(1, 763) = 2.28, p = .13, \eta_p^2 = .00$. The main effect of depression was significant, $F(1, 763) = 25.78, p < .001, \eta_p^2 = .03$. The main effect of busyness was also significant, $F(1, 763) = 25.78, p < .001, \eta_p^2 = .03$.

When taking into the account these covariates, the main effect of age, found in original ANOVA was no longer significant, $F(4, 763) = 1.30, p = .27, \eta_p^2 = .00$. The main effect of error type remained significant with the same pattern observed without controlling for covariates. Additionally, whilst EMF type by age group interaction remained significant, some patterns have changed (see Figure 4-3).

Tests of simple main effects with alpha level adjusted to 0.0167, showed the same pattern of results obtained without controlling for covariates for AM failures. Similar patterns were also observed for PM failures, except that young and middle-aged no longer differed from each other ($p = .05$). However, unlike the original ANOVA, significant group differences appeared in the frequency of RM errors, $F(4, 761) = 2.81, p < .05, \eta_p^2 = .02$, with very old adults reporting the highest frequency of RM than any other age group ($p_s < .015$), but other groups did not differ from each other ($p_s > .07$).

Additional set of tests of simple main effects of EMF type within each of the age groups revealed identical patterns to those reported in the initial analyses prior to controlling for covariates.

However, there was a significant EMF type by anxiety interaction effect, $F(1.935, 1476.766) = 6.28, p < .01, \eta_p^2 = .01$. The interactions between busyness and EMF type, as well as depression and EMFs type were not significant ($F_s < 1$).

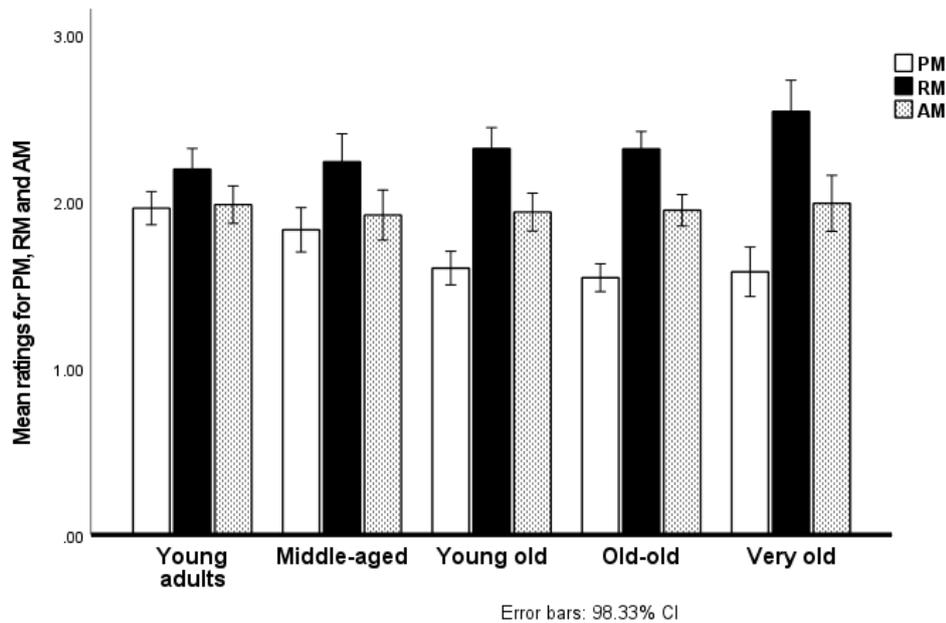


Figure 4 - 3: Mean frequency of memory errors as a function of type of error (PM, RM, AM) and age group (Young, Middle-aged, Young-old, Old-old, Very Old), controlling for differences in ratings of busyness, anxiety, and depression.

4.4 Discussion

Despite a large number of metamemory questionnaires developed to date, none of them seem to be fully representative of memory errors reported in diary studies, to reflect three major types of EMF categories: prospective, retrospective, and absent-minded errors. Therefore, for the first time, we developed a metamemory questionnaire using empirically valid items, representing these three major types of EMFs and compared their frequency in young, middle-aged, young-old, old-old, and very old adults.

Several important findings emerged from this study. First, an interesting set of findings was obtained in relation to age differences in the overall mean ratings of memory errors. The initial analyses revealed that young adults indicated higher mean frequency of failures compared to the three older age groups but did not differ from middle-aged, who indicated higher frequency of EMFs compared to young-old and old-old but did not differ from very old. However, since the groups differed significantly in their ratings of busyness and mood, a follow up analyses were conducted controlling for these differences. In line with our prediction, no age differences were observed in the overall mean frequency ratings of EMFs when controlling for these variables. The same result was obtained in a diary Study 1a,

where young and older adults did not differ in a total number of EMFs recorded over the period of three days, indicating that this questionnaire, due to its choice of items, may be reflecting a similar pattern in a wider population.

Second, contrary to what we had anticipated and to the results of Study 1a, RM failures had the highest frequency ratings across all age groups. This finding is also in contrast to the results from other diary studies which show that most frequently reported EMF by adults of all ages is PM (Haas et al., 2020; Niedźwieńska et al., 2020, but see Unsworth et al., 2012 for different results).

Third, in line with our prediction, young adults reported significantly higher frequency of PM errors than middle-aged and the three older adult groups. More importantly, this result still held up, apart from the differences between young and middle-aged disappearing, when busyness and mood were considered. This finding is in support of results found in our Study 1a, as well as results from previous diary studies (Haas et al., 2020; Niedźwieńska et al., 2020; Schnitzspahn et al., 2016). Findings that PM frequency decreases with increasing age was also noted in a study by Rönnlund et al. (2008), however, it is important to note that in our study, PM frequency decreased only until the young-old age and then remained stable for the rest of the age groups.

Findings in relation to age differences in the frequency of RM only partially supported our prediction. Whilst the initial analyses showed no age differences in the frequency of RM, after controlling for mood and busyness, the results show that it was very old adults who reported the highest frequency of RM failures compared to the other groups. Moreover, in line with our prediction, no age differences were observed in the mean frequency of AM. Interestingly, contrasting patterns of frequency of each EMF type within groups were found in comparison to the results from Study 1a. In the latter study, young adults reported more PM than RM or AM, whereas in the present study, they reported significantly higher frequency of RM, than PM or AM, with no difference between the last two. However, older adults seemed to demonstrate more similar patterns to those observed in Study 1a by reporting the highest frequency of RM failures. These results may potentially suggest a higher lack of self-awareness in younger adult groups, including middle-aged, as it seems that their retrospective self-reports are in marked contrast to what Study 1a and other diary studies have demonstrated so far ((Haas et al., 2020; Niedźwieńska et al., 2020).

Lastly, contrary to the suggestions made by Rendell and Thompson (1999), levels of routine were not associated with the frequency of EMFs, confirming identical findings from our Study 1a. While the associations were found between the measures of mood and the frequency of EMFs in all groups (apart from anxiety and EMFs in very old group) appear to be echoing the findings by Rowell et al. (2016), it is worth noting that these correlations were weak.

4.5. Limitations

Given that this study was conducted whilst in the middle of worldwide COVID-19 pandemic, rather than asking participants to rate the frequency of EMFs “over the last month”, we asked them to indicate the frequency of different EMFs in a “typical month”. This decision was made in an attempt to minimize the impact of potential differences in the lifestyle of participants due to lockdown related changes. These changes may have also contributed to a higher reported scores of anxiety and depression which can impact the frequency of EMFs. Even though we have controlled for these in the subsequent analyses, additional studies using this questionnaire would be helpful to see if the same patterns of age differences can be observed. Another important limitation of this study was that the groups differed in the level of education. There is some evidence showing that people with lower levels of education may rate their everyday memory more positively., i.e., report their memory failures as less frequent. Hence, future studies that compare self-reports of different age groups may wish to ensure that groups do not differ in their levels of education. Alternatively, using “years of education” instead of “the highest level of education” may allow for a better exploration of the impact of education on the self-reports using EMEQ. Lastly, we have not screened participants for any potential cognitive impairments, hence there is a possibility that some of our participants in the older age groups may have not answered the questions accurately.

4.6 Conclusion

The pattern of age effects observed in our diary Study 1a only held true for the PM and AM errors. More importantly, the results in relation to the frequency of PM provide further support for the PM-age benefit, observed in previous self-reported diary studies.

However, the fact that all age groups rated RM errors as the most frequent may indicate that the diary method is somewhat superior to this questionnaire. Nevertheless, it seems that the EMEQ is better suited for older adults as they appeared to be assessing their memory more accurately than younger adults. For example, their ratings for RM failures appear to be more in line with our finding in the diary Study 1a, where older adults reported more RM failures. In comparison, whilst young adults in this study rated RM failures as most frequently experienced, in our Study 1a it was the PM failures that were most frequently reported.

Chapter 5: Everyday Memory Strategy Use in Healthy Adults Across the Lifespan: An Online Survey (Study 4a)

5.1. Introduction

In everyday life, people use memory strategies to support themselves in recalling information from the past or ensuring that they remember needed information in the future. Within the literature, memory strategies are often defined as means for memory compensation (de Frias et al., 2003; Garrett et al., 2010; Karr, 2022), or cognitive offloading (Morrison & Richmond, 2020). The importance of studying memory strategy use in adult life cannot be underestimated for few reasons. First, it is well established that as people age, their episodic memory abilities decline (Craik, 2020; Rhodes et al., 2019). Hence, the logical assumption is that in order to maintain high levels of functioning in everyday life, older adults would need to use more compensatory strategies (Tomaszewski Farias et al., 2018). Second, findings in relation to the Age-Prospective Memory (PM) paradox, showing no age effects or even positive age effects in naturalistic PM tasks (e.g., remembering to make a phone call to a researcher), prompted a lot of suggestions that older adults must be making a greater use of memory strategies in their day-to-day lives (Haas et al., 2020; Henry et al., 2004, 2012; Ihle et al., 2012; Niedźwieńska et al., 2020).

To date, everyday memory strategy use has been mostly studied using questionnaire methods (Pizzonia & Suhr, 2022). One of the most used, validated and comprehensive measure to examine different ways of memory compensation is the Memory Compensation Questionnaire (MCQ, Dixon et al., 2001). The MCQ is comprised of seven subscales, five of which directly cover questions about the frequency of various types of strategies grouped into external (e.g., notes, calendars, etc.), internal (e.g., the use of imagery, rehearsal, etc.), time (e.g., when trying to memorize read material, one may read it more slowly, or more than once), effort (e.g., trying harder when trying to memorize something) and reliance (e.g., asking another person to remind you of something). Despite the availability of these five subscales, most studies using this questionnaire have mainly focused on the results in relation to internal versus external strategy use (see Pizzonia & Suhr, 2022, for a review). Importantly, the majority of these studies focused on strategy use in adults aged 55 and over, and reported that higher age was associated with higher overall use of strategies (de Frias et al., 2003), higher frequency of external strategies, time, and effort (Van der Elst et al., 2011), or just higher frequency of external strategies (Garrett et al., 2010), with one study finding no association between age and MCQ (de Frias, 2013). Of the limited number of studies looking

at age effects on MCQ, the results so far indicate that older adults report using more external strategies than young adults, and no age differences are found in the use of internal memory strategies (Schryer & Ross, 2013).

Another well-known questionnaire used for investigating strategy use is the Metamemory in Adulthood Questionnaire (MIA, Dixon et al., 1988). The MIA contains seven subscales, one of which is dedicated to assessing the frequency of strategy use. However, unlike MCQ, MIA strategy subscale covers only internal and external strategies. Studies using MIA to investigate age effects on strategy use have produced variable results. For example, some earlier studies reported more frequent use of external strategies in older adults and more frequent use of internal strategies in young adults (Dixon & Hultsch, 1983), while others found no increase in strategy use with age and an overall preference for internal strategies, regardless of age group (Ponds & Jolles, 1996). Likewise, more recent studies have also produced mixed findings with either no correlation between age and the MIA strategy subscale (Frankenmolen et al., 2018), or older adults reporting higher frequency of external strategy use than young, with internal strategy use decreasing with age (Bouazzaoui et al., 2010; Tournier & Postal, 2011). The change in the frequency of internal and external strategy use was also noted in a study by Hertzog, Small, McFall, & Dixon (2019) that examined longitudinal changes using the MIA questionnaire in a large sample of adults, aged 55 to 85. The data was collected in the Victoria Longitudinal Study between the years of 1986 and 2000, and the results showed that over this period, whilst the reported frequency of external strategies increased, the frequency of internal strategy use decreased. The latter results were also supported by the outcomes of a recent systematic review by Pizzonia and Suhr (2022), which included studies using other memory strategy questionnaires, as well as the two discussed above, further strengthening the view of age-related changes in the use of different types of memory strategies.

It is worth noting that whilst popular, not all studies to date used the strategy questionnaires in order to investigate different ways people compensate their memory. For example, Harris (1980) used an interview method (combined with a predetermined list of various strategies) with a group of students (aged 19-27) in Study 1 and adult women (aged 23-67) in Study 2. Another interview study was conducted more recently by Hertzog, Lustig, Pearman and Waris (2019) who interviewed 25 older adults in the community. Amongst the questions asked, participants had to discuss how they supported memory in their day-to-day lives. All participants in this study reported regularly using various external strategies (e.g.,

calendars, shopping lists), maintaining habits and routines, with very little mentioning of the internal strategies. Most importantly, authors found that whilst external strategy use in this study was very common, contrary to beliefs that such use is due to concerns about declining memory, participants reported these strategies to be part of their lifetime habits and routine.

Lastly, only one study published to date has used a diary method by asking young and older adults to record every instance in which they had used some sort of strategy to aid their memory (J. C. Cavanaugh et al., 1983). A marginally significant age difference was found with older adults reporting more frequent use of strategies to remember objects (e.g., remembering an object which will be needed later), appointments, and routines. However, both age groups reported strong preference for using external strategies.

Overall, the review of existing literature on everyday memory strategy use indicates that it is the questionnaire method that has been used most often. However, one problem with the commonly used strategy questionnaires, such as MCQ, is that they have been developed a long time ago, and therefore do not include external strategies involving the use of new technology (Tomaszewski Farias et al., 2018). For example, the simplicity of using electronic reminders or electronic calendars and notes may change the reported frequency of the external strategy use and, as recently demonstrated by the interview study, older adults do report using certain types of electronic aids as well (Hertzog, Lustig et al., 2019). Therefore, the main aim of the current study was to investigate the frequency of memory strategy use across the adult lifespan using a newly developed memory strategy questionnaire, which comprised strategy items that were the most frequently reported in our diary Study 1b, including the use of electronic aids. Some of our predictions were based on the results of Study 1b. In particular, it was predicted that no age differences would emerge in the overall frequency of strategy use and that external strategies would be reported as the most frequently used by all age groups. However, we also expected to obtain an age by strategy type interaction whereby young adults would report more frequent use of external electronic aids and older adults more frequent use of external non-electronic aids. An additional prediction was made based on the literature reviewed above: with increasing age, the frequency of internal strategy use would decrease.

The secondary aim of the present study was to explore the effect of individual differences on the frequency of memory strategy use. In a recent systemic review, Pizzonia and Suhr (2022) noted that available studies have produced mixed results in terms of the effect of mood on strategy use, with some indicating associations between low mood and

increased use of internal memory strategies, while others failing to find any significant correlations. Moreover, within the literature on the Age-PM paradox, it has been proposed that young adults may be committing more PM failures in everyday life due to considerable lifestyle differences between them and older adults (Rendell & Thomson, 1999). Indeed, even in Study 1a, significant differences in the levels of busyness emerged between younger and older adults. For these reasons, to achieve our secondary aim, we included measures of mood (PHQ-9 and GAD-7) and lifestyle (MPED measuring busyness and routine) as in Study 1a (e.g., ratings of busyness and routine), to explore if these would be associated with the frequency of memory strategy use in different age groups.

5.2 Method

5.2.1 Design

This study used a mixed-subjects design with age of participants (young, middle-aged and older adults) as a between subjects variable and the type of memory strategies used (external electronic aids, external non-electronic aids, internal, multiple) as a within subjects variable. The dependent variable was participants' ratings of frequency with which these four types of strategies were used.

5.2.2 Participants and data screening

A total of 574 responses were received during the period between January 2021 and July 2021. The data was screened for any missing or invalid responses. From the initial dataset, five participants (0.9%) were removed due to not indicating their age. A further 36 (6.3%) participants were removed due to completing the survey in less than 7 minutes. Next, the dataset was screened to see how many participants omitted more than one answer when rating the frequency of memory strategy use, resulting in exclusion of another two (0.4%) participants. The final sample included a total of 531 participants, aged between 18 and 91 years, of which 398 (75%) were females, 127 (23.9%) were males, and 6 (1.1%) participants, who chose the “*Other/Prefer not to say*” option.

The sample was then divided into three age groups of 226 young adults (aged 18-39, $M = 24.10$, $SD = 6.46$), 135 middle-aged (aged 40-59, $M = 49.02$, $SD = 6.01$) and 170 older adults (aged 60-91, $M = 72.29$, $SD = 5.97$). The three groups were similar in gender distribution within each group, with majority of participants being females (76.5%, 71.9% and 75.3%, respectively). While the majority of young adults were students (58.4%), the

majority of middle-aged adults were in some form of employment (70.4%), and the majority of older adults were retired (90.6%).

5.2.3 Materials

Everyday Memory Strategies Questionnaire (EMSQ) (Appendix XVI) This questionnaire was developed using the data collected from the diary Study 1b, where healthy young and older adults recorded their memory strategies in a diary as soon as they had used them for a total of 3 days. Using a bottom-up approach, strategies were coded into *External* (with further subcategories of *portable aids*, *environmental cue*, *reliance on others*), *Internal* (with subcategories of *retracing*, *imagery*, *rehearsal*, *alphabet*, *association/cluster*), *Multiple strategies* (where a person used more than one strategy for one purpose), and *Other strategies*, when a described strategy did not fit into any of mentioned categories. Because the portable aid subcategory of the external strategies had the highest reported frequency in both young and older adult groups, for the purpose of a more fine-grained analysis in the questionnaire, it was further separated into five smaller subcategories: paper notes, paper calendar/diary, electronic notes, electronic calendar, and electronic reminders. The final questionnaire resulted in 13 items. For each item of the EMSQ, participants had to rate how often they had used a particular strategy in a typical month using a 5-point Likert scale with the following response options: 1 = *Never*; 2 = *Rarely (once or twice per month)*; 3 = *Sometimes (Once a week)*; 4 = *Often (2-4 times per week)*; 5 = *Very Often (almost daily)*.

In addition, participants were also asked to rate the frequency of using each of the presented strategy for several age groups (people in their 20s, 40s, 60s, and 80s) in order to examine potential stereotypical views the general public may hold related to ageing and strategy use. The same answer options were used with an additional option “Don’t Know”, to try an eliminate participants guessing. However, the data in relation to ratings for others will be presented and discussed in Chapter 6 as a Study 4b.

Subjective health was assessed by asking participants to rate their current health using a 5-point Likert scale with the following response options: 1 = *Very poor*; 2 = *Poor*; 3 = *Neither good or bad*; 4 = *Good*; 5 = *Very good*. In addition, participants were asked to rate (1) their health in comparison to their peers and (2) their memory in comparison to their peers on a 5-point Likert scale, with responses for both questions ranging from 1 = *significantly worse* to 5 = *Significantly better*.

5.2.4 Procedure

The survey was presented to participants using Qualtrics Survey software between January 2021 and July 2021 and circulated on a variety of social media platforms such as Facebook, Twitter, The University of Hertfordshire StudyNet and Psychology SONA recruitment system, and by contacting many branches of the University of 3rd Age (U3A). An additional 150 participants (aged 30-59) were recruited via Prolific platform and received £1.88 payment each for completing the survey. The participation in this study was not restricted to UK only and was available to anyone online who was either native or fluent English speaker and was aged 18 and older. After reading the Participant Information Sheet and giving consent, participants completed the EMSQ survey, three questionnaires relating to mood and lifestyle (GAD-7; PHQ-9, MPED) and filled in their demographic details. At the end, participants were provided with the Study Debrief and thanked for taking part. The entire study took approximately 15-20 minutes to complete.

5.3 Results

Both parametric and non-parametric methods of analysis were conducted depending on the type of independent variable used. The effect size, measured by partial eta-squared (η_p^2), was defined as .01, .06, and .16 for small, medium and large effects respectively (Cohen, 1988). When measured by Cohen's *d*, the effect size was defined as .2, .5, and .8 for small, medium and large effects, respectively (Cohen, 1988). For multiple tests of simple main effects, a Bonferroni correction for multiple comparisons was used, with alpha level adjusted for the number of tests.

5.3.1 Group differences in background characteristics

Table 5-1 shows background characteristics of the sample. Groups differed in the highest level of education achieved, with both middle-aged and older adults having higher level of education compared to young ($p_s < .001$), but no difference in education was observed between middle-aged and older adults ($p = 1.00$). Significant group differences emerged in terms of lifestyle, with young and middle-aged adults indicating higher levels of busyness compared to older adults ($p_s < .001$) but did not differ from each other ($p = 1.00$). Significant age differences were also found in ratings for routine, with middle-aged and older adults having more routinized lifestyle compared to young adults ($p_s < .001$).

Significant age differences were also noted in the ratings of mood, with young adults reporting the highest levels for anxiety and depression, followed by middle-aged and the older adult groups, and middle-aged adults indicating higher levels of anxiety compared to older adults ($p < .001$). There was no age difference in subjective ratings of current health ($p_s > .05$). However, whilst both young and middle-aged adults rated their health compared to their peers as the same ($p = 1.00$), older adults on average indicated that that their health was slightly better than their peers, compared to young and middle-aged ($p < .001$). When rating memory in comparison to their peers, the only significant difference was observed between middle-aged adults and older adults, with middle-aged adults giving lower ratings, compared to the older adults ($p < .001$), but there were no differences in these ratings between middle-aged and young ($p = .09$), or older and younger ($p = .10$).

Table 5 - 1. Background characteristics of participants across all age groups (Means, SD)

	Young	Middle-aged	Older	<i>F</i>	<i>p</i>	η_p^2
Education (Level) ¹	3.22 (0.61)	3.71 (0.98)	3.71 (1.11)	19.77	< .001	.07
Busyness (MPED)	20.40 (4.77)	19.90 (5.84)	15.02 (4.76)	60.83	< .001	.19
Routine (MPED)	11.86 (3.27)	14.79 (2.99)	15.07 (3.21)	61.08	< .001	.19
Anxiety (GAD-7)	8.34 (5.81)	5.72 (5.44)	3.23 (4.28)	45.60	< .001	.15
Depression (PHQ-9)	9.32 (6.88)	5.94 (5.44)	3.53 (3.88)	49.25	< .001	.16
Current health	3.76 (0.86)	3.74 (0.83)	3.92 (0.85)	2.25	.11	.01
Health - Peers	3.02 (0.81)	3.00 (0.82)	3.54 (0.83)	23.46	< .001	.08
Memory - Peers	3.03 (0.87)	2.91 (0.79)	3.20 (0.64)	5.25	< .01	.02

Note: ¹ Education: means are based on the number assigned to each response option (1 = Secondary school/High school (up to 16 years); 2 = Further education (A-levels, BTEC, NVQ, College); 3 = Undergraduate degree (BA, BSc); 4 = Master's degree (MA, MSc, Med); 5 = Doctorate (PhD, EdD). MPED = Martin and Parks Environmental Demands Questionnaire – higher scores on busyness and routine indicate higher busyness and more routinized daily life, respectively. GAD-7 = Generalized Anxiety Disorder - Higher mean indicates higher level of anxiety symptoms; PHQ-9 = Patient Health Questionnaire – higher mean indicates higher levels of depressive symptoms. Current health ratings: 1 = Very poor, 2 = Poor, 3 = Neither good or bad, 4 = Good, 5 = Very good. Health in comparison to peers and Memory in comparison to peers: 1 = Significantly worse, 2 = Worse, 3 = About the same, 4 = Better, 5 = Significantly better.

5.3.2 The frequency of different types of memory strategy use in the three age groups

The frequency ratings for EMS were entered into a 3 (age group: young, middle-aged, older) by 13 (type of strategy) mixed ANOVA with repeated measures on the last factor (see Table 5-2). The main effect of age was not significant, $F(2, 528) = 1.899, p = .15, \eta_p^2 = .00$. The main effect of strategy type was significant, $F(8.160, 4308,73) = 87.11, p < .001, \eta_p^2 = .14$. However, this was qualified by the significant age group by the type of strategy interaction, $F(16.664, 4308,73) = 24.03, p < .001, \eta_p^2 = .08$.

Significant age effects using alpha level adjusted to 0.0038 were obtained for all strategies except for three internal strategies: mental retracing, mental imagery, and making associations/links.

Table 5 - 2. Mean (standard deviation) frequency of Everyday Memory Strategies as a function of strategy type and age group. The table also shows results of tests of simple main effects with alpha level adjusted to 0.0038 to account for multiple comparisons.

Type of Strategy	Young	Middle-aged	Older	<i>F</i>	<i>p</i>	η_p^2
Paper notes	2.98 (1.36)	3.88 (1.21)	3.79 (1.10)	30.62	<.001	.14
Paper calendars/diaries	2.62 (1.44)	2.92 (1.48)	3.58 (1.40)	21.83	<.001	.08
E-notes	3.40 (1.24)	2.79 (1.42)	2.20 (1.43)	38.86	<.001	.13
E-calendars	3.19 (1.41)	3.05 (1.50)	2.49 (1.65)	10.98	<.001	.04
E-reminders	3.32 (1.46)	3.11 (1.59)	2.40 (1.54)	18.80	<.001	.07
Environmental cues	2.69 (1.20)	3.35 (1.10)	3.62 (1.10)	34.74	<.001	.12
Reliance on another person	2.69 (1.13)	2.64 (1.17)	2.06 (1.10)	17.17	<.001	.06
Mental retracing	2.89 (1.07)	2.87 (1.13)	2.81 (1.14)	< 1	.283	.00
Mental imagery	2.56 (1.24)	2.21 (1.22)	2.27 (1.26)	4.34	.014	.02
Rehearsal	3.15 (1.25)	2.68 (1.18)	2.41 (1.21)	18.91	<.001	.07
Alphabet	1.48 (0.91)	1.91 (1.12)	2.41 (1.33)	34.70	<.001	.12
Making associations/links	2.24 (1.16)	1.91 (1.06)	2.04 (1.13)	4.02	.018	.02
Multiple strategies at once	2.37 (1.20)	2.10 (1.14)	2.01 (1.13)	4.99	.003	.02

Post hoc tests revealed that older adults used paper notes more often than young adults ($p < .001$), but there was no difference in the frequency of using paper notes between middle-aged and older adults ($p = .516$). Older adults reported using paper calendars/diaries

more often than young and middle-aged adults ($p_s < .001$), but no difference in this strategy use was observed between young and middle-aged adults ($p = .06$). A reversed pattern was observed in the use of electronic notes (e-notes), with young adults reporting higher frequency of using these than middle-aged and older adults ($p_s < .001$), and middle-aged adults reporting higher frequency than older adults ($p < .001$). In relation to using electronic calendars (e-calendars), older adults reported lower frequency compared to young and middle-aged adults ($p_s < .001$), who did not differ from each other ($p = .40$). The same pattern was obtained in relation to using electronic reminders (e-reminders), with older adults reporting lower frequency compared to young and middle-aged individuals ($p_s < .001$), who did not differ from each other ($p = .20$). Young adults reported using environmental cues less frequently than middle-aged and older adults ($p_s < .001$), who did not differ from each other ($p = .04$). Young and middle-aged adults reported more often relying on another person compared to older adults ($p_s < .001$). In addition, young adults reported using rehearsal as a memory strategy more often than middle-aged and older adults ($p_s < .001$), and middle-aged adults reported using this strategy more often than older adults ($p < .001$). Older adults reported using alphabet more frequently than young and middle-aged ($p_s < .001$), and middle-aged adults reported higher frequency of this strategy than young adults ($p < .001$). Finally, young adults reported using multiple strategies significantly more frequently compared to older adults ($p = .003$), but no differences appeared between young and middle-aged, or middle-aged and older adults ($p_s > .04$).

5.3.3 Effects of age on the four categories of strategies

Based on the age group differences in the item-by-item analyses, the types of strategies were grouped into larger categories for a further analysis as follows: external electronic aids (e-notes, e-calendars, e-reminders), external non-electronic aids (paper notes, paper calendars, environmental cues, and reliance on another person), internal strategies (mental retracing, mental imagery, rehearsal, alphabet, making associations/links) and multiple strategies (when a person uses more than one strategy at once).

The mean frequency ratings for these four different strategy categories are presented in Table 5-3. These ratings were entered into 3 (age group: young, middle-aged, older) by 4 (strategy category: external electronic aids, external non-electronic aids, internal, multiple) mixed ANOVA with repeated measures on the last factor. The main effect of age group was significant, $F(2, 528) = 5.19, p < .01, \eta_p^2 = .02$. The main effect of strategy category was also

significant, $F(2.460, 1298.91) = 123.61, p < .001, \eta_p^2 = .19$. However, these main effects were qualified by a significant age group by strategy category interaction, $F(4.920, 1298.91) = 26.25, p < .001, \eta_p^2 = .09$ (see Figure 5-1). Test of simple main effects, with alpha corrected to 0.0125, showed that there were significant group differences in the frequency of using external electronic aids, $F(2, 528) = 32.26, p < .001, \eta_p^2 = .11$, external non-electronic aids, $F(2, 528) = 24.47, p < .001, \eta_p^2 = .09$, and multiple strategies, $F(2, 528) = 4.99, p < .001, \eta_p^2 = .02$, but groups did not differ in the use of internal strategies, $F(2, 528) = 1.58, p = .21, \eta_p^2 = .01$.

Table 5 - 3. Mean (standard deviation) frequency of strategies as a function of strategy category (external electronic aid, external non-electronic aid, internal strategies) and group (young, middle-aged, older adults).

	Young adults (n = 226)	Middle-aged adults (n = 135)	Older adults (n = 170)
External electronic aids	3.31 (0.08)	2.98 (0.10)	2.36 (0.09)
External non-electronic aids	2.74 (0.05)	3.20 (0.07)	3.26 (0.06)
Internal strategies	2.47 (0.52)	2.32 (0.07)	2.39 (0.06)
Multiple Strategies	2.36 (0.77)	2.10 (0.10)	2.01 (0.09)

Post hoc tests revealed that, young adults used external electronic aids more frequently than middle-aged adults ($p = .011$) and older adults ($p < .001$), and middle-aged adults used this strategy more frequently than older adults ($p < .001$). Young adults also indicated using multiple strategies more frequently than older adults ($p < .01$), but no differences were observed between middle-aged and young, or middle-aged and older adults ($p_s > .11$). However, older and middle-aged adults reported using external non-electronic aids more frequently than young adults ($p_s < .001$), but they did not differ from each other ($p = .48$). No age differences were found in the frequency of internal strategy use ($p_s > .08$).

An additional set of tests of simple main effects, with alpha level corrected to 0.0125, showed that the main effect of strategy category was significant in young adults, $F(3.000, 526.000) = 40.44, p < .001, \eta_p^2 = .19$, middle-aged adults, $F(3.000, 526.000) = 61.39, p < .001,$

$\eta_p^2 = .26$, and older adults, $F(3.000, 526.000) = 79.29, p < .001, \eta_p^2 = .31$. Post hoc tests showed that the frequency of using external electronic aids in the young adult group was significantly higher than the use of external non-electronic aids, internal strategies, and multiple strategies ($p_s < .001$). For middle-aged adults, the frequency of using external non-electronic aids was significantly higher than internal or multiple strategy usage ($p_s < .001$), but there was no difference between the use of external electronic and external non-electronic aids ($p = .07$). Older adults used external non-electronic aids more frequently than external electronic aids, internal, or multiple strategies ($p_s < .001$), but no difference was observed between the use of internal and external electronic aids ($p_s = .79$).

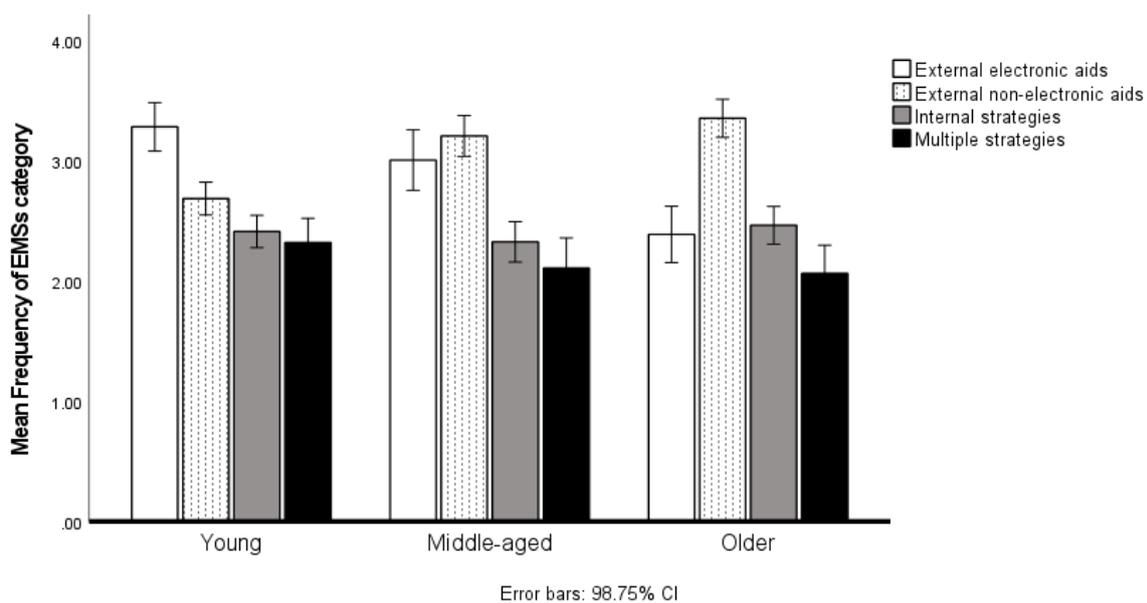


Figure 5 - 1: Mean frequency of EMSs as a function of the strategy category (External Electronic Aids, External Non-electronic Aids, Internal, Multiple) and age group (Young, Middle-aged, Older).

5.3.4 Correlations between strategy use and individual difference variables

The data presented in Table 5-1 showed that the groups significantly differed in the ratings of busyness, routine, anxiety, and depression. Before repeating the main 3 (age group: young, middle-aged, older) by 4 (strategy type: external electronic, external non-electronic, internal, multiple) mixed ANOVA, it was necessary to check if these variables correlated with the frequency of using the four EMSs categories in all groups. Therefore, Pearson's correlations were computed between the four main categories of EMSs and

education, measures of busyness (MPED – Busyness), routine (MPED – Routine), anxiety (GAD-7), and depression (PHQ-9) (Table 5-4). Results showed that in all age groups correlations were fairly small and that the obtained patterns differed somewhat in each age group, with the fewest number of weak correlations obtained in the older adult sample, such as significant and weak correlations between business and anxiety with external non-electronic aids and internal strategies (correlations ranging between .15 to .19). More consistent patterns emerged in the young and middle-aged groups, where positive and significant correlations were obtained between business and each of the four strategy categories (in young adults correlations ranged from .15 to .34, and in the middle-aged group from .23 to .36), and between anxiety and some of the strategy categories (i.e., with external non-electronic aids and internal strategies in young adults, and with external non-electronic aids, internal, and multiple strategies in the middle-aged group).

Table 5 - 4. Pearson’s correlations between EMSs and individual difference variables in young, middle-aged and older adults.

	External electronic aids	External non-electronic aids	Internal strategies	Multiple
<i>Young adults (n = 226)</i>				
Education	.09	.13*	-.02	.14*
MPED-Busyness	.22**	.34**	.27**	.15*
MPED-Routine	.01	.02	-.11	.01
GAD-7 (Anxiety)	.05	.17*	.14*	.01
PHQ-9 (Depression)	.11	.16*	.11	-.06
<i>Middle-aged adults (n=135)</i>				
Education	.18*	-.05	.01	.03
MPED-Busyness	.23**	.29**	.34**	.36**
MPED-Routine	-.04	-.07	-.18*	-.19*
GAD-7 (Anxiety)	.04	.24**	.24**	.21*
PHQ-9 (Depression)	.07	.08	.17	.25**
<i>Older adults (n = 170)</i>				
Education	.11	-.04	-.10	-.12
MPED-Busyness	.13	.15*	.19*	.12
MPED-Routine	-.05	.02	-.10	-.14
GAD-7 (Anxiety)	.04	.18*	.16*	.11
PHQ-9 (Depression)	.08	.02	.02	.17*

Note. * Correlation significant at 0.05; ** Correlation significant at 0.01

5.3.5 The impact of busyness and anxiety scores on the frequency of EMSs in young, middle-aged, and older adults

The assumptions of homogeneity of slopes for the analysis of covariance was met for two individual difference variable as indicated by the non-significant interactions between busyness and age group ($F(2, 532) = 1.17, p > .05$), and anxiety and age group ($F(2, 521) = 1.12, p > .05$), therefore, only two repeated measures ANCOVAs were run whilst controlling for the levels of business and anxiety. Accounting for these two covariates did not change any of the results of original ANOVA.

5.4 Discussion

To date, studies employing one of the most extensively used and validated measure of memory strategy use, the Memory Compensation questionnaire (MCQ), have shown consistently that the use of external strategies increases with age, while the use of internal strategies decreases (see a recent review by Pizzonia & Suhr, 2022). Interestingly, the majority of studies using the MCQ have focused mainly on studying strategy use in the older adult population. Moreover, as noted by Tomaszewski Farias et al. (2018), the MCQ was developed quite a long time ago, and with the recent increase of using electronic calendars and reminders, it may not fully capture the memory aids people use nowadays. Therefore, to address this important gap in the literature, we developed a new Everyday Memory Strategy Questionnaire (EMSQ), using most up-to-date and empirically validated items, which also capture the use of electronic aids, and compared these strategies in young, middle-aged and older adult groups.

Several interesting and important findings emerged from this study. The initial item-by-item analysis revealed significant group differences, with older adults reporting more frequent use of paper notes, paper calendars/diaries and going through the alphabet in order to remember something, compared to young and middle-aged individuals. By contrast, young adults reported higher frequency of using electronic aids (calendars, notes, and reminders), multiple strategies, as well as relying on another person, and rehearsal strategy than older adults. Middle-aged adults did not differ from younger adults in using paper calendars, electronic calendars, electronic reminders, reliance on others, or multiple strategies, but reported higher frequency in using the alphabet than younger adults, and higher frequency in using rehearsal as a strategy compared to older adults. Interestingly, groups did not differ in

the frequency of using mental imagery, mental retracing, or making links/associations, providing an indication that these kinds of strategies, which are normally referred to as internal strategies, are not very popular among adults of different ages. The results in relation to internal strategies provide initial evidence that internal strategies, which had been commonly believed to be favoured by young adults and abandoned by older adults (Pizzonia & Suhr, 2022) may not be entirely accurate.

Subsequent analyses using strategies grouped into external electronic aids, external non-electronic aids, internal strategies and multiple strategies provided some thought-provoking results. Contrary to our prediction, there were no age group differences in the frequency of using internal strategies, with all three groups using this type of strategy at similar and relatively low frequency. Only one study to date, comparing young and older adults, observed the same result (Schryer & Ross, 2013), with the majority of studies showing the decrease in internal strategies with increasing age (Bouazzaoui et al., 2010; Hertzog, Small, et al., 2019; Horhota et al., 2012; Tournier & Postal, 2011).

In addition, group differences emerged when looking at the frequency of using external electronic and external non-electronic aids. For the external electronic aid use, young and middle-aged adults reported using these types of strategies more frequently than older adults. However, both older and middle-aged adults reported using external non-electronic aids more frequently than young individuals. These results are very interesting and perhaps help explain our next finding. In terms of reported age differences in the overall frequency of memory strategy use, again, in line with our prediction, and with the results of diary Study 1b, no age differences were found. Whilst prior studies showed that older adults use more strategies than young (Schryer & Ross, 2013), it is not unreasonable to believe that these results might have been achieved due to older adults reporting higher frequency of external strategies, for example.

The results supported our prediction that, overall, all groups would indicate they use external strategies more frequently than all other strategy categories. Overall, external non-electronic aids were reported being used more frequently than external electronic aids, internal, or multiple strategies by all age groups. Moreover, external electronic aids were more frequently used than internal strategies. Whilst the external strategies were split into two subgroups (electronic versus non-electronic aids), when we run an additional analysis (not reported here) to check if the results change if we combine the external strategy subcategories into one category of external strategies, the external strategies were still more

frequent than internal or multiple across all age groups. This finding is in line with the results of our diary Study 1b, as well as a large number of studies that have revealed a strong preference for this type of memory compensation across all age groups (J. C. Cavanaugh et al., 1983; Garrett et al., 2010; Hertzog, Lustig, et al., 2019a).

For our secondary aim, we wanted to see if individual differences in mood and lifestyle would affect the frequency of self-rated strategy use. Indeed, we found significant group differences in the mean scores of anxiety, depression, levels of busyness and routine across age groups. Subsequent correlation analyses revealed that increased levels of anxiety and busyness were associated with higher frequency of overall strategy use, external electronic, external non-electronic and internal strategies in young and middle-aged adults, and external non-electronic, internal and overall frequency of strategies in older adults. These findings highlight the importance of taking into account one's current emotional state and current lifestyle circumstances when assessing everyday memory functioning and memory strategy use. Importantly, however, despite these significant correlations and group differences in the levels of anxiety and busyness, the outcome of the main analyses with respect to age group and strategy type effects did not change.

5.5. Conclusions

The absence of age effects in the overall frequency of using strategies reported in diary Study 1b was replicated in this questionnaire study, with no age differences in the overall frequency of self-rated strategy use. Similarly, as in diary Study 1, there was an overall preference across the groups for the use of external memory aids/strategies. Contrary to the existing literature, but in line with the results of our diary Study 1b, no age differences were observed in the use of internal memory strategies. Interestingly, compared to older individuals, young and middle-aged adults indicated higher frequency for using external electronic strategies, whereas, compared to young individuals, both older and middle-aged adults reported higher frequency of using external non-electronic strategies. Finally, while higher levels of anxiety and busyness were associated with higher frequency of EMSs, the age group differences did not change after controlling for these variables.

5.6. Limitations

Similarly to Study 3a, reported in Chapter 4, this study was conducted during the worldwide COVID-19 pandemic, and rather than asking participants to rate the frequency of EMSs “over the last month”, we asked them to indicate the frequency of different EMSs in a “typical month”. This decision was made in an attempt to minimize the impact of potential differences in the lifestyle of participants due to lockdown related changes. It may be that due to decreased activity, even though we tried to control for the lifestyle factors, participants may still have had a different levels of responsibilities and therefore their normal use of strategies outside the pandemic may not have been captured. Lastly, just like in Study 3a, in the current study groups differed in the levels of education with young adults reporting lower levels of education than middle-aged and older adults, who did not differ from each other. Whilst findings on the relationship between education and the use of memory strategies are mixed (Pizzonia & Suhr, 2022), there is indication that lower levels of education can be associated with a less frequent use of internal strategies. Whilst we did not find any correlations between education levels and the internal strategy use across the three groups of participants, future studies using EMSQ may need to explore this in more detail by examining correlations between the strategy use and years of educations, rather than levels of education.

Chapter 6: Stereotypical Views on Memory and Aging: An Online Survey (Study 3b and 4b)

6.1 Introduction

While self-reported memory functioning across different age groups is a very important aspect of memory research, it has been noted that such reports are sensitive to age-related stereotypes/beliefs which can impact a person's retrospective ratings of memory ability (Bouazzaoui et al., 2016, 2020; Lineweaver et al., 2009). More importantly, plenty of evidence has been accumulated to date showing that when older adults are exposed to negative age stereotypes before performing memory tasks in laboratory settings, it impairs their recall and metacognitive judgements (Fourquet et al., 2020), as well as episodic and working memory performance (Armstrong et al., 2017; Lamont et al, 2015). In addition, negative age stereotypes have also been linked to increased depressive symptoms and subjective memory complaints (Sindi et al., 2012), highlighting the importance of studying the presence of stereotypical views towards ageing in modern society.

Despite a large variety of measures used to investigate beliefs and attitudes towards typical ageing (Klusmann et al., 2020), to date, the investigation of general public's knowledge or beliefs about memory has mostly focused on the understanding of changes related to atypical ageing, such as changes due to Alzheimer's disease or dementia (Anderson et al., 2009; Carpenter et al., 2009; Reese et al., 2000; Rust & Kwong See, 2010; Spector et al., 2012). Nonetheless, there are few studies that investigated common misconceptions or general beliefs about age-related memory changes. For example, Palmore (1977) developed a short quiz covering a variety of physical, mental, and social facts about ageing, using 25 statements with True/False response options. This quiz was later revised by Breyspraak and Badura (2015) by adding 25 more items and rewording some of the old ones. However, despite the addition of new items, this quiz contains only a few items directly linked to cognition, hence it is not useful in assessing the public's knowledge of normal memory changes across the lifespan.

Prompted by the lack of appropriate measures to assess general public's knowledge of normal memory ageing, Cherry et al. (2000) developed The Knowledge of Memory Ageing Questionnaire (KMAQ). The KMAQ is made up of 28 true/false statements relating to normal and abnormal memory changes. After testing this measure within different populations (mental health professionals, undergraduate students, and older adults), the authors concluded that mental health professionals and older adults were more

knowledgeable about abnormal memory than normal memory ageing, whereas undergraduate students' knowledge did not differ between normal and abnormal ageing. One of the criticisms of this instrument was that the response options did not include a "Don't Know" answer. However, in a later study with college students, Cherry et al. (2013) concluded that this third option mostly increased sensitivity for items relating to abnormal memory ageing. The KMAQ was later used in several other studies which confirmed the initial findings that overall, people have more knowledge about pathological/abnormal memory ageing (Cherry, Blanchard, Walker, Smitherman, & Lyon, 2014; Reese & Cherry, 2006).

While the KMAQ contains a good number of items assessing knowledge of memory functioning in relation to episodic memory, memory organizations and other domains (e.g., "*Older people tend to remember specific past events in their daily life better than they remember the meaning of words and general facts*" – True of false?), it does not provide sufficient information on the public's understanding of what "normal" memory functioning across different age groups is. That is, how memory functions in day-to-day lives of people of different ages. It is very unlikely that stereotypical thinking about age-related memory changes in healthy individuals is driven by extensive knowledge about abnormal ageing. On the contrary, it is precisely because of the lack of knowledge about normal ageing that stereotypes emerge in society.

To measure general public's beliefs about memory changes due to age, Lineweaver and Hertzog (1998) developed the General Beliefs about Memory Instrument (GBMI). In this instrument, participants were asked to rate different statements about memory in the general population for separate age decades starting from 20 to 90. The results of the study showed that adults of all ages expected memory to decline with age, however, older adults expected this decline to begin later and progress slower than the younger adult group. Another interesting finding of this study was that the participants rated greater decline in memory for most recent events compared to more remote ones. This indicates that the public does understand that short-term memory is more susceptible to ageing compared to long-term memory.

In addition to GBMI, Lineweaver and Hertzog (1998) developed the Personal Beliefs about Memory Instrument (PBMI) which aimed to measure participants' beliefs about their memory (personal belief) and just like GBMI was based on ratings in memory efficacy, memory change and control over memory. One interesting finding that emerged from this study was that when participants compared their memory to others in the same age group, no

age differences were found. However, when they compared themselves to people of all age groups used within the study, significant age differences emerged. The results indicated that while older adults see their memory decline as normal for their age group, when comparing themselves to younger people they perceive this decline as much greater. These findings are not surprising as it has been previously noted, that older adults evaluate their memory by comparing the present to the past, whereas young people's views of ageing point towards the future and only become part of the present around the middle-age (Kornadt et al., 2020).

A strong general belief that memory declines with age fits in nicely with a Stereotype Embodiment Theory (SET, Levy 2009, *in* Kornadt et al., 2020). According to this theoretical framework, the old age stereotypes start developing from a very young age and are based on both personal experiences with older people, as well as on cultural exposure to negatively presented information about the old age. Consequentially, when people reach a certain age and start identifying as "old", the age stereotypes acquired throughout their lives may become a self-fulfilling prophecy, leading to enhanced worrying and beliefs that memory loss is inevitable. More importantly, a potential lack of knowledge about normal memory changes can have significant implications as this can lead to distorted perceptions of ageing in both young and older adults. For example, in a recent study, Cherry et al. (2019) investigated young and older adults' perceptions of forgetfulness in two experiments. In Experiment 1, young and older adults were presented with a total of six vignettes describing a target person who had an everyday memory error, with a description of its consequence. Each of the vignettes also had coloured photographs portraying young and older target characters. For each vignette, participants were asked to provide ratings of attribution in relation to poor memory ability, lack of effort, the difficulty of the task, bad luck, and attentional problems. Participants also had to indicate if they thought the memory failure was a sign of mental difficulty or whether a target person should seek memory training and at which point it would be recommended for the target person to seek evaluation if his/her forgetting was caused by medical and/or psychological problems. In the end, participants were asked to rate the age group that they thought the target person belonged to. In Experiment 2, the same procedure was followed using new vignettes, where the consequences now were not just for the target person but also for others in their social environment. Overall, the results revealed an age-based double standard, that is, both age groups more often indicated the ability as a cause of forgetting in older target person, as well as forgetfulness being a sign of mental difficulty.

However, when a target person was perceived as young, the forgetfulness was more often rated as being due to a lack of effort.

The beliefs that many cognitive skills, including memory, decline with increased age were also evident in a recent UK-wide ageing survey conducted by Vaportzis and Gow (2018). Amongst the questions asked, respondents were given a list of cognitive skills and were asked to write down the age at which they thought each skill might start to decline. If they thought that a certain skill never declined, they were asked to write 100. Perhaps unsurprisingly, out of over 3000 respondents, only 2.4% thought that the ability to remember things does not decline. Overall, respondents expected a memory capacity to start decline at the earliest age (at a mean age of 59.4), followed by the speed of thinking around mid-60s. A large proportion of the skills listed, such as the ability to focus/pay attention, problem-solving, ability with numbers and words, and ability to make decisions, were expected to decline between the ages of 71 and 77. Interestingly, younger respondents were more pessimistic, compared to older respondents, and expected cognitive skills to start declining 10-15 years earlier. This finding is again in line with the idea that when evaluating memory, older adults reflect retrospectively on their personal experiences, whereas a person in their 40s will be more guided by the outside exposure to the information about memory and ageing.

To date, the measures used to investigate people's beliefs and attitudes towards ageing have mostly focused on either normal versus abnormal ageing (e.g., KMAQ), or used items from existing memory questionnaires (GBMI was created after consulting Metamemory in Adulthood Questionnaire and Memory Functioning Questionnaire). Other attitudes or beliefs about memory changes were collected with surveys asking people about their expectations concerning cognitive skill changes in general. Therefore, the first aim of the present study was to obtain a clearer picture of people's attitudes and views regarding specific types of EMFs in relation to ageing using empirically validated items. To achieve this aim, in Study 3a participants rated not only the frequency of experiencing different EMFs in their own lives (by completing a newly developed EMEQ), but also how frequently they would expect a person in their 20s, 40s, 60s, and 80s to commit the same EMF in a typical month. In doing so, we expected to be able to assess the magnitude of stereotypical views towards everyday memory and ageing in everyday life in adults of different ages. In addition, we wanted to see if people's perceptions were more in line with the results obtained in the experimental studies, showing a general decline across prospective and retrospective memory, or if they

were more in line with the results from our diary studies, described in Chapter 2 (Study 1a), and Chapter 3 (Study 2), as well as prior structured diary studies demonstrating the age-PM benefit (Haas et al., 2020; Niedźwieńska et al., 2020),

Given the suggestions, often made in the literature, that older adults use more strategies in their daily lives to compensate for their fading memory ability, and the scarcity of studies examining lay peoples' views and beliefs about memory strategies used in ageing, the second aim of this study was to explore the general public's views on memory strategy use across the adult lifespan. To achieve this aim, we asked participants in Study 4a, who rated the frequency with which they themselves used different memory strategies, to also rate the frequency of memory strategy use in people in their 20s, 40s, 60s, and 80s.

6.2 Stereotypical views on everyday memory errors and ageing: An online survey (Study 3B)

Study 3b sought to investigate stereotypical views people may hold in relation to EMFs across the lifespan. For this aim, we asked participants to rate how often they would expect people in their 20s, 40s, 60s, and 80s to experience a range of EMFs. To avoid random guessing or skipping the questions due to participants not having an opinion, we included an option to select "Don't Know".

6.2.1 Method

6.2.1.1 Design

This study used a mixed design, with the age of the participants as the between-subjects variable (with five levels: young, middle-aged, young-old, old-old, and very old adults) and two within-subjects variables, which were the types of EMFs (with three levels: PM, RM, and AM) and the target age groups (with four levels: 20s, 40s, 60s, 80s). The dependent variable was the rated frequency of each of the three types of EMFs (PM, RM and AM).

6.2.1.2 Participants and data screening

For the current study, we used data from a total of 971 participants from Study 3a, who also provided ratings on EMEQ for other age groups. A total of 55 participants (6%) were excluded due to having more than 12 (10%) missing values. A further 221 participants (24%) were removed for selecting a “*Don’t Know*” answer at least once when rating others (see results section for the analyses of “*Don’t Know*” responses). Thus, the final sample included a total of 695 participants (72% of the initial sample), aged between 18 – 92, of whom 527 were females (76%), 163 were males (23.5%), and 5 (0.01%) stated “Other”.

The sample was divided into five age groups representing 212 young adults aged 18 to 39 ($M=23.17$, $SD = 5.42$), 93 middle-aged adults aged 40 to 49 ($M = 50.49$, $SD = 5.90$), 143 young-old adults aged 60 to 69 ($M = 65.51$, $SD = 2.69$), 193 old-old adults aged 70 to 79 ($M = 73.80$, $SD = 2.51$), and 54 very old adults aged 80 to 92 ($M = 82.81$, $SD = 2.92$). There were more females than males in the sample with females constituting 83%, 77%, 76%, 72% and 59% of participants in each of the five age groups, respectively. A Chi-squared test revealed significant differences between the five age groups in gender balance with more women in the younger age groups, compared to the oldest group, $\chi^2(8, 695) = 25.18$, $p < .01$. In addition, the majority of young adults were students (66%), the majority of middle-aged adults were working (75%), whereas adults in the three older groups were mostly retired (84%, 96% and 100% for young-old, old-old, and very old, respectively).

In terms of education, the majority of young adults indicated to have completed further education (64%), whereas more middle-aged, young-old, and old-old adults had undergraduate or higher levels of education (66%, 59%, 50%, respectively), and very old adults were split between below undergraduate level (48%) and undergraduate and above (41%) (see Table 6-1). A Chi-squared test revealed significant group differences in the levels of education, $\chi^2(20, 695) = 162.46$, $p < .001$. To assess group differences in the level of education, a one-way ANOVA was conducted using the means based on the number assigned to each response (1 = *Secondary school/High school (up to 16 years)*; 2 = *Further education (A-levels, BTEC, NVQ, College)*; 3 = *Undergraduate degree (BA, BSc)*; 4 = *Master’s degree (MA, MSc, Med)*; 5 = *Doctorate (PhD, EdD)*), but excluding “Other” as not all of the participants descriptions could be accurately assigned to a specified category of education. The results of this ANOVA showed significant group differences in the mean level of education, $F(4, 644) = 8.21$, $p < .001$, $\eta^2 = .05$. Young adults had a lower level of education ($M = 3.44$, $SD = 0.70$) compared to middle-aged ($M = 4.00$, $SD = 1.06$) and young-old ($M = 3.96$, $SD = 1.08$), but did not differ from old-old ($M = 3.61$, $SD = 1.06$) and very old adults

($M = 3.50$, $SD = 1.15$) ($p_s > .99$). Middle-aged adults had higher level of education compared to old-old and very-old ($p_s < .05$) but did not differ from young-old ($p > .99$). Young-old adults had higher level of education than very old adults ($p < .05$), with the difference between young old and old-old reaching significance ($p = .049$).

Table 6 - 1. Levels of education of each age group (raw numbers and percentages)

	Young adults (n=212)	Middle-aged (n=93)	Young-old (n=143)	Old-old (n=193)	Very old (n=54)
Level of Education					
Secondary/High school (Up to 16 years)	2 (0.9%)	8(8.6%)	10 (7.0%)	30 (15.5%)	11 (20.4%)
Further education (A-levels, BTEC, NVQ, College)	136 (64.2%)	16(17.2%)	36 (25.2%)	44 (22.8%)	15 (27.8%)
Undergraduate degree (BA, BSc)	52 (24.5%)	36(38.7%)	45 (31.5%)	66 (34.2%)	10 (18.5%)
Master's degree (MA, MSc, Med)	21 (9.9%)	18(19.4%)	27 (18.9%)	23 (11.9%)	11 (20.4%)
Doctorate (e.g., PhD, EdD)	1 (0.5%)	7 (7.5%)	12 (8.4%)	7 (3.6%)	1 (1.9%)
Other	-	8 (8.6%)	13 (9.1%)	23 (11.9%)	6 (11.5%)

6.2.1.3 Materials

Everyday Memory Errors Questionnaire - Others (EMEQ, Appendix x). In Study 3a, in addition to rating their own memory failures, participants were asked to rate each EMEQ item in terms of how frequently they expected a person in their 20s, 40s, 60s and 80s to experience that particular memory failure in a typical month, using the following response options: 1= *Never*; 2 = *Rarely (once or twice per month)*; 3 = *Sometimes (Once a week)*; 4 = *Often (2-4 times per week)*; 5 = *Very Often (almost daily)*; 6 = *Don't Know*.

6.2.1.4 Procedure

As described in Study 3a, participants were rating the frequency of different types of EMFs that they had been experiencing themselves in a typical month. In addition, after completing a rating for a particular item from EMEQ, they were then asked to rate the

frequency with which a person in their 20s, 40s, 60s and 80s would commit the same memory failure in a typical month by using the same answer options as for the self. An additional “*Don’t Know*” response option was provided to avoid guessing, or participants skipping a question due to not having an opinion.

6.2.2 Results – Study 3b

As in Studies 1 and 2 described in previous chapters of this thesis, both parametric and non-parametric methods of analysis were used depending on the type of the independent variable used, and effect sizes were measured by partial eta-squared (η_p^2), or by Cohen’s *d*, depending on the type of statistical test used (Cohen, 1988). Similarly, for multiple tests of simple main effects, a Bonferroni correction for multiple comparisons was used, with alphas divided by the number of simple main effects tested for a given factor.

6.2.2.1 Age effects on the “*Don’t Know*” responses when rating EMEs in others

Out of 916 participants who provided EMEQ ratings for each target age group, the frequency of “*Don’t Know*” (DK) response option was checked in each of the five age groups. A total of 221 participants selected a “*Don’t Know*” answer option at least once. Out of these, 78 participants were young adults (35%), 26 were middle-aged (12%), 27 were young-old (12%), 68 were old-old (31%), and 22 were very old adults (10%).

To examine whether DK responses were affected by any of the independent variables used in this study, the number of DK answers in each EMF category was entered into a 5 (age group: young, middle-aged, young-old, old-old, very old) by 4 (Target age: 20s, 40s, 60s, 80s) by 3 (EMF type: PM, RM, AM) mixed ANOVA with repeated measures on the last factor. The main effect of age group was not significant, $F(4, 212) = 2.32, p > .05, \eta_p^2 = .04$. However, the main effect of target age was significant, $F(1.554, 329.361) = 24.36, p < .001, \eta_p^2 = .10$, with the target age of 80s receiving the highest number of DK responses ($M = 7.82, SD = 9.73$) compared to the target ages of people in their 20s ($M = 4.89, SD = 8.67$), 40s ($M = 4.50, SD = 8.73$), and 60s ($M = 4.83, SD = 8.82$) ($p_s < .001$). The main effect of EMF type was also significant, $F(1.619, 343.305) = 21.81, p < .001, \eta_p^2 = .09$, with PM errors receiving a higher number of DK responses ($M = 12.34, SD = 5.90$) than RM errors ($M = 6.68, SD = 11.34$) ($p < .001$), but there was no difference between PM and AM errors ($M = 9.40, SD = 14.74$) ($p = .21$), and AM errors receiving a higher number of DK answers than RM errors. None of the two-way and a three-way interactions were significant (all $F_s < 1.38$).

6.2.2.2 Age effects in EMF frequency ratings in four target age groups

To examine the effects of age on the ratings of EMF frequency in others, the mean ratings of EMFs were entered into a 5 (age group: young, middle-aged, young-old, old-old, very old) by 4 (target age: 20s, 40s, 60s, 80s) x 3 (EMF type: PM, RM, AM) mixed ANOVA with repeated measures on the last two factors. The main effect of participant age group was significant, $F(4, 683) = 94.05, p < .001, \eta_p^2 = .36$, with young adults giving higher frequency ratings ($M = 2.89, SD = 0.48$) compared to middle-aged ($M = 2.41, SD = 0.56$), young-old ($M = 2.16, SD = 0.45$), old-old ($M = 2.08, SD = 0.49$) and very old ($M = 1.95, SD = 0.39$) (all $p_s < .001$), and middle-aged adults having higher frequency ratings than young-old ($p < .01$), old-old and very old ($p_s < .001$), but the three older groups did not differ from each other ($p_s > .06$). The main effect of EMF type was also significant, $F(2, 1366) = 217.19, p < .001, \eta_p^2 = .24$. Overall, RM failures received higher ratings of forgetting ($M = 2.53, SD = 0.60$) than PM ($M = 2.23, SD = 0.66$) or AM failures ($M = 2.34, SD = 0.65$) ($p_s < .001$), and AM errors received higher forgetting rating than PM failures ($p < .001$). The main effect of target age group was also significant, $F(1.490, 1017.94) = 1885.97, p < .001, \eta_p^2 = .73$, with those in their 80s receiving significantly higher ratings of forgetting ($M = 3.41, SD = 0.79$) than the target ages of 20s ($M = 1.66, SD = 0.59$), 40s ($M = 1.92, SD = 0.63$), and 60s ($M = 2.53, SD = 0.75$) (all $p_s < .001$).

Moreover, these main effects were qualified by a significant participant age group by target age group interaction, $F(5.962, 1017.94) = 9.41, p < .001, \eta_p^2 = .05$, EMF type by target group interaction, $F(3.803, 2597.31) = 212.22, p < .001, \eta_p^2 = .24$, and a 3-way error type by target age group by participant age group interaction, $F(15.21, 2597.31) = 6.93, p < .001, \eta_p^2 = .04$ (See Figure 6-1). The EMF type by Age group interaction was not significant, $F(7.939, 2597.31) = 1.88, p = .06, \eta_p^2 = .00$

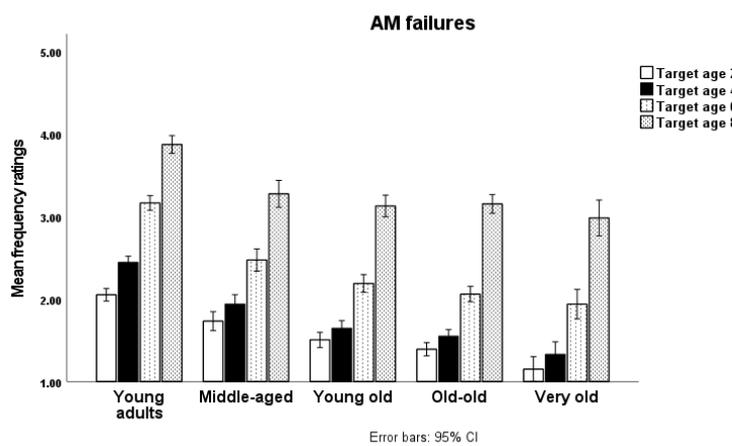
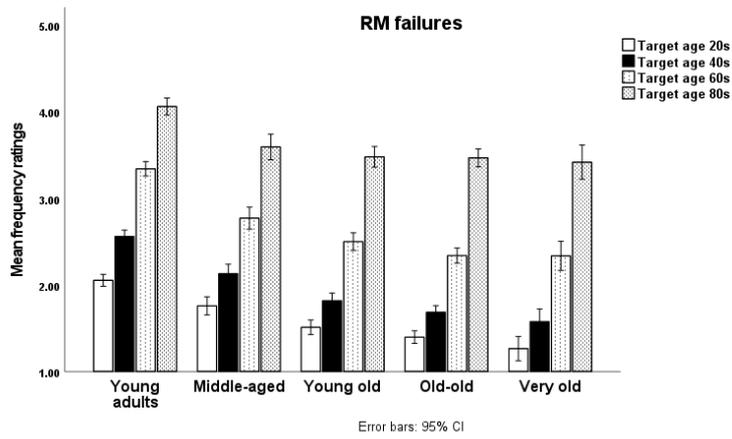
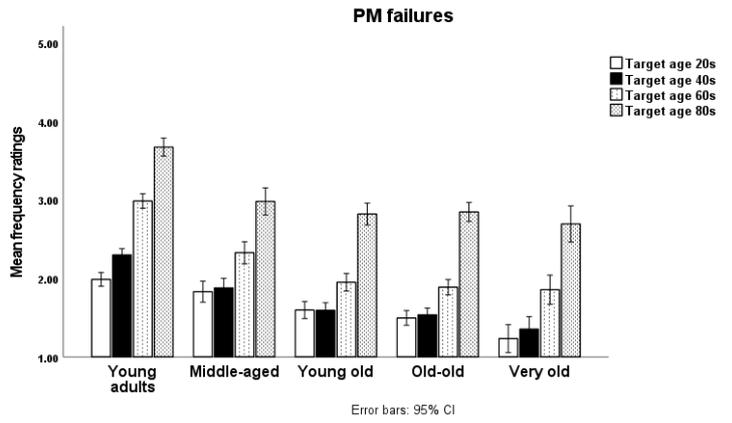


Figure 6 - 1: Mean frequency ratings by young, middle-aged, young-old, old-old and very old for target age groups (20s, 40s, 60s, 80s) as a function of EMF type (PM, RM, AM).

To tease apart the significant 3-way interaction between the independent variables, we conducted three separate 2-way mixed ANOVAs with participants' age group (young, middle-aged, young-old, old-old, very old) as a between subject factor and target age group (20s, 40s, 60s, 80s) as a within subjects factor on each of the three types of EMFs (PM, RM, AM). All three ANOVAs resulted in significant interactions between the independent variables: For PM, $F(6.199, 1198.020) = 11.52, p < .001, \eta_p^2 = .06$; for RM $F(6.294, 1164.374) = 7.64, p < .001, \eta_p^2 = .04$; and for AM, $F(6.432, 1230.132) = 8.19, p < .001, \eta_p^2 = .04$. A series of tests of simple main effects with alpha level adjusted to 0.0125, were conducted to tease apart these significant interactions.

Analyses of simple main effects for PM failures

For ratings of PM failures, main effects of target age group was obtained within each of the five participant age groups with very large effect sizes: for young adults, $F(3.000, 681.000) = 232.35, p < .001, \eta_p^2 = .51$, middle-aged, $F(3.000, 681.000) = 63.16, p < .001, \eta_p^2 = .22$, young-old, $F(3.000, 681.000) = 137.08, p < .001, \eta_p^2 = .38$, old-old, $F(3.000, 681.000) = 214.27, p < .001, \eta_p^2 = .49$, and very old, $F(3.000, 681.000) = 52.89, p < .001, \eta_p^2 = .19$. Results of post-hoc within subjects analysis for young participants confirmed strong stereotypical views in young adults by showing that with each increasing target age group, the frequency ratings increased with highest ratings provided for the target age 80s and the lowest ratings given for the target age 20s ($p_s < .001$) that was closest to participants' own age. For middle-aged adults, young -old, old-old and very old, identical patterns were observed with the target age group 80s receiving the highest frequency ratings compared to all younger groups ($p_s < .001$), target age 60s had higher frequency rating than those in 40s and 20s ($p_s < .001$), who did not differ from each other ($p_s > .06$). Thus all these participants believed, including the middle-aged group, that there were no differences between target ages of 20s and 40s, but that significant PM forgetting occurred in people in 60s and especially in 80s, again demonstrating stereotypical views on ageing and PM in everyday life.

An alternative set of simple main effects of participants age group within each of the four target age groups was also significant for ratings of PM errors: target age 20s, $F(4, 683) = 23.23, p < .001, \eta_p^2 = .12$, target age 40s, $F(4, 683) = 61.16, p < .001, \eta_p^2 = .26$, target age 60s, $F(4, 683) = 85.32, p < .001, \eta_p^2 = .33$, and target age 80s, $F(4, 683) = 35.88, p < .001, \eta_p^2 = .17$. Post hoc analyses revealed that for the target age of 20s, young and middle-aged

participants ratings of PM failures did not differ from each other ($p = .06$), but their ratings of frequency of PM failures were significantly higher than in the three older participant groups ($p_s < .001$), indicating that older adults also hold stereotypical views about younger adults' PM, but in the opposite direction. When rating frequency of PM in 40s, young adults gave the highest rating compared to other four groups ($p_s < .001$), middle-aged gave higher ratings than the three older groups ($p_s < .001$), who did not differ from each other ($p_s > .019$), again demonstrating somewhat elevated views that older adults hold towards middle-aged adults PM functioning. An identical pattern was observed in the PM ratings for 60s. Finally, for target age 80s, whilst the same pattern remained for young participants, the other four groups did not differ from each other ($p_s > .05$).

Analyses of simple main effects for RM failures

For ratings of RM failures, significant main effects of target age group were observed in young adults, $F(3.000, 681.000) = 426.59, p < .001, \eta_p^2 = .65$, middle-aged, $F(3.000, 681.000) = 162.60, p < .001, \eta_p^2 = .42$, young-old, $F(3.000, 681.000) = 314.04, p < .001, \eta_p^2 = .58$, old-old, $F(3.000, 681.000) = 500.631, p < .001, \eta_p^2 = .69$, and very old, $F(3.000, 681.000) = 140.14, p < .001, \eta_p^2 = .38$. Post hoc analyses revealed exactly the same pattern of frequency ratings, with all age groups rating the frequency of RM failures for target age 80s higher than in any other target age groups ($p_s < .001$), and this frequency rating decreasing stepwise with each younger target age group ($p_s < .001$). It is interesting that unlike PM, for RM all participants age groups, including the middle-aged group, believed that middle adults committed higher frequency of RM errors than younger adults.

An alternative set of main effects for the frequency of RM failures also resulted in significant main effects of participants' age within each of the for target age category: target age 20s, $F(4, 683) = 55.50, p < .001, \eta_p^2 = .25$, Target age 40s, $F(4, 683) = 89.32, p < .001, \eta_p^2 = .34$, Target age 60s, $F(4, 683) = 80.83, p < .001, \eta_p^2 = .32$, and Target age 80s, $F(4, 683) = 23.46, p < .001, \eta_p^2 = .12$. Post hoc analyses revealed that when rating the target age 20s, young adults again gave the highest ratings of RM failures compared to the other four groups ($p_s < .001$), middle-aged gave higher ratings than the three older groups ($p_s < .001$), young-old gave higher ratings than very old ($p < .01$), but the two oldest groups did not differ from each other ($p = .046$). Identical patterns were observed for the Target age 40s, again indicating that similar to PM failures, older participants overestimate young and middle-aged adults'

RM ability. When rating target age 60s, patterns for young and middle-aged remained the same, however all three older groups did not differ from each other ($p_s > .019$). For Target age 80s, whilst young adults again gave highest ratings compared to other four groups ($p_s < .001$), the other four groups did not differ from each other ($p_s > .16$).

Analyses of simple main effects for AM failures

For ratings of AM failures, significant main effects of target age groups were again observed in young adults, $F(3.000, 681.000) = 317.82, p < .001, \eta_p^2 = .58$, middle-aged, $F(3.000, 681.000) = 105.92, p < .001, \eta_p^2 = .32$, young-old, $F(3.000, 681.000) = 201.12, p < .001, \eta_p^2 = .47$, old-old, $F(3.000, 681.000) = 327.40, p < .001, \eta_p^2 = .59$, and very old, $F(3.000, 681.000) = 91.58, p < .001, \eta_p^2 = .29$. Post hoc analyses showed identical patterns to those observed in ratings for RM, demonstrating strong stereotypical views about increased AM forgetting with increased target age group.

An alternative set of simple main effects of participants age was also significant when rating the frequency of AM failures in Target age 20s, $F(4, 683) = 50.67, p < .001, \eta_p^2 = .23$, Target age 40s, $F(4, 683) = 92.02, p < .001, \eta_p^2 = .35$, Target age 60s, $F(4, 683) = 93.59, p < .001, \eta_p^2 = .35$, and Target age 80s, $F(4, 683) = 31.56, p < .001, \eta_p^2 = .17$. Post hoc analyses were identical to those obtained for RM failures showing that young and middle-aged participants provided higher ratings of AM failures for 20' and 40s than participants in all three older age groups, the latter provided lower ratings of failures for 60s and 80s than young and middle-aged adults, further supporting the findings from analysis of PM and RM failures that younger adults overestimate older adults forgetting while older adults underestimate younger and middle-aged adults' absent-minded failures in everyday life.

6.2.2.3 Association between the level of education and the total EMEQ ratings for others

Spearman's rank correlations were computed to assess the association between the mean frequency ratings of EMEQ and the levels of education (see Table 6-2). There were no significant correlations between the level of education and the mean ratings for others on EMEQ. In addition, the correlations were computed (not presented in the table 6-2) between participants education and ratings for each of the target age group. The only weak negative

correlation was observed in the old-old group between education and the mean overall ratings for Target age 80s ($r = -.17, p < .05$) Therefore, education was not analysed as a covariate.

Table 6 - 2. Correlations between the level of education and the overall mean rating of the EMEQ - Other by 5 age groups (Young, Middle-aged, Young-old, Old-old, Very old).

	Young ($n = 212$)	Middle-aged ($n = 93$)	Young-old ($n = 143$)	Old-old ($n = 193$)	Very old ($n = 54$)
	<i>EMEQ</i>	<i>EMEQ</i>	<i>EMEQ</i>	<i>EMEQ</i>	<i>EMEQ</i>
Level of education	-.098	-.043	-.022	-.088	.070

6.2.3 Discussion - Study 3b

By conducting this study, we wanted to obtain the general public’s beliefs about the frequency of EMFs experienced by people in the target age groups of 20s, 40s, 60s, and 80s using empirically validated examples of such errors. This study found strong age differences in the views regarding the frequency of different types of memory errors across the adult lifespan. First, adults of all ages thought that RM errors would be experienced more frequently than prospective or absent-minded errors. This result is perhaps to be expected, given that most research publications for a long time focused on reporting a decline in RM and even today, the most common examples of forgetting that older adults discuss are examples of RM errors (e.g., forgetting names of people or places, words, etc.). Somewhat surprisingly though, PM errors received the lowest frequency ratings from all age groups. While research in PM is not as old as in RM, as reported in diary studies of EMFs, PM failures are more frequent than retrospective and absent-minded errors in young, middle-aged and older adults (Haas et al., 2020; Niedźwieńska et al., 2020), and as such these results are in stark contrast to what may be actually happening in real life.

In addition, irrespective of participants’ age, the highest ratings of forgetting were ascribed to the target age group of 80s, and the lowest levels of forgetting to the target age group in their 20s. In other words, there was a linear increase in people’s perceptions of the frequency of EMFs with increased age, which is in line with the findings from previous studies examining people’s views towards memory and ageing (Lineweaver & Hertzog,

1998). Interestingly, some differences emerged in ratings provided by all participants for each of the target age groups. While ratings made by young adults for all target age groups significantly differed from all other participant groups (i.e., increased with increasing target age), there was no significant difference in ratings by young-old and old-old for people in their 20s, 40s, and 60s. Moreover, no significant difference in ratings for 60s was observed between the young-old, old-old, and very old groups. For the target age group of 80s, no differences in ratings were observed between middle-aged and three older participant groups. Moreover, even though participants differed in their levels of education, it did not correlate with the overall frequency ratings of EMF in others, indicating that the level of education did not influence participants' opinions towards others.

While not the main aim of this study, we also examined how frequently participants selected the “Don’t Know” (DK) answer option when rating others, before excluding them from the analyses relating to the main aim of this study. Given that nearly a quarter of participants were excluded, it is interesting that the most frequent selection of DK answers across all age groups was for questions about PM errors. At the same time, the lowest number of DK answers was for RM items, indicating that participants were more confident in their opinions whilst answering questions relating to these types of errors, or they were simply less familiar with PM failures as opposed to RM. Most importantly, regardless of which age groups participants belonged to, they did not differ in the frequency of DK answers.

6.3. Stereotypical views on memory strategy use and ageing: An online survey (Study 4b)

The main aim of the present study was to investigate stereotypical views people may hold when thinking about the memory strategy use across the adult lifespan. To address this question, participants in Study 4 a were asked to rate not only the frequency of using various memory strategies in their own lives (by completing a newly developed EMSQ), but also how frequently they would expect a person in their 20s, 40s, 60s, and 80s to use the same memory strategies.

6.3.1 Method

6.3.1.1 Design

This study used a mixed design, with the age of the participants as the between-subjects variable (with three levels: young, middle-aged, older adults) and two within-subjects variables, which were the types of everyday memory strategies (EMSs) used (with four levels: external electronic aids, external non-electronic aids, internal, multiple) and the target age group (with four levels: 20s, 40s, 60s, 80s). The dependent variable was the ratings of different types of EMSs used by the four target age groups.

6.3.1.2 Participants

Out of 533 participants in Study 4a, who also provided ratings on EMSQ for others, 18 participants (3%) were removed due to having more than 5 (10%) missing values. A further 205 participants (40%) were removed due to selecting the “*Don’t Know*” response when rating others (see results section for the analyses of “*Don’t Know*” responses).

The final dataset included a total of 310 participants (58% of the initial sample), aged between 18 – 84, of whom 224 were females (72%), 83 were males (27%), and 3 stated “Other” (1%). To allow for age group comparisons, the sample was divided into three age groups representing 145 young adults aged between 18 and 39 ($M = 24.43$, $SD = 6.72$), 92 middle-aged adults aged 40 to 59 ($M = 49.14$, $SD = 5.92$), and 73 older adults age between 60 and 84 ($M = 82.81$, $SD = 5.63$). There were more females than males in the sample with 75%, 72%, and 67% of participants being female in each of the three age groups, respectively. A Chi-squared test revealed no significant group differences in the gender distribution ($p = .40$). A large proportion of young adults were students (56%), the majority of middle-aged adults were working (71%), and the majority older adults were retired (92%).

The majority of young adults indicated to have completed further education (71%), whereas the majority of middle-aged and older adults had undergraduate or higher levels of education (60% and 58%, respectively) (see Table 6-3). In addition, a one-way ANOVA, using the means based on the number assigned to each response to a level of education (1 = *Secondary school/High school (up to 16 years)*; 2 = *Further education (A-levels, BTEC, NVQ, College)*; 3 = *Undergraduate degree (BA, BSc)*; 4 = *Master’s degree (MA, MSc, Med)*; 5 = *Doctorate (PhD, EdD)*) resulted in a significant age effect, $F(3, 309) = 10.94$, $p < .001$, $\eta^2 =$

.07, with younger adults having the lowest level of education to date ($M = 3.27$, $SD = 0.65$) compared to middle-aged ($M = 3.68$, $SD = 0.96$) and older participants ($M = 3.51$, $SD = 1.06$) ($p_s < .01$), who did not differ from each other ($p = .86$).

Table 6 - 3. Levels of education in each age group (raw numbers and percentages)

	Young adults (n=145)	Middle-aged (n=92)	Older (n=73)
Secondary school/High school (Up to 16 years)	6 (4.1%)	10 (10.9%)	7 (9.6%)
Further education(A-levels, BTEC, NVQ, College)	103 (71%)	27 (29.3%)	24 (23.9%)
Undergraduate degree (BA, BSc)	28 (19.3%)	41 (44.6%)	27 (37.0%)
Master’s degree (MA, MSc, Med)	7 (4.8%)	10 (10.9%)	9 (12.3%)
Doctorate (e.g., PhD, EdD)	1 (0.7%)	4 (4.3%)	6 (8.2%)

6.3.1.3 Materials

Everyday Memory Strategies Questionnaire (EMSQ) (Appendix X). In Study 4a, in addition to rating the frequency of their memory strategy use in their everyday life, participants were also asked to rate each memory strategy in terms of how frequently they expected a person in their 20s, 40s, 60s and 80s to use that strategy in a typical month, using the following response options: 1 = *Never*; 2 = *Rarely (once or twice per month)*; 3 = *Sometimes (Once a week)*; 4 = *Often (2-4 times per week)*; 5 = *Very Often (almost daily)*; 6 = *Don’t Know*. An additional “*Don’t Know*” response option was provided to avoid the bias of guessing, or participants skipping a question due to not having an opinion

6.3.1.4 Procedure

Procedure was the same as used in Study 4a and described in detail in Chapter 5.

6.3.2 Results – Study 4b

The structure of the results section is identical to the one used in Study 3b described earlier in this chapter. Thus, the number of “Don’t Know” responses was analysed first before presenting the main analysis on the frequency of strategy use as a function of independent variables, followed by correlation analysis examining associations between education levels and ratings of strategy use.

6.3.2.1. Age effects on the “Don’t Know” responses when rating EMSs in others

Out of 515 participants who provided ratings on EMSQ for each of the target age groups, the frequency of “Don’t Know” (DK) response options was checked in each of the three age groups. A total of 81 young adults (36%), 40 middle-aged adults (30%), and 84 of older adults (54%) selected a DK option at least once.

The number of DK answers in each EMS category were entered into a 3 (age group: young, middle-aged, older) by 4 (Target age: 20s, 40s, 60s, 80s) by 4 (EMS type: External electronic aids, External non-electronic aids, Internal, Multiple) mixed ANOVA with repeated measures on the last two factors. The main effect of age group was significant, $F(2, 202) = 6.25, p < .01, \eta_p^2 = .06$, with older adults indicating higher number of DK answers ($M = 3.15, SD = 2.49$) than young adults ($M = 1.98, SD = 1.74$) ($p < .01$) but did not differ from middle-aged adults ($M = 2.53, SD = 2.23$) ($p = .37$). The main effect of strategy type was also significant, $F(1.514, 305.860) = 153.30, p < .001, \eta_p^2 = .43$, with internal strategies having a higher mean of DK answers ($M = 7.02, SD = 6.05$) than external electronic ($M = 1.17, SD = 2.10$), external non-electronic ($M = 0.73, SD = 1.44$) and multiple strategies ($M = 1.35, SD = 1.70$) ($p_s < .001$). No differences were observed in the mean number of DK answers between external electronic and multiple strategies ($p > .05$). The main effect of target age groups was also significant, $F(1.817, 366.993) = 42.98, p < .001, \eta_p^2 = .18$, with target group 80s receiving higher number of DK answers ($M = 0.80, SD = 0.57$) compared to target group 20s ($M = 0.48, SD = 0.59$), 40s ($M = 0.48, SD = 0.57$), and 60s ($M = 0.55, SD = 0.54$) ($p_s < .001$), but the number of DK was similar between 20s and 40s target groups, or between 20s and 60s (all $p_s > .28$).

However, these main effects were qualified by a significant type of EMS by target age group interaction, $F(4.721, 953.571) = 14.50, p < .001, \eta_p^2 = .07$, which was further qualified

by a significant three-way interaction between the independent variables, $F(9.441, 953.571) = 2.14, p < .01, \eta_p^2 = .02$. The remaining 2-way interactions were not significant ($F_s < 2.55$).

To tease apart this three-way interaction we carried out four additional 4 (target age group) by 4 (type of EMS) mixed ANOVAS in groups of young, middle-aged and old participants. Two out of the four analyses resulted in significant interactions: for external non-electronic aids, $F(4.158, 419.925) = 3.22, p < .05, \eta_p^2 = .03$, and for internal strategies, $F(3.916, 395.555) = 2.66, p < .05, \eta_p^2 = .03$. The interactions for external electronic aids and multiple strategies were not significant ($F_s < 1$).

The tests of simple main effects with alpha level adjusted to 0.0125, were conducted for each the two significant interactions. For both types of ratings (i.e., external non-electronic aids and internal strategies), this analysis resulted in significant main effects of target age group within each of the three participant groups with effect sizes (η_p^2) varying between .07 and .16. Post hoc analyses for ratings of external non-electronic aids showed that both young and middle-aged participants had higher number of DK responses for target age 80s than for target age 20s and 60s ($p_s < .01$), but there was no difference in the frequency of DK answers between target age 20s, 40s and 60s ($p_s > .20$). By contrast, older adults had higher number of DK answers for target age 20s compared to 60s ($p < .01$), and higher number for 40s compared to 60s ($p_s < .01$), but no difference observed between target ages of 20s, 40s and 80s ($p_s > .07$).

Similarly, post hoc analyses on ratings of internal strategies showed that young adults had the highest number of DK answers for target age 80s, compared to the other three target age groups ($p_s < .001$), but there was no difference between target age 20s and 40s ($p > .05$). Identical pattern of ratings were observed in middle-aged and older adult groups.

6.3.2.2 Age differences in the ratings of the frequency of using various memory strategies in four target age groups

To examine age effects on the ratings of EMSs used in others, the mean ratings of EMS use were entered into a 3 (age group: young, middle-aged, older) by 4 (target age: 20s, 40s, 60, 80) x 4 (Strategy type: External electronic aids, External non-electronic aids, Internal, Multiple) ANOVA with repeated measures on the last factor (see Table 6-4).

Table 6 - 4. Mean (Standard Deviation) frequency ratings of the use of External electronic aids, External non-electronic aids, Internal strategies, and Multiple strategies as rated by Young, Middle-aged, and Older for Target age groups (20s, 40s, 60s, 80s).

	Young (n = 145)	Middle-aged (n = 92)	Older (n = 73)
Target age 20s			
External electronic aids	3.92 (0.85)	4.04 (0.88)	3.86 (1.12)
External non-electronic	2.21 (0.62)	2.22 (0.66)	1.91 (0.70)
Internal strategies	2.59 (0.77)	2.01 (0.64)	1.69 (0.62)
Multiple Strategies	2.59 (1.18)	1.78 (0.86)	1.58 (0.72)
Target age 40s			
External electronic aids	3.50 (0.68)	3.59 (0.72)	3.84 (0.88)
External non-electronic	2.61 (0.62)	2.22 (0.66)	1.91 (0.70)
Internal	3.35 (0.71)	2.86 (0.69)	2.69 (0.73)
Multiple	3.04 (1.06)	2.20 (0.94)	1.90 (0.87)
Target age 60s			
External electronic aids	2.44 (0.88)	2.51 (0.83)	3.20 (0.80)
External non-electronic	3.92 (0.60)	3.13 (0.62)	2.56 (0.73)
Internal	3.35 (0.71)	2.86 (0.69)	2.69 (0.73)
Multiple	3.28 (1.07)	2.49 (1.10)	2.39 (1.03)
Target age 80s			
External electronic aids	3.20 (0.89)	3.33 (0.67)	3.56 (0.59)
External non-electronic	4.02 (0.82)	4.16 (0.67)	4.15 (0.66)
Internal	3.51 (0.90)	3.11 (0.82)	3.36 (0.86)
Multiple	3.39 (1.23)	2.70 (1.35)	2.84 (1.18)

Note. The frequency of items in each strategy category was rated using the following response options: 1 = Never; 2 = Rarely (once or twice per month); 3 = Sometimes (Once a week); 4 = Often (2-4 times per week); 5 = Very Often (almost daily).

The main effect of participant age group was significant, $F(2, 293) = 23.03, p < .001, \eta_p^2 = .14$, with young adults indicating the highest mean ratings overall ($M = 3.21$), compared to the middle-aged ($M = 2.90$) and older adults ($M = 2.81$) ($p_s < .001$), who did not differ from each other ($p = .73$). The main effect of EMS type was also significant, $F(2.145, 628.478) = 3203.37, p < .001, \eta_p^2 = .41$, with external electronic aids receiving the highest mean frequency ($M = 3.42$) ratings compared to external non-electronic ($M = 3.27$), internal ($M = 2.73$) and multiple strategies ($M = 2.51$) ($p_s < .001$). In addition, external non-electronic aids received higher frequency ratings than internal and multiple strategies ($p_s < .001$), and the internal strategies received higher frequency ratings than multiple strategies ($p < .001$). The main effect of target age group was also significant, $F(1.469, 430.501) = 182.62, p < .001, \eta_p^2 = .38$, with the highest overall frequency ratings given to the target age 80s compared to 20s, 40s and 60s ($p_s < .001$), and the frequency ratings decreasing linearly from 60s to 40s to 20s ($p_s < .001$). However, these main effects were qualified by significant two way interactions between the independent variables with medium to very large effects sizes (η_p^2 varying from .06 to .50), which in turn were qualified by a significant three-way interaction between the independent variables, $F(9.38, 628.478) = 5.531, p < .001, \eta_p^2 = .04$ (see Figure 6-2).

To tease apart this three-way interaction, we conducted four separate 3 (participant group: young, middle-aged, older) by 4 (target age: 20s, 40s, 60s, 80s) mixed ANOVAS on each type of memory strategy use. Three analysis resulted in significant interactions: for external electronic aids $F(4.219, 637.075) = 6.43, p < .001, \eta_p^2 = .04$, external non-electronic aids $F(3.669, 546.646) = 17.41, p < .001, \eta_p^2 = .11$, internal strategies $F(2.836, 431.014) = 12.10, p < .001, \eta_p^2 = .07$, but not for multiple strategies $F(4.219, 637.075) = 6.43, p = .06, \eta_p^2 = .02$. The tests of simple main effects with alpha level adjusted to 0.0125, were conducted for each the three significant interactions.

Analysis of simple main effects for external electronic aids

For ratings of external electronic aids, this analysis showed significant main effects of target age group within each of the three participant groups: young, $F(3.000, 300.000) = 95.34, p < .001, \eta_p^2 = .49$, middle-aged, $F(3.000, 300.000) = 66.51, p < .001, \eta_p^2 = .40$, and for older adults, $F(3.000, 300.000) = 17.54, p < .001, \eta_p^2 = .15$. Post hoc analysis showed that for

young and middle-aged adults, frequency ratings decreased with each increasing target age group ($p_s < .01$), although somewhat surprisingly ratings for target age 80s were higher than for target age 60s ($p < .001$). For older adults there were no differences in ratings for target age 20s, 40s, and 80s ($p_s > .09$), but target age 60s received the lowest ratings compared to other target age groups ($p_s < .001$). These findings suggest that while young and middle aged participants believe in very substantial reduction in the use of external electronic aids in target age group of 80s and especially 60s, older participants believe such decline to be present only in target age group of 60s.

An alternative set of simple main effects on the frequency of external electronic aids showed that the main effect of participants' age was not significant for target age 20s, $F(2, 302) = 1.13, p = .32, \eta_p^2 = .01$, and target age 40s, $F(2, 302) = 4.16, p = .017, \eta_p^2 = .03$, indicating that young, middle-aged and older participants believed that external electronic aids were used equally often by people in their 20s and 40s. However, there significant main effects of participants' age were obtained for target age 60s, $F(2, 302) = 19.12, p < .001, \eta_p^2 = .11$, and target age 80s, $F(2, 302) = 5.72, p < .001, \eta_p^2 = .04$. Post hoc analyses revealed that when rating target age 60s, older adults indicated higher frequency than young and middle-aged ($p < .001$), who did not differ from each other ($p = .53$). When rating target age 80s, older adults indicated higher frequency than young ($p < .01$), but did not differ from middle-aged ($p = .04$). Middle-aged did not differ from young ($p = .21$). This pattern of findings suggests that young and middle-aged adults may be somewhat underestimating the use of external electronic aids by people in their 60s and 80s.

Analysis of simple main effects for external non-electronic aids

For ratings of external non-electronic aids, this analysis showed significant main effects of target age group within each of the three participant groups: young, $F(3.000, 296.000) = 140.92, p < .001, \eta_p^2 = .59$, middle-aged, $F(3.000, 296.000) = 145.45, p < .001, \eta_p^2 = .60$, and for older adults, $F(3.000, 296.000) = 119.82, p < .001, \eta_p^2 = .55$. Post hoc analyses revealed that in contrast to findings for external electronic aids, young adults gave highest frequency for target age 60s and 80s ($p_s < .001$) and followed by the target age 40s ($p < .001$), who received higher frequency rating than Target age 20s ($p < .001$), while ratings for target age 60s and 80s did not differ ($p = .038$). For middle-aged and older adults frequency ratings also increased with each increasing target age group ($p_s < .001$), suggesting that all

participants, irrespective of their age, believed that the use of external non-electronic strategies increased with increasing target ages from 20s to 80s.

An alternative set of simple main effects on the frequency of external non-electronic aids showed a significant main effect of participants age for the target age 20s, $F(2, 298) = 27.63, p < .001, \eta_p^2 = .16$, target age 40s, $F(2, 298) = 38.24, p < .001, \eta_p^2 = .20$, and target age 60s, $F(2, 298) = 18.56, p < .001, \eta_p^2 = .11$, but not for the target age 80s, $F(2, 298) = 1.25, p = .29, \eta_p^2 = .01$. The latter finding indicates that all participant age groups including the older adults themselves believed that people in their 80s frequently use external non-electronic aids. Post hoc analyses for significant effects revealed that when rating target age 20s, young adults gave higher frequency ratings than middle-aged and older ($p_s < .001$), and middle-aged indicated higher frequency than older ($p < .001$). For the target age 60s, there was no difference in ratings by young and middle-aged ($p = .47$), but both indicated higher ratings than older ($p_s < .001$). These effects suggest that older participants may be somewhat underestimating the use of external non-electronic aids in younger and middle-aged adults while the latter may be overestimating the use of such aids in people in their 60s.

Analysis of simple main effects for internal strategies

This analysis resulted in significant main effects of target age within each participant group: young, $F(3.000, 302.000) = 50.03, p < .001, \eta_p^2 = .33$, middle-aged, $F(3.000, 302.000) = 40.30, p < .001, \eta_p^2 = .29$, and for older adults, $F(3.000, 302.000) = 63.62, p < .001, \eta_p^2 = .39$. Post hoc analyses showed that all three participant groups indicated increasing frequency of using this strategy with each increasing target age group ($p_s < .001$).

An alternative set of simple main effects showed a significant main effect of participants' age for the target age 20s, $F(2, 304) = 44.87, p < .001, \eta_p^2 = .23$, target age 40s, $F(2, 304) = 48.41, p < .001, \eta_p^2 = .24$, target age 60s, $F(2, 304) = 14, p < .001, \eta_p^2 = .14$, and target age 80s, $F(2, 304) = 5.65, p < .001, \eta_p^2 = .04$. Post hoc analysis revealed that for target age 20s, young adults gave higher ratings than middle aged and older participants ($p_s < .001$), and middle-aged participants gave higher ratings than older participants ($p < .01$). The same pattern was observed for target age of 40s ($p < .001$). For target age 60s, young adults gave higher ratings than middle-aged and older ($p < .001$), who did not differ from each other ($p = .11$). And for the target age 80s, young adults gave higher ratings than middle-aged ($p < .01$)

but did not differ from older ($p = .22$), and there was no difference in ratings between middle-aged and older ($p = .09$). As in case with analyses on external non electronic aids, this pattern suggests that while younger adults may be somewhat overestimating the use of internal strategies in people of 40s and 60s, older participants may be somewhat underestimating the frequency of internal strategies in people in their 20s and 40s.

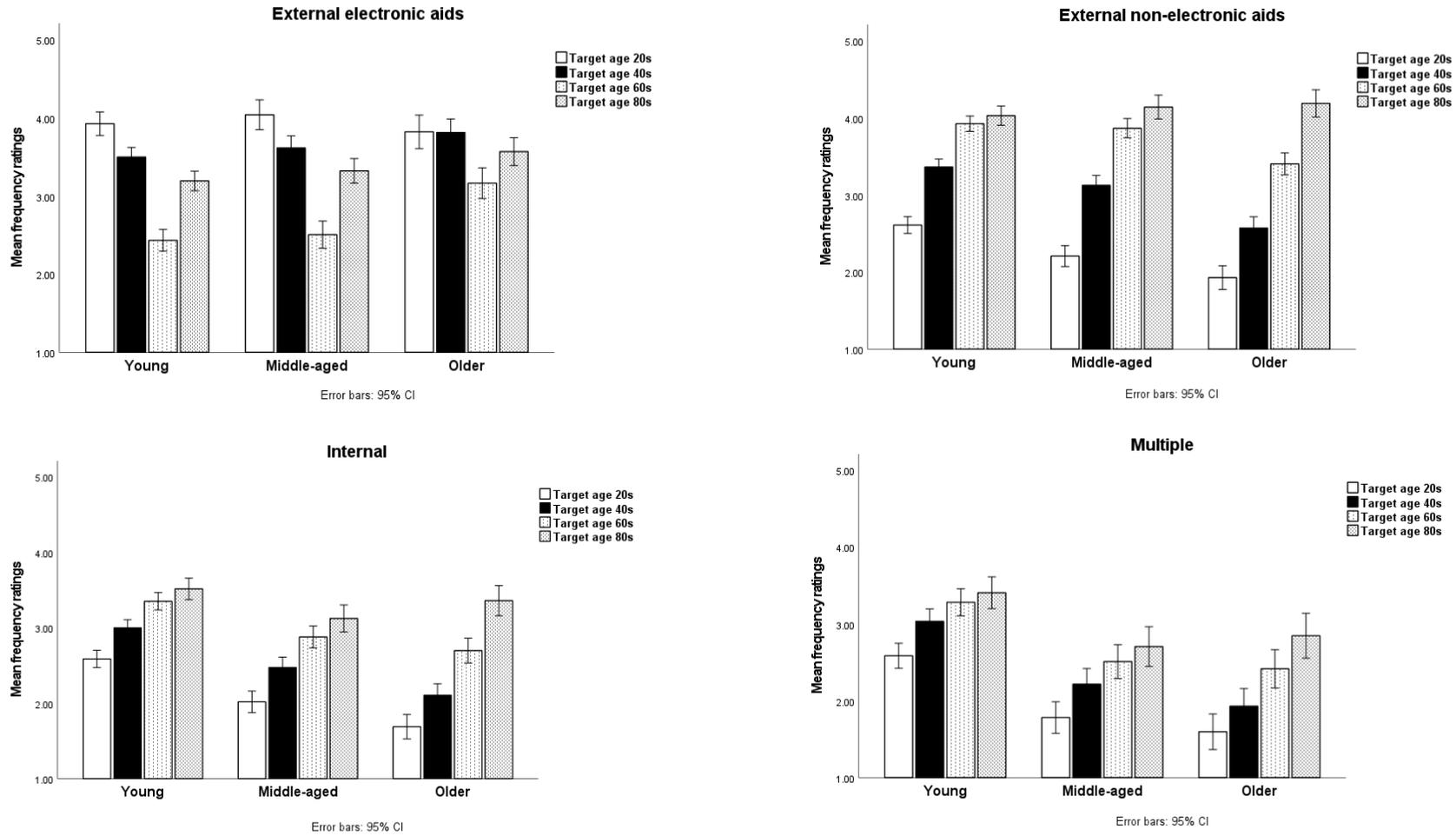


Figure 6 - 2: *The Mean Frequency Ratings for the Use of External electronic aids, External non-electronic, Internal strategies, and Multiple strategies for each of the target age groups (20s, 40s, 60, 80).*

6.3.2.3 Association between the level of education and the mean EMSQ ratings for others

Spearman’s rank correlations were computed to assess the association between the mean frequency ratings of EMS and the levels of education (see Table 6-5). The only significant and negative, but very weak correlation was found in the young adult group between the level of education and the mean ratings of EMS in other ($r = -.17, p = .04$). The level of education did not correlate with the mean overall ratings on EMEQ others ($p_s > .19$). For this reason, education was not analysed as a covariate.

Table 6 - 5. Spearman’s rank correlations between the mean rating of the overall EMSQ and the level of education in young, middle-aged, and older adults

	Young	Middle-aged	Older
	<i>Mean EMSQ rating</i>	<i>Mean EMSQ rating</i>	<i>Mean EMSQ rating</i>
Level of Education	-.174*	-.003	-.143

Note. * p -value < .05

6.3.3 Discussion – Study 4b

The current study resulted in several novel findings concerning the general public’s views towards the memory strategy use in people in their 20s, 40s, 60s, and 80s. For example, results showed significant age differences in participants’ overall ratings of EMS frequency. Thus, irrespective of target age group or the strategy use type, young adults expected memory strategies to be used more frequently compared to middle-aged and older adults, who did not differ from each other. This finding in itself is very interesting, given that research to date suggests at least an increase in external strategy use with increased age (Bouazzaoui et al., 2010; Pizzonia & Suhr, 2022). Another interesting finding was that the highest frequency ratings by all age groups were given to the external electronic strategies, followed by the external non-electronic aids, internal and lastly, multiple strategies. Such results are perhaps to be expected since many studies, looking at the use of memory strategies indicate a preference for external strategy use (Cavanaugh et al., 1983; Garrett et al., 2010; Hertzog, Lustig, et al., 2019), hence one would assume that people would expect these to be

used more frequently by people of all ages. Moreover, the results of this study indicate that the general public's views are in line with studies showing that memory strategy use increases with increasing age, that is the frequency ratings for the overall use of strategies were highest for the target age of 80s and decreased linearly with decreasing target age.

There were also significant differences in the expectations towards the frequency of specific strategy use for different target age groups. People in their 20s were expected to use external electronic aids most frequently, followed by external non-electronic aids, but both, internal and multiple strategies were expected to be used least frequently. For people in their 40s, the expectations were similar with the exception of multiple strategies, which received the lowest frequency ratings. However, this pattern changed starting from the target age 60s. The expectation was for the external non-electronic aids to be used most frequently, followed by the internal strategies which were expected to be used more frequently than external electronic aids, with multiple strategy use rated as the least frequent but no different from the external electronic aid use. Finally, people in their 80s, just like those in their 60s, were expected to be using external non-electronic aids most frequently, followed by the external non-electronic aids which were more frequent than multiple strategies, but internal and external aids received similar frequency ratings.

Perhaps the most interesting results from this study were found when looking at how participants of different ages rated the frequency of using memory strategies in different target age groups. First, it was found that participants views on multiple strategy use in others were very similar. However, young and middle-age expected people in their 20s and 40s to use external electronic aids more often than those in their 60s and 80s, while older adults thought this type of strategy is used least frequently by people in their 60s but at the similar rate by 20s, 40s, and 80s. This could potentially signal that younger adults may believe older generation is not yet used to using electronic technology. This pattern was reversed when looking at the use of external non-electronic aids where young adults thought this strategy is used most frequently by people in their 60s and 80s, whereas both middle-aged and older adults expected the use of this strategy increase with each increasing target age. These results are in line with the recent findings of age differences in the use of external strategies showing that such strategy use increases with age (Pizzonia & Suhr, 2022, also Study 4a), but in contrast to our Study 1b where we found no age effects in the overall use of external strategies. More importantly, views towards internal strategy use were in complete contrast to general findings of other studies, as all age groups indicated increase in such strategy use

with each increasing target age (see review by Pizzonia & Suhr, 2022). Moreover, they are also in contrast to the results found in Study 1b and Study 4a, where no age differences were observed in the use of this strategy.

Additionally, the present study looked at the frequency of “Don’t Know” answers provided by participants. Importantly, 40% of all respondents selected this answer option at least once when rating the frequency of strategy use in others, with older adults using this answer option most frequently indicating that many adults are less knowledgeable about the strategy use in others compared to frequency of EMFs in others. More importantly, groups differed in the frequency of DK answers for the use of external non-electronic aids and internal strategies, but the number of DK answers were similar for external electronic and multiple strategies. In terms of external non-electronic aids, young and middle-aged had the highest number of DK answers when rating those in their 80s, whereas older adults more frequently chose DK response when ratings younger generations (20s and 40s). For internal strategies, all three groups had the highest number of DK answers for 80s, but no differences in DK answers for those in their 20s, 40s, and 60s. This is somewhat surprising as one would think that due to internal strategies being more covert and not as observable as external strategies, the number of DK answers should be the same for all target ages and by all participant groups.

6.4 General discussion

Taken together, several interesting and important findings emerged from Studies 3b and 4b. First, Study 3b demonstrated that not only do stereotypical views towards memory and ageing exist, but they also exist in both directions, with younger adults generally believing memory declines with increasing age, whereas older adults believing that young adults have almost perfect memory. Study 4b is somewhat unique in the sense that whilst memory researchers appear to hold beliefs that as people age, they start using more strategies to compensate for poorer memory, no study to date asked the general public what they think about the memory strategy use in people of different ages.

6.4.1 Stereotypical views on EMFs and ageing

In Study 3b, young, middle-aged, young-old, old-old and very old adults were asked to rate how frequently they expected people in their 20s, 40s, 60s, and 80s to experience different everyday memory errors, which were categorised into PM, RM and AM errors. It was found that the highest ratings of forgetting were ascribed to the target age group of 80s, and the lowest levels of forgetting to the target age group in their 20s. In other words, there was a linear increase in people's perceptions of the frequency of EMFs with increased age. These results are in line with previous studies looking at stereotypical views of ageing showing that people believe forgetting is increasing with increased age (Lineweaver & Hertzog, 1998; Vaportzis & Gow, 2018). What is, however, interesting, is that all participants, including young adults, thought that those in the target age of 20s have nearly perfect memory as the mean rating for the frequency in a typical month was between never to almost never. This latter finding is in stark contrast to the results obtained from diary studies, showing that young adults report, for example, experiencing quite a lot of PM errors over just three, or even seven days (e.g., see results of Study 3a in Chapter 2) (Haas et al., 2020; Niedźwieńska et al., 2020). By contrast, all participants, including the very old, thought that those in the target age of 80s have fairly poor everyday memory as the mean ratings of EMF frequency in a typical month was between sometimes and often (from once per week to 2-4 times per week). Again, this finding seems to contradict the results of Study 1a, where the mean frequency of RM failures in just over three days for older adults was 2.68.

The current study also showed that participants' views concerning RM errors, appeared to be more in line with the results from diary Study 1a. Irrespective of participants' age group, the average rating for experiencing RM errors increased from the target age of 20s to the target age of 80s, indicating that people of all ages, including very old adults expect RM errors to become more frequent with increasing age. However, views relating to PM and AM errors were far from the results obtained in diary studies. Indeed, starting from the target age of 40s, participants expected PM errors to be the least frequent, whereas AM errors received the second-highest ratings. This finding contrasts with the results from the study by Niedźwieńska et al. (2020) where it was found that PM errors were the most frequent in young, middle-aged and older adults.

6.4.2 Stereotypical views on memory strategy use and ageing

Results of Study 4b are important because no previous study has explored people's views concerning memory strategy use and ageing using a questionnaire that is based on people's actual use of various strategies as documented by diary data. However, what is known from studies investigating everyday forgetting in naturalistic settings, is that the scientific community has often suggested that any age benefit found in everyday memory studies, is due to older adults using more memory strategies, i.e., compensating for their depleting ability to remember (Haas et al., 2020; Ihle et al., 2012; Niedźwieńska et al., 2020). Therefore, a careful assumption could be drawn that at least members of the scientific community expect older adults to be using more strategies. Results from Study 4b appear to be in line with those expectations. Irrespective of age groups, participants in the current study expected those in their 80s to be using memory strategies most frequently, with people in their 20s using strategies the least frequent. However, while this may be true for external strategies, previous studies investigating strategy use in young and older have shown that the use of internal strategies decreases with increasing age (Pizzonia & Suhr, 2022). The results of the current study were in stark contrast to this finding as participants expected the use of internal strategies to increase with increased age.

Many earlier studies looking at the use of memory strategies have indicated a preference for using external strategies by all age groups (Cavanaugh et al., 1983; Garrett et al., 2010; Hertzog, Lustig, et al., 2019). Our participants' views appear to be conveying these results when rating target age groups, as regardless of participant age or a specific target age, the highest frequency was given to the use of external electronic aids, followed by external non-electronic aids, internal, and multiple strategies.

Perhaps the most interesting findings relate to the frequency of each strategy type for separate target age groups. Whilst participants, in general, expected people in their 20s and 40s to use external electronic aids most frequently, the expectation changed for those in their 60s and 80s, with external non-electronic aids rated as more frequently used than any other types of strategies. These latter findings indicate the importance of separating external strategies into electronic versus non-electronic as they demonstrate that people do not see that as the same.

6.4.3 The frequency of “Don’t Know” responses when expressing views about everyday memory errors and the use of memory strategies in ageing

Participants in both Study 3b and Study 4b, who checked the “Don’t Know” (DK) answer at least once, were excluded from the main analyses. However, it is important to discuss the results for DK answers in both studies for a few reasons. First, it is noteworthy that the number of participants with DK answers in Study 4b was proportionally much larger with 40% of the overall sample, compared to 24% of participants in Study 3b. This difference may potentially indicate that adults are much less knowledgeable about the memory strategy used by adults of different ages and feel more knowledgeable regarding the frequency of everyday memory errors in others. If the stereotypical views towards ageing are formed based on the exposure to the information about older adults, then these results are not unexpected as the topic of memory strategy use is much less researched, disseminated, and portrayed in the media, compared to memory failures.

Moreover, in Study 3b, DK answers were significantly more frequent for questions relating to PM and the least frequent for RM across all age groups. Once again, this potentially indicates higher confidence in one’s knowledge regarding RM, than PM. Whilst participant group did not differ in the mean frequency of DK answers in Study 3b, in Study 4b older adults had higher frequency of DK answers compared to young, but did not differ from middle-aged. Moreover, the highest frequency of DK answers was observed for internal strategies which is not surprising, given that internal strategies are much less, if ever, observable by others.

6.5. Limitations

Inclusion of the “Don’t Know” answer option led to a large number of participants being excluded from Studies 3b and 4b, resulting in smaller sample sizes, especially in Study 4b. Future studies may want to consider a better way of dealing with DK answers, or not offering this option at all. It is also worth noting, that both of the above-discussed studies were part of larger surveys asking participants to rate others in addition to rating themselves. It is interesting to see whether the results would be different if the questionnaires on stereotypical views were completed separately from self-ratings of memory failures. Moreover, across both studies, participant groups differed in the levels of education. Whilst the level of education was not associated with the ratings of EMEQ, when rating the strategy use in others, there was a small but significant and negative correlation in the young adult

group, which could have potentially influenced their ratings. Therefore, future studies may wish to compare age differences in participants' views on memory strategy use across target age groups in samples of adults with a similar educational level. Finally, in the present study the target age groups were presented in a linearly increasing order, but future studies should present the target age groups randomly to participants to avoid any potential biases in responding.

6.6 Conclusions

Both studies, 3b and 4b confirmed the existence of strong stereotypical views of ageing. When rating the frequency of EMFs in others, people's views seemed to be in line with the evidence from laboratory studies of memory, showing increased forgetfulness with increased age in target age groups. But these views are in contrast to the evidence on the frequency of PM and AM reported in naturalistic studies. Moreover, stereotypical views appear to be two-way, with younger adults significantly underestimating older adults' everyday memory, and older adults significantly overestimating younger adults' memory. Findings concerning views on memory strategy use suggest that participants' beliefs in strategy use did not reflect the findings of the diary study, described in Chapter 2 (Study 1b) and are more in line with general assumptions and suggestions made in the literature on memory ageing, that the overall strategy use is increasing as people get older.

Chapter 7: General Discussion

7.1 Aims of the Thesis

The first key aim of the present thesis was to investigate EMFs in young and older adults using a structured diary method. A handful of diary studies, to date, have provided fairly similar results, indicating that younger adults consistently report experiencing more PM errors in their everyday life than older adults (Haas et al., 2020; Niedźwieńska et al., 2020), and in doing so, have provided further support for the so-called Age-PM paradox. Finding this positive age effect in everyday PM has attracted quite a lot of attention in the literature and several explanations have been proposed to try and explain this phenomenon. For example, it has been suggested that older adults may not be able to remember that they have forgotten something (Rabbitt & Abson, 1990) or that they need to record their EMF in the diary. However, findings from diary studies have shown that although older adults report fewer PM errors than young, no age differences have been obtained for RM or AM errors. If older adults were unable to remember their forgetting instances, would not they be also recording fewer RM and AM? In addition, whilst investigating EMFs in young and older adults, this thesis also attempted to address an important question about the stability of recorded pattern of errors across the time and the reliability of the diary method when studying everyday memory errors. While it is a common practice to use a test-retest design to assess the reliability of any new psychometric tool in psychology (Aldridge et al., 2017), the diary method, whilst not a diagnostic tool per se, should still be subjected to similar standards (Iida et al., 2012). However, to date, no study using a structured diary method for investigating EMFs has sought to answer this important question: would the results be the same or at least, similar, if the same participants kept the of diary of EMFs once again, after a brief period?

The second key aim of the present thesis was to investigate everyday memory strategy use in young and older adults, and in doing so, to address another suggestion made in an attempt to explain the Age-PM paradox that older adults may be using more memory strategies and therefore do not commit as many PM errors as young. Research in the everyday strategy use to date has primarily used questionnaires and has shown that with increased age, older adults seem to be using more external strategies, whereas the use of internal strategies seems to be decreasing (Pizzonia & Suhr, 2022). However, as is the case with the everyday memory errors, unlike the diary, retrospective reports on strategy use may too not be able to demonstrate the full extent of strategy use in day-to-day life. Yet,

only one study to date, conducted nearly 40 years ago, used a diary method to investigate strategy use by young and older adults and failed to produce reliable results due to a small sample size (J. C. Cavanaugh et al., 1983). Therefore, the present thesis aimed to address this gap and capture the frequency of the different strategies in young and older adults by using a structured diary method.

The third key aim was to investigate the self-reported frequency of EMFs and everyday memory strategy use across the adult lifespan, using a retrospective questionnaire method. A large number of questionnaires have been developed to study everyday forgetting (Carrigan & Barkus, 2016; Dixon, 1989; Herrmann, 1982), however, very few studies have used these questionnaires to investigate age effects. Moreover, none of the questionnaires have a balanced representation of the three, most commonly experienced types of memory errors, which, whilst sometimes labelled differently, were repeatedly found in the diary studies, including Study 1a, described in Chapter 2 (Haas et al., 2020; Niedźwieńska et al., 2020; Unsworth et al., 2012). In addition, as noted in Chapter 1, some existing questionnaires still contain questions which may not be relevant to today's living. For example, how many people can say that they still try and memorize phone numbers when modern technology eliminates the need for it? Similarly, while a few measures exist for investigating everyday memory strategy use, these have been criticised for not capturing the use of new technology (Tomaszewski Farias et al., 2018). Hence, it would not be unreasonable to presume that the ease of using electronic notes, calendars, reminders, etc., may have changed the frequency of using external strategies in both, young and older adults. To achieve this aim, two new questionnaires, the Everyday Memory Errors Questionnaire (EMEQ, Study 3a) and the Everyday Memory Strategies Questionnaire (EMSQ, Study 4a), were developed using those memory errors and memory strategies that were most often reported in diary Studies 1a and 1b.

A final aim of this thesis was to investigate stereotypical views towards memory and ageing. The existing evidence suggests that stereotypical views can impact retrospective reports of one's memory ability (Bouazzaoui et al., 2016; Lineweaver et al., 2009), as well as performance on episodic and working memory tasks (Armstrong et al., 2017; Lamont et al., 2015). Research to date shows that people have more knowledge about abnormal ageing than normal ageing in general (Cherry et al., 2014; Reese & Cherry, 2006). Given that stereotypical thinking can be primarily attributed to the lack of knowledge about normal memory changes in ageing (Donizzetti, 2019), the present thesis

attempted to obtain a clearer picture of people's views on forgetting in everyday life. In Study 3b, participants were asked to rate how frequently they expected people of different age groups to experience different memory errors (EMEQ items) in a typical month. In Study 4b, participants had to rate how frequently they expected people of different ages to use different memory strategies (EMSQ items) in a typical month.

7.2. Main Findings

7.2.1 Findings related to the diary studies of everyday memory errors in young and older adults.

Studying EMFs using a structured diary method is an emerging area of research, with only a handful of studies conducted to date that have examined the effects of age (J. C. Cavanaugh et al., 1983; Haas et al., 2020; Niedźwieńska et al., 2020), and just a few more that have investigated everyday forgetting in young adults only (Crovitz et al., 1984; Sellen, 1994; Terry, 1988; Unsworth et al., 2012, 2013). The two diary studies described in Chapters 2 to 3, were the first comprehensive studies looking not just into age effects on EMFs, but also addressing the issue of individual differences and the reliability of a diary method.

First, results from the studies in Chapters 2-3 show, that young and older adults report a similar number of memory failures in their daily lives, which means that there is potentially a “disconnect” between the negative age effects across many memory domains in the laboratory and people's memory performance in the real-life environments. Whilst these findings are similar to those found in a study by Laughland (2017), other diary studies reported different results, with either older adults reporting more memory failures overall (J. C. Cavanaugh et al., 1983), or younger adults reporting a higher frequency of failures than older (Haas et al., 2020; Niedźwieńska et al., 2020). This discrepancy can potentially be explained by the variation in the clarity of the instructions on what constitutes a memory error. For example, Sellen (1994) noted that some everyday memory errors may be difficult to detect as the person may not see some erroneous actions as a failure of memory. With that in mind, the instructions given to participants in Studies 1a and 2 were clarified by encouraging to record instances even if they were not sure, if an experience they had could be classed as a memory failure. This in turn could have changed the pattern of reporting, resulting in no overall age differences.

Findings concerning which type of memory error is most frequently reported by both age groups were somewhat peculiar and signify the importance of considering individual differences when studying everyday forgetting. Previously, two diary studies reported that PM failures were most frequent in young and older adult groups (Haas et al., 2020; Niedźwieńska et al., 2020). However, Laughland (2017) found that while participants recorded more PM errors than AM, and more RM errors than AM, there was no significant difference between PM and RM. Initial results of Study 1a showed all three types of failures being reported at a similar frequency. However, when age differences in busyness were taken into the account, as it similarly correlated with at least one type of memory error in both groups, the PM errors appeared to be most frequently reported, followed by the AM and then RM. In Study 2, different patterns were observed. The initial analyses revealed that in both age groups, PM errors were most frequently reported, and there were no differences in frequency between AM and RM. Nevertheless, when the age differences in the reported levels of procrastination were taken into the account, the superiority of PM errors disappeared. These results indicate the importance of considering individual differences when studying everyday memory failures, as they can quite prominently change at least some of the main findings. Interestingly, whilst Niedźwieńska et al. (2020) demonstrated that controlling for differences in lifestyle did not change their initial findings, it is important to note, that in their study authors did not use a specific measure to assess levels of busyness, or routine in different age groups. Instead, differences in lifestyle were judged based on the assumption, that those with full-time jobs would have more routinized lives than young students, and older adults with frequent, albeit irregular social activities would have less routinised lifestyles, compared to older adults who are not enrolled in any social clubs. Correlational analyses between routine and the frequency of EMFs in Study 1a speak against this assumption, as no significant correlations were found between the measures of routine and PM, RM, AM, or even the total number of recorded memory failures in both age groups. In fact, it was the levels of busyness that were positively associated with the frequency of PM failures in both age groups, and additionally with the RM and the total number of failures in the older adult group.

The importance of considering individual differences was further demonstrated by looking at age differences in the frequency of specific types of memory failures. In relation to PM failures, results from Study 1a were in line with those found in studies by

Niedźwieńska et al. (2020) and Haas et al. (2020), showing that young adults reported significantly more PM errors compared to older adults, thus providing further support for the age-PM paradox. More importantly, these results held up even after controlling for the age differences in the level of busyness. However, whilst this result was also replicated in the initial analysis in Study 2, when controlling for large groups differences in the reported levels of procrastination, the advantage in PM for older adults disappeared, and the age differences in PM were no longer observed. The role of procrastination in PM tasks was noted before in a study by Zuber et al. (2021) who found that self-reported level of procrastination was a significant predictor for the number of PM failures, but no diary studies to date have taken this into the account.

Whilst findings on age differences in the frequency for AM were similar to previous diary studies, showing no age effect across both studies in Chapters 2-3, results in relation to age effects on RM errors were mixed. Whilst Study 1a showed that older adults reported significantly more RM failures than young, this was not replicated in Study 2, as no age differences in RM were observed. While the latter result is consistent with prior diary studies (Haas et al., 2020; Niedźwieńska et al., 2020), it is not clear why this age effect was found in Study 1a. There is, however, one significant methodological difference between these studies. In Study 1a, all participants throughout the study were wearing a wristwatch, which acted as a prompt by vibrating three times per day, with a message displayed on the screen during vibration: “Diary”. It is, therefore, possible, that this prompt enabled both groups to capture more errors overall, revealing the age differences in RM, but more studies would need to be conducted to test this assumption, as this extra prompt has never been used in prior studies.

Results in relation to the frequency of different types of memory failures within the young adult group were fairly similar to prior diary studies, but differences emerged for the older adult group. Across both studies, young adults reported experiencing more PM errors than RM or AM. However, whilst Study 2 showed no differences between RM and AM errors in young adults, an identical finding to that of Niedźwieńska et al. (2020), Study 1a demonstrated that in addition to reporting PM failures as the most frequent, young adults also reported more AM failures than RM. For older adults, however, the type of failure was only significant in Study 1a, and only in the initial analysis before accounting for differences in busyness. Once busyness was accounted for, no significant differences between the types of errors were found in the older adults’ group across studies reported in

Chapters 2-3, again indicating the importance of looking at the individual differences and their correlations with the reported everyday memory failures.

Interesting findings also emerged in relation to the frequency of specific memory failures within the categories of PM, RM and AM. Study 1 results were largely similar to those found by Niedźwieńska et al. (2020) with older adults reporting more often than young forgetting names and words, and young adults more frequently reporting that they forgot to call or text someone, forgot to buy or collect something, or forgot to complete a one-off activity. However, Study 1a also showed that young adults also reported more frequently than older forgetting the appointments, and unlike prior studies, no age differences were observed in the subcategories of AM. Study 2 produced different patterns in subcategories of three types of memory failures. Whilst in Period 1 of diary keeping, age differences appeared only in the subcategory of RM, with older adults reporting forgetting names and words more frequently than young, unlike in Study 1a, young adults reported more frequently forgetting that a particular intention was formed. However, in Period 2, age differences were only observed in PM, with young adults reporting that they forgot to take something extra from home more frequently than older adults, and in AM, with older adults more frequently than young forgetting why they came into a certain location, but young adults reporting that they more frequently forgot to take the usual things from home. This variation in the frequency of specific types of failures obtained across the two diary studies of EMFs is suggesting that at least when looking at the micro-level, EMFs are not a stable phenomenon, and their manifestation or type can change from month to month.

In summary, the results from the studies described in Chapters 2-3 provided further support for the existence of the age-PM paradox, however, in Study 2 this was only true when individual differences in the levels of procrastination were not taken into consideration, signalling that the procrastination may explain positive age differences in everyday PM. It is, however, important to note that the lack of age effects on the overall number of memory failures was found in both study designs, using a single diary, or keeping two diaries 3-4 weeks apart.

7.2.2 Findings related to the diary study of memory strategy use in young and older adults

The second aim of this thesis was to investigate the frequency of everyday memory strategy use in young and older adults. To the best of my knowledge, this is the first diary study that has allowed for a comprehensive evaluation of age effects on memory strategy

use not just by simply examining differences in the internal versus external strategies, but also assessing differences in the use of strategies which serve a specific purpose.

First, results of Study 1b clearly demonstrated that young and older adults use memory strategies at a similar rate in their daily lives, as no age differences in the overall number of reported strategies were noted. More importantly, in Study 1b, memory strategy descriptions provided in the diary allowed for a more detailed evaluation of strategies specifically used to aid PM or resolve RM and AM failures. One of the most common explanations for why the age-PM paradox occurs is the proposition that older adults must be using more memory strategies to aid their PM (Haas et al., 2020; Ihle et al., 2012; Niedźwieńska et al., 2020). However, the results of Study 1b provided the first empirical evidence that older adults do not use more PM-related strategies to help them with daily PM tasks. Interestingly, out of all recorded strategies, PM-related strategies were reported as most commonly used by both young and older adults (53% and 57%, respectively) with no age differences in this type of strategy use observed. Moreover, strategies recorded by both age groups were mostly reported to be used at the encoding stage, which also explains why PM-related strategies were reported most frequently.

Furthermore, the results indicated that young and older adults reported using internal and external strategies with similar frequency. The lack of age effects on the use of external and internal strategies is in contrast to some studies showing that older adults use more external strategies, and young adults use more internal strategies (Bouazzaoui et al., 2010; Dixon & Hultsch, 1983), or that in general, external strategy use increases with increasing age (Pizzonia & Suhr, 2022). It is, however, important to note that overall, prior research in strategy use in everyday life mostly used questionnaire methods and produced mixed results in relation to age effects. Given that a diary method allows to overcome the need to rely on retrospective memory and also allows a person to describe the strategies they use in their own words, it may be possible that a structured diary method is better equipped to provide a more accurate picture of memory strategy use in everyday life. Likewise, it is possible that the lack of age effects on the use of external memory strategies could be due to advances of technology, which, due to its simplicity, may have increased the use of external strategies in young adults thus eliminating the age differences.

7.2.3 Findings related to retrospective self-reports of everyday memory errors and memory strategy using questionnaire method

The third aim of the present thesis was to investigate EMFs and the use of memory strategies using retrospective questionnaires. Retrospective data from Study 3a produced interesting and very promising results, obtained using the newly created Everyday Memory Errors Questionnaire (EMEQ). First, it must be noted, that whilst no age differences were found in the overall frequency ratings of EMFs, this was only achieved after controlling for busyness and mood, yet again demonstrating the importance of considering individual differences when using self-reported measures. Perhaps the most promising results of all, however, was the ability to capture age differences in PM failures, which mimicked the results of the diary Study 1a, described in Chapter 2, as well as those found by Haas et al. (2020). Moreover, a higher frequency of PM failures in young and middle-aged adults, compared to older adults was also noted in a diary study by Niedźwieńska et al. (2020), indicating that the items chosen for EMEQ, at least those reflecting PM, elicit similar accounts of EMFs to those obtained via structured diaries. These results suggest that potentially, EMEQ may be more useful in detecting age differences in PM, compared to a well-known Prospective and Retrospective Memory Questionnaire, which generally fails to find significant age effects (Crawford et al., 2003; Papaliagkas et al., 2017; Piaulino et al., 2010; Smith et al., 2000).

Whilst findings of age differences in PM were promising, age differences in RM only partially reflected the results of the diary study described in Chapter 2, as only very old adults reported a higher frequency of RM compared to all younger groups. However, Study 3a produced a surprising and somewhat counterintuitive result, showing that the highest frequency by all age groups, including young adults, was assigned to memory failures belonging to RM. As such, these results contradict results from prior diary studies, including Study 1a, which demonstrated that all age groups report more PM failures than RM or AM (Haas et al., 2020; Niedźwieńska et al., 2020).

Study 3a also provided somewhat alarming indication, that young and middle-aged adults appeared to be significantly misjudging the patterns of memory failures by reporting the highest frequency of RM failures, when in fact, diary studies to date show that generally, PM failures are most prevalent in these two age groups. In addition, one diary study investigating EMFs in young adults only reported attentional failures as the most frequently recorded by young adults (Unsworth et al., 2012), however, since mind-wondering instances were also categorised as attentional failures, it is possible that without these, different patterns of the frequency of PM, RM and attentional failures would have

been obtained.⁷ In contrast, the three older age groups in Study 3a appeared to be somewhat better at judging their memory abilities by ascribing the highest frequency to RM failures. Perhaps the most noteworthy result, suggesting that findings from meta-memory questionnaires should be interpreted with great caution, is the finding that the overall mean frequency ratings across all age groups were very small. In Study 3a, the highest mean frequency ratings did not reach 3, which would suggest that during a typical month a person would experience a memory failure only sometimes (Once a week). For comparison, in Study 1a, the mean number of reported memory failures over just 3 days was 6.86 in young and 6.44 in older adults, and in Study 2, the mean number of reported memory failures was 5.85 in young and 5.65 in older adults in Period 1, and 4.20 in young, and 4.60 in older adults in Period 2. These results suggest that adults, regardless of their age, may not be very good at retrospectively judging the frequency with which they forget things in their day-to-day lives.

Whilst some EMFs can be easily forgotten and thus reduce the accuracy of retrospective reports, it should not be the case for self-reports of everyday memory strategy use, since the decision to use a specific strategy is made on a more conscious level. The results from the Study 4a, described in Chapter 4 demonstrated an overall preference by all age groups to use external memory strategies, which is in line with the findings of diary Study 1b, as well as prior studies using memory strategy questionnaires and interviews (Cavanaugh et al., 1983; Garrett et al., 2010; Harris, 1980; Hertzog, Lustig, et al., 2019). Another finding in line with the results of Study 1b was that no age differences were observed in the overall use of memory strategies, suggesting that the newly created Everyday Memory Strategy (EMSQ) can capture similar patterns in strategy use as obtained by structured diary diary method.

The decision to separate external strategies into electronic versus non-electronic has produced some very interesting and meaningful insights into age differences in external strategy use and offered some explanation for the lack of age effects in the overall external strategy use. The results of Study 4a (Chapter 5) demonstrated that young and middle-aged adults reported using external electronic aids more often than older adults, whereas older adults were using external non-electronic aids more often than young. It is,

⁷ In the study by Unsworth et al. (2012), young adults recorded a total of 934 attentional failures, 674 RM failures and 613 PM failures. Out of 934 attentional failures, 277 were instances of mind-wandering.

therefore, possible, that this is why prior studies investigating age effects on memory strategy use with questionnaires only covering non-electronic aids indicate an increase in the use of external strategies with age (Pizzonia & Suhr, 2022), or finds no age effects (de Frias et al., 2003; Ponds & Jolles, 1996).

Another interesting finding from Study 4a was that no age effects were found in the use of internal memory strategies. Investigations of age effects on the internal strategy use to date, while mixed, by large indicate a reduction of the use of this type of strategy with increasing age (Guerrero Sastoque et al., 2019; Pizzonia & Suhr, 2022). Nevertheless, results of Study 4a are in line with those found in Study 1b, indicating that the EMSQ produces similar results to those found in the diary study in relation to age effects on both, external and internal strategy use.

Finally, an important discovery in relation to the effect of mood and lifestyle on the use of memory strategies was made. As in all studies in the present thesis, age groups in Study 4a significantly differed in their subjective ratings of mood and lifestyle (levels of busyness). The systemic review by Pizzonia and Suhr (2022) showed that the results regarding the effect of anxiety on memory strategy use to date were very mixed. Likewise, it would not be unreasonable to believe that differences in lifestyle, that is, higher levels of busyness may require a person to resort to using more memory strategies. Indeed, the results of Study 4a showed positive associations between levels of anxiety, busyness, and memory strategy use. However, an important finding was that controlling for these individual differences did not alter the results of the main analyses on age effects, indicating that whilst they are associated with the use of strategies, anxiety and busyness do not directly impact the strategy use in day-to-day lives.

In summary, retrospective reports on EMFs and memory strategy use in Studies 3a and 4a largely align with the results obtained in diary Studies 1a and 1b and demonstrate no age differences in the overall number of everyday memory failures or strategy use. However, results from Study 3a offer a word of caution when relying on retrospective reports on the frequency of EMFs. As shown by this study, adults, especially young and middle-aged, seem to be misjudging the patterns of their EMFs and, more importantly, adults of all age groups are potentially underreporting the frequency of EMFs in their daily lives.

7.2.4 Findings related to stereotypical views on memory and ageing

Results from the two studies presented in Chapter 6 strongly suggest the existence of stereotypical views not only towards everyday memory functioning and ageing (Study 3b) but also towards the strategy use and ageing (Study 4b). First, adults of all ages seem to believe that the frequency of PM, RM and AM increase with increasing age, whilst older adults, including young adults themselves, believe that people in their 20s, and to some extent those in their 40s, have perfect memory and never, or almost never experience any type of memory failures. Views of increasing frequency of memory failures with age in Study 3b are perhaps not surprising, given that many previous studies consistently demonstrated similar beliefs (Lineweaver & Hertzog, 1998; Vaportzis & Gow, 2018). As noted by Kornadt et al. (2020), the old age stereotypes develop throughout the lifespan and are based on personal experiences as well as cultural exposure to negatively presented information about ageing. As it happens, the vast majority of studies in memory and ageing are conducted using laboratory experiments and show negative age effects across many memory domains. Therefore, it is perhaps not surprising that the general public, in light of these results, views ageing as mostly associated with memory decline and expects this decline to be evident in real-life performance.

What is, however, surprising, is just how wrong people are when rating the frequency of PM failures within each target age group. It is known from diary studies, including Study 1a, that young, middle-aged and older adults report experiencing more PM failures than RM or AM (Haas et al., 2020; Niedźwieńska et al., 2020). Yet participants in Study 3b believed that starting from the age of 40, PM failures are the least frequent. It is also very interesting to see that adults do not seem to be using self as a reference point when rating the frequency of EMFs in their peer group. For example, in Study 3a when rating their frequency of memory failures, young adults indicated that they experience more RM failures than PM or AM, yet when rating others in the same age group as themselves, the pattern was different.

The views towards strategy use in ageing, described in Chapter 6 in Study 4b, while in contrast to what was found in Study 1b, appeared to be in line with results from prior studies showing, that increasing age is associated with increased use of external strategies (Pizzonia & Suhr, 2022). However, this was only true for external non-electronic aids, as the use of external electronic aids was expected to be the least frequent in older adult target groups. This can also suggest that perhaps young and middle-aged

adults hold a different kind of biased views towards older adults thinking that they may not be as “technology savvy” as the younger generation? Contrary to the existing evidence on strategy use, participants of all ages believed that the frequency of using internal strategies will also increase with increasing age. As no age effects were found in the use of internal strategies in Study 1b using a diary method, or in the Study 4a with retrospective reports, and other evidence suggests the decrease in the internal strategy use with older age (Pizzonia & Suhr, 2022), these findings are quite surprising. Nevertheless, a possible explanation for this could be that in general, people may view memory strategies as a way of providing support for failing memory. Since Study 3a demonstrated general views that everyday memory functioning declines with increasing age, it is not unreasonable to then see that people also associate increased use of memory strategies (apart from external electronic aids) with increasing age, i.e., hold the same stereotypical views towards memory strategy use.

Still, unlike rating the frequency of EMFs for others in Study 3a, people appear to use self as a reference point when rating the frequency of strategy use in people close to their age. For example, young adults expected those in their 20s to use external electronic aids most frequently, just as they have indicated the frequency of using this type of strategy for themselves in Study 4a.

In summary, results from Study 3a and 4b demonstrate clear stereotypical views towards ageing which are not isolated to everyday memory functioning alone but appear to also hold in relation to memory strategy use.

7.3 Methodological implications

This thesis has made several methodological contributions to studying EMFs. The first important contribution is the use of a 3-day diary for recording EMFs. In previous diary studies of EMFs, the dairies were predominantly kept by participants for a total of 7 days (Crovitz et al., 1984; Crovitz & Daniel, 1984; Niedźwieńska et al., 2020; Unsworth et al., 2012, 2013), with few others using a 28-day diary (Laughland, 2017; Reason, 1984). However, as noted by Lida et a. (2012), dairies requiring participants to make a record every time something happens, if kept for a longer time, can lead to participants' burnout. Indeed, Laughland (2017) compared 28- and 7-day dairies of EMFs and found a significant diary entry reduction rate in a 28-day diary, with a 7-day diary having a significantly larger

number of entries compared to the week 1 of the 28-day diary. The results from the present thesis showed that keeping a diary of EMFs for only three days is sufficient enough to capture everyday failures without imposing too much burden on participants, as the initial analyses on age effects produced similar results to those found in a 7-day diary. Moreover, Study 2 demonstrated that the diary is a reliable method for investigating EMFs, as the main results regarding age effects remained the same during both diary-keeping times, and the number of recorded EMFs in Period 1 and 2 significantly and positively correlated with each other.

Additional methodological consideration should be made in relation to using prompts in the structured diary studies. In Study 1a, significant age differences emerged in relation to RM failures with older adults reporting experiencing them more frequently than young, but this was not replicated in Study 2, nor was found in prior diary studies investigating age differences in EMFs (Haas et al., 2020; Niedźwieńska et al., 2020). One of the most pronounced differences between these studies is that in Study 1a, participants were given plastic wristwatches to wear for the duration of the diary-keeping, which were set to vibrate three times per day (random times each day) whilst displaying a message on the screen “*Diary*”. The fact that the paper diary itself is already acting as a prompt was already demonstrated by Laughland and Kvavilashvili (2018), where it was noted that significantly more EMFs were recorded in the paper diary compared to a smartphone. However, it is possible that having a reminder watch throughout the study makes people even more alert and in turn increased self-monitoring. Hence, more future studies need to be conducted to test this hypothesis and see if (1) this additional prompt would increase the number of entries in both, young and older, and (2) other studies incorporating reminder watches would replicate the findings in relation to age differences in RM.

Another significant methodological contribution of the present thesis is the development of a coding manual for everyday memory failures. At present, studies investigating EMFs, apart from Niedźwieńska et al. (2020), use quite varied coding systems or make a questionable judgement when allocating failures to specific EMFs categories. This in turn makes the comparison of findings between the studies somewhat difficult. For example, Haas et al. (2020), adapted the coding scheme developed by Eldridge et al. (1992), with some changes made mostly to the category of PM failures. In their coding under RM failures, they have included a subcategory of “Near RM failure” and the same was in the PM category. If a person reports that he/she almost forgot

something, this cannot be classed as a failure because they did not fail to recall something (RM) or did not fail to do something (PM). In other words, the failure did not happen. In addition, under PM failures, Haas and colleagues included a subcategory of “*RM component of a future intention*” with an example of a person going to get something from another room and once there, failing to remember why or what they came in there for. As noted by Kvavilashvili and Ellis (1996), these types of failures cannot be classed as failure in PM as it indicates the loss of aspect of an immediate intention whilst already performing an intended activity, i.e., intention in action, and therefore would constitute an absent-minded failure. Similarly, whilst Unsworth et al. (2012) coded EMFs into PM, RM and Attention failures, the latter category, in addition to absent-mindedness, also contained examples of mind-wandering, which are never included in other diary studies of EMFs. Likewise, in another study by Unsworth et al. (2013), when coding RM failures, authors included instances of when a person forgets what he/she was doing or looking for, which is another very clear example of AM failure, not RM (Kvavilashvili & Ellis, 1996).

Lastly, another methodological contribution was made by creating two new questionnaires with empirically validated items, for studying EMFs and memory strategy use. The existing questionnaires to date, especially for studying EMFs contain items selected from personal observations and experiences (Broadbent et al., 1982), some are based mainly on the theoretical distinctions or by referring to already developed questionnaires (Troyer & Rich, 2002). Whilst the reliability of our questionnaires will still need to be tested, preliminary findings from Studies 3a, for example, suggest that in relation to age differences, the EMEQ can show similar patterns to those found in the diary studies in relation to age benefit on PM. The latter results were not found in prior questionnaire studies. Likewise, the strategy questionnaire (EMSQ) also demonstrated similar patterns of strategy use to one found in the diary study described in Chapter 2. In addition, EMSQ contains examples of strategies using technology, something that has been lacking in the existing memory strategy questionnaires (Tomaszewski Farias et al., 2018). The inclusion of technology-based strategies has important implications for studying memory strategy in studies with between-subjects design, as Study 4a demonstrated that younger adults relied mostly on external electronic aids, whereas older adults maintained the preference for non-electronic external aids. The rise in the use of technology and the ease of using it might explain, at least until the next generational change, why no age effects were found in the use of external strategies in Study 4a.

7.4 Theoretical implications

The results of the present thesis offer some theoretical implications for our understanding of memory functioning in everyday life and, most importantly, the age-PM paradox. As noted in Chapter 1, results from the laboratory experiments, supported by varying theoretical approaches, consistently show episodic memory impairments in older adults. However, in naturalistic settings, we do not see such large age effects. This is especially true for PM as for the most part, the substantially negative age effects are found in the laboratory performance, but in the natural environment, the age effects are often reversed in naturalistic studies of pM especially those that use time-based PM tasks (Henry et al., 2004b). However, since the emergence of the “*age-PM paradox*”, new research evidence started to appear indicating that this paradox may be due to using specific tasks. For example, Schnitzpahn et al. (2020) found no age differences in the event-based tasks in the naturalistic setting, as opposed to the negative age effects in the lab, but significant age benefit in the experimenter set naturalistic time-based tasks. In addition, when the authors looked that the results of the self-assigned time-based task in the naturalistic setting, both, young and older reported similar rates of success in carrying out these self-set intentions. Moreover, Haines et al. (2020) proposed that the age-PM paradox can be explained by the use of diverse PM tasks across naturalistic and laboratory settings. The authors offered to separate time-based tasks into two conceptually distinct tasks: time-of-day tasks (which are supported by environmental cues) and time-interval tasks (in which little environmental support is provided). The results from their Experiments 1 and 3 showed that whilst in the laboratory setting, young adults outperformed older adults on all three types of PM tasks (event-based, time-interval, time-of-day), no age differences were found in any of the naturalistic tasks, apart from age benefit found in Experiment 1 on a time-of-day task. Whilst in the present thesis, we did not attempt to categorise PM failures based on the type of tasks, the results of Study 2 offer yet another possible explanation for the age-PM paradox. Whilst the PM benefit was demonstrated in Study 1a and remained present after controlling for busyness, Study 2 is the first study to demonstrate, that the age-PM benefit disappeared as soon as differences in procrastination levels were taken into the account. These results indicate that procrastination may be a key variable which creates this age-PM benefit, found in our studies, as well as prior diary studies (Haas et al., 2020; Niedźwieńska et al., 2020).

Another important consideration relates to the use of memory strategies. Craik (1986) postulated that older adults would perform better on memory tasks if they were given more environmental support. Following this view, suggestions have been made that the age-PM paradox can be explained by the increased use of memory aids in older adults (Haas et al., 2020; Ihle et al., 2012; Niedzwienska & Kvavilashvili, 2019). Schnitzpahn et al. (2020) have already demonstrated that the reminder use did not explain the age-PM paradox. Our Study 1b adds additional evidence by demonstrating that not only that there is no age difference in the overall use of strategies, but young and older adults report using a similar number of PM-related strategies and a similar number of strategies used at the encoding level.

7.5 Limitations and future directions

The findings of this thesis are subject to some limitations but also offer some new and exciting future directions. The first limitation of the current thesis was that we did not have a proportionate gender balance with the majority of female participants across all our studies. Whilst it was not our aim to investigate gender differences, it would be interesting to see if EMFs are more prevalent in one gender compared to another, especially in light of the evidence of gender differences in episodic memory, showing a female advantage (Asperholm et al., 2019). Thus, future studies may consider more targeted recruitment. Another limitation of this thesis was that we were not able to test the hypothesis of the importance of the prompt when using the structured diary method. Whilst the comparison of the results between Studies 1a and 2 is possible, if differences are found in the number of recorded EMFs across the studies, it would be hard to conclude whether they were truly due to a prompt, or due to Covid-19 restrictions imposed on participants in the Study 2. Future studies should include subgroups of participants with and without a reminder-watch, to check whether (1) the watch will elicit more entries, and (2) to check whether the negative age effects in the number of recorded RM failures can be replicated when the reminder-watches or prompts are used.

It is also worth noting, that none of the studies in the present thesis were pre-registered. Whilst at the beginning of this journey, pre-registering studies at the University of Hertfordshire was considered desirable but not fully mandated, Studies 2, 3a, 3b, 4a, and 4b, had to be all designed in very short space of time (due to a complete change in the

direction of this thesis imposed by Covid-19 pandemic) and hence the consideration for pre-registering studies was not deemed possible.

Lastly, due to the lack of time and the need for more thorough examination, the newly created questionnaires (EMEQ and EMSQ) were not subjected to a process of validation and full psychometric analyses. However, this will be achieved in a due course following the submission of the current thesis.

The present thesis also offers new avenues for future research of EMFs. First, the results relating to the association between the age-PM benefit and procrastination merit the need for more diary studies which also check the differences in the procrastination factor. Results of Study 2, as well as those found by Zuber et al. (2021), provide the first evidence of the importance procrastination plays in PM performance. If future studies can replicate these findings, the age-PM paradox may finally be explained.

In addition, future use of our newly developed coding manual for EMFs in other studies would be welcomed, as it not only would allow a direct comparison between study results but also potentially allow to have collaborative project work. By aggregating data from many studies using the same coding scheme, it would be possible to make better conclusions as to the frequency and types of EMFs, that are prevalent in different age groups of cognitively healthy adults. Moreover, by extending the use of a semi-structured diary to study EMFs in people with Mild Cognitive Impairment⁸ and those with early stages of Alzheimer's disease via their carers, we may be able to gain more understanding of which types of EMFs become more prevalent in atypical ageing and use this information to help aid the early diagnostic process.

7.6 Conclusion

The current thesis presented new evidence of the existence of age-PM benefit in naturalistic settings, and at the same time demonstrated that some individual difference variables, such as procrastination, have the potential to eliminate this benefit. Moreover, this thesis demonstrated that structured diaries are a reliable method for studying memory functioning in everyday life. Results from the newly created questionnaire on EMFs also

⁸ Only one study to date by Niedźwieńska and Kvilashvili (2019) has successfully used this type of diary in people with Mild Cognitive Impairment.

suggested that retrospective self-reports of everyday memory functioning should be interpreted with caution, as even young adults seem to have somewhat impaired metamemory for their memory functioning in everyday life. However, a new questionnaire on the memory strategy use demonstrated a potential to reflect similar findings to those obtained via the diary method, showing a good potential for future use. The evidence from the study on stereotypical views further proved the lack of knowledge people have about normal everyday memory functioning as well as the existence of strong stereotypical views which goes both ways – younger adults think memory inevitably declines with increasing age, whereas old adults believe that young person’s memory is perfect. Finally, this thesis proposes interesting avenues for future research, which can also potentially help to disentangle the age-PM paradox.

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Appendix I: Martin and Park Environmental Demands Questionnaire (Study 1a, Study 2, Study 3a, Study 4a, Chapter 2, Chapter 3, Chapter 4, Chapter 5)

Busyness Items

1. How busy are you during an average day?

Not busy at all Rarely busy Somewhat busy Very Busy
Extremely busy

2. How often do you have too many things to do each day to actually get them all done?

Never Rarely Sometimes Often Very often

3. How often do you find yourself rushing from place to place to get to appointments or to get things done?

Never Rarely Sometimes Often Very often

4. How often are you so busy that you miss scheduled breaks or rest periods?

Never Rarely Sometimes Often Very often

5. How often are you so busy that you miss your regular meal times?

Never Rarely Sometimes Often Very often

6. How often do you rush out of the house in the mornings to get to where you

need to be?

Never Rarely Sometimes Often Very often

7. How often do you have so many things to do that you go to bed later than your regular bedtime?

Never Rarely Sometimes Often Very often

Routine Items

8. How often do your days follow a basic routine?

Never Rarely Sometimes Often Very often

9. How often do you get out of bed in the morning and go to bed at night at about the same time?

Never Rarely Sometimes Often Very often

10. How often do you eat all of your meals at the same time each day and night?

Never Rarely Sometimes Often Very often

11. How often do you engage in activities at home at a specific time (i.e. read the paper after work, watch a particular television show, children, hobbies, etc.)?

Never Rarely Sometimes Often Very often

*Appendix II: Multifactorial Metamemory Questionnaire (Study 1a and 1a,
Study 2, Chapters 2 and 3)*

How I Feel About My Memory

Name: _____ Date: _____

Below are statements about feelings that people may have about their memory. Read each statement and think about your feelings over the past *two weeks*. Then, check the box next to the response that best describes how much you agree or disagree.

1. I am generally pleased with my memory ability.

Strongly Agree Agree Undecided Disagree Strongly Disagree

2. There is something seriously wrong with my memory.

Strongly Agree Agree Undecided Disagree Strongly Disagree

3. If something is important, I will probably remember it.

Strongly Agree Agree Undecided Disagree Strongly Disagree

4. When I forget something, I fear that I may have a serious memory problem, like Alzheimer's disease.

Strongly Agree Agree Undecided Disagree Strongly Disagree

5. My memory is worse than most other people my age.

Strongly Agree Agree Undecided Disagree Strongly Disagree

6. I have confidence in my ability to remember things.

Strongly Agree Agree Undecided Disagree Strongly Disagree

7. I feel unhappy when I think about my memory ability.

Strongly Agree Agree Undecided Disagree Strongly Disagree

8. I worry that others will notice that my memory is not very good.

Strongly Agree Agree Undecided Disagree Strongly Disagree

9. When I have trouble remembering something, I'm not too hard on myself.

Strongly Agree Agree Undecided Disagree Strongly Disagree

Please turn page over to complete the questionnaire.

10. I am concerned about my memory.

Strongly Agree Agree Undecided Disagree Strongly Disagree

11. My memory is really going downhill lately.

Strongly Agree Agree Undecided Disagree Strongly Disagree

12. I am generally satisfied with my memory ability.

Strongly Agree Agree Undecided Disagree Strongly Disagree

13. I don't get upset when I have trouble remembering something.

Strongly Agree Agree Undecided Disagree Strongly Disagree

14. I worry that I will forget something important.

Strongly Agree Agree Undecided Disagree Strongly Disagree

15. I am embarrassed about my memory ability.

Strongly Agree Agree Undecided Disagree Strongly Disagree

16. I get annoyed or irritated with myself when I am forgetful.

Strongly Agree Agree Undecided Disagree Strongly Disagree

17. My memory is good for my age.

Strongly Agree Agree Undecided Disagree Strongly Disagree

18. I worry about my memory ability.

Strongly Agree Agree Undecided Disagree Strongly Disagree

Memory Mistakes

Name: _____ Date: _____

Below is a list of common memory mistakes that people make. Decide how often you have done each one in the *last two weeks*. Then, check the box next to the appropriate response.

1. Forget to pay a bill on time.

All the Time Often Sometimes Rarely Never

2. Misplace something you use daily, like your keys or glasses.

All the Time Often Sometimes Rarely Never

3. Have trouble remembering a telephone number you just looked up.

All the Time Often Sometimes Rarely Never

4. Not recall the name of someone you just met.

All the Time Often Sometimes Rarely Never

5. Leave something behind when you meant to bring it with you.

All the Time Often Sometimes Rarely Never

6. Forget an appointment.

All the Time Often Sometimes Rarely Never

7. Forget what you were just about to do; for example, walk into a room and forget what you went there to do.

All the Time Often Sometimes Rarely Never

8. Forget to run an errand.

All the Time Often Sometimes Rarely Never

9. In conversation, have difficulty coming up with a specific word that you want.

All the Time Often Sometimes Rarely Never

10. Have trouble remembering details from a newspaper or magazine article you read earlier that day.

All the Time Often Sometimes Rarely Never

11. Forget to take medication.

All the Time Often Sometimes Rarely Never

12. Not recall the name of someone you have known for some time.

All the Time Often Sometimes Rarely Never

13. Forget to pass on a message.

All the Time Often Sometimes Rarely Never

14. Forget what you were going to say in conversation.

All the Time Often Sometimes Rarely Never

15. Forget a birthday or anniversary that you used to know well.

All the Time Often Sometimes Rarely Never

16. Forget a telephone number you use frequently.

All the Time Often Sometimes Rarely Never

17. Retell a story or joke to the same person because you forgot you already told him or her.

All the Time Often Sometimes Rarely Never

18. Misplace something that you put away a few days ago.

All the Time Often Sometimes Rarely Never

19. Forget to buy something you intended to buy.

All the Time Often Sometimes Rarely Never

20. Forget details about a recent conversation.

All the Time Often Sometimes Rarely Never

Use of Memory Strategies

Name: _____ Date: _____

People often use different tricks or strategies to help them remember things. Several strategies are listed below. Decide how often you used each one in the *last two weeks*. Then, check the box next to the appropriate response.

1. Use a timer or alarm to remind you when to do something.

All the Time Often Sometimes Rarely Never

2. Ask someone to help you remember something or to remind you to do something.

All the Time Often Sometimes Rarely Never

3. Create a rhyme out of what you want to remember.

All the Time Often Sometimes Rarely Never

4. In your mind, create an image of something you want to remember, like a name and face.

All the Time Often Sometimes Rarely Never

5. Write things on a calendar, such as appointments or things you need to do.

All the Time Often Sometimes Rarely Never

6. Go through the alphabet one letter at a time to see if it sparks a memory for a name or word.

All the Time Often Sometimes Rarely Never

7. Organize information you want to remember; for example, organize your grocery list according to food groups.

All the Time Often Sometimes Rarely Never

8. Say something out loud in order to remember it, such as a phone number you just looked up.

All the Time Often Sometimes Rarely Never

9. Use a routine to remember important things, like checking that you have your wallet and keys when you leave home.

All the Time Often Sometimes Rarely Never

Please turn page over to complete the questionnaire.

10. Make a list, such as a grocery list or a list of things to do.

All the Time Often Sometimes Rarely Never

11. Mentally elaborate on something you want to remember; for example, focus on a lot of the details.

All the Time Often Sometimes Rarely Never

12. Put something in a prominent place to remind you to do something, like putting your umbrella by the front door so you will remember to take it with you.

All the Time Often Sometimes Rarely Never

13. Repeat something to yourself at increasingly longer and longer intervals so you will remember it.

All the Time Often Sometimes Rarely Never

14. Create a story to link together information you want to remember.

All the Time Often Sometimes Rarely Never

15. Write down in a notebook things that you want to remember.

All the Time Often Sometimes Rarely Never

16. Create an acronym out of the first letters in a list of things to remember, such as carrots, apples, and bread (cab).

All the Time Often Sometimes Rarely Never

17. Intentionally concentrate hard on something so that you will remember it.

All the Time Often Sometimes Rarely Never

18. Write a note or reminder for yourself (other than on a calendar or in a notebook).

All the Time Often Sometimes Rarely Never

19. Mentally retrace your steps in order to remember something, such as the location of a misplaced item.

All the Time Often Sometimes Rarely Never

*Appendix III: Patient Health Questionnaire (Studies 1a, 1b, 2, 3a, and 4a,
Chapters 2, 3, 4, 5)*

PATIENT HEALTH QUESTIONNAIRE-9 (PHQ-9)

Over the last 2 weeks, how often have you been bothered by any of the following problems?
(Use "✓" to indicate your answer)

	Not at all	Several days	More than half the days	Nearly every day
1. Little interest or pleasure in doing things	0	1	2	3
2. Feeling down, depressed, or hopeless	0	1	2	3
3. Trouble falling or staying asleep, or sleeping too much	0	1	2	3
4. Feeling tired or having little energy	0	1	2	3
5. Poor appetite or overeating	0	1	2	3
6. Feeling bad about yourself — or that you are a failure or have let yourself or your family down	0	1	2	3
7. Trouble concentrating on things, such as reading the newspaper or watching television	0	1	2	3
8. Moving or speaking so slowly that other people could have noticed? Or the opposite — being so fidgety or restless that you have been moving around a lot more than usual	0	1	2	3
9. Thoughts that you would be better off dead or of hurting yourself in some way	0	1	2	3

FOR OFFICE CODING 0 + + +
=Total Score:

If you checked off any problems, how difficult have these problems made it for you to do your work, take care of things at home, or get along with other people?

Not difficult
at all

Somewhat
difficult

Very
difficult

Extremely
difficult

Appendix IV: Generalized Anxiety Disorder Assessment (Studies 1a and 1b, 2, 3 and 4, Chapters 2, 3, 4 and 5)

Generalized Anxiety Disorder 7-item (GAD-7) scale

Over the last 2 weeks, how often have you been bothered by the following problems?	Not at all sure	Several days	Over half the days	Nearly every day
1. Feeling nervous, anxious, or on edge	0	1	2	3
2. Not being able to stop or control worrying	0	1	2	3
3. Worrying too much about different things	0	1	2	3
4. Trouble relaxing	0	1	2	3
5. Being so restless that it's hard to sit still	0	1	2	3
6. Becoming easily annoyed or irritable	0	1	2	3
7. Feeling afraid as if something awful might happen	+	+	+	
<i>Add the score for each column</i>				
Total Score (add your column scores) =				

If you checked off any problems, how difficult have these made it for you to do your work, take care of things at home, or get along with other people?

Not difficult at all _____ Somewhat difficult _____ Very difficult
 _____ Extremely difficult _____

Source: Spitzer RL, Kroenke K, Williams JBW, Lowe B. A brief measure for assessing generalized anxiety disorder. *Arch Intern Med.* 2006;166:1092-1097.

*Appendix V: Diary of Everyday Memory Failures (Studies 1a and 2,
Chapters 2 and 3)*

Diary of Everyday Memory Errors

Code: _____

Date: _____

Instructions for diary recording

During the next 3 days, you will keep a diary of everyday memory errors. These errors take a variety of forms and may involve forgetting **future tasks** (e.g., feeding your pet, or buying milk from the supermarket), **past information** (e.g., where you put your keys or the name of your neighbour) or **lapses of attention** or absent-mindedness (e.g., forgetting why you went in a room or putting milk in a cupboard instead of fridge).

In this diary booklet, there are 32 pages (one page for each memory error). Every time a memory error occurs, please complete a questionnaire on a diary page. There is no expected minimum or maximum number of recorded errors, as you may have very few or quite a lot. People vary greatly in this respect. If, on a particular day, you do not experience any memory errors at all that's fine, too. If you find that you are running out of diary pages, please contact me and I will send you an extra booklet.

Please, remember that it is essential that you carry the diary booklet with you all the time throughout the day, so that you can record each memory error immediately after it occurs, or immediately you realise you did not do something you meant to do. However, we appreciate that this may not be feasible on every occasion, for example, you will not be able to record the memory error while you are driving or in the middle of a meeting or conversation. In such cases, please record the memory error at the earliest opportunity after its occurrence, or realisation that it occurred. If, by the time you can record the memory error, you have already forgotten the essential details, then you do not need to record it in the diary by filling in the questions. **Instead, you can acknowledge the occurrence of this memory error by 'ticking' a box on a grid provided on the inner cover page of the diary.**

For each memory error that you notice, you will have to answer 5 questions presented on one page of the diary. Some are structured (you need to select the appropriate response), others are open (you need to describe something with your own words).

Further explanation for these questions are provided below:

1. Write down the date and the exact time when the memory error occurred, or when you realised your error. Also, please write down when you recorded it.
2. Describe your memory error, including what it was, when it occurred, where you were, what you were doing and any other details you think relevant.

3. Indicate your mood immediately before the memory error occurred, on the scale from “very unhappy” to “very happy”.
4. Indicate how serious you think the error was. For example, insignificant (if perhaps it was just slightly annoying or embarrassing), to very significant if could it have been dangerous to you or someone else.
5. Please indicate how upset you were by the memory error on the scale from “not at all upset” to “very upset”.

If you have any problems or questions while you are recording your memory errors please contact the chief investigator.

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Please use this section to acknowledge any memory errors you were unable to record

<p>If you experienced a memory error but were unable to record it at a time and later forgot some details (i.e., what happened, what you were doing at the time, etc.), then please acknowledge having this memory error by ticking a box below for each such unrecorded one.</p>										
DAY 1										
DAY 2										
DAY 3										

Diary

1a. When did you have the memory error? Time _____ Date _____

Or when did you realise you made an error?

1b. When did you record it here? Time _____ Date _____

2. Please briefly describe your memory error (what, when, where):

3. What was your mood immediately before the error? *(circle as appropriate)*

----- 1 ----- 2 ----- 3 ----- 4 ----- 5 -----
 Very **Somewh** **Neutral** **Somew** **Very**

4. How serious/consequential was the memory error? *(circle as appropriate)*

----- 1 ----- 2 ----- 3 ----- 4 ----- 5 -----
 Not at all **Slightly** **Somew** **Quite** **Very**

5. How upset are you with the memory error? *(circle as appropriate)*

----- 1 ----- 2 ----- 3 ----- 4 ----- 5 -----
 Not at all **Slightly** **Somew** **Quite** **Very**

*Appendix VI: Post Diary of Everyday Memory Failures Compliance
Questionnaire (Studies 1a and 2, Chapters 2 and 3)*

5. How did you find recording difficulties/problems using the diary provided?

- Very easy Somewhat easy Somewhat difficult Very difficult

If you found it difficult, what made it difficult for you?

6. Do you think that keeping a diary had any effect on your mood and how you feel?

1	2	3	4	5	6	7
Made me feel			No effect			Made
me feel						
A lot worse						a lot
better						

7. Any other comments?

Appendix VII: Diary of Memory Strategy Use (Study 1b, Chapter 2)

Diary of Memory Strategy Use

Code: _____

Date: _____

Instructions for diary recording

During the next 3 days, you will keep a diary of memory strategies that you may be using in your daily life. Memory strategies can take a variety of forms and may involve using external memory aids (e.g., writing in calendars, using sticky notes, smartphone applications, medication boxes, checklists for shopping) or internal memory strategies (e.g., mental rehearsal of facts or plans, going through alphabet and looking for letter associations, retracing your steps mentally, etc.). Sometimes we might rely on others to help us to remember or just give ourselves more time to remember.

In this diary booklet, there are 32 pages (one page for each memory error). Every time you use a strategy, please complete a questionnaire on a diary page. There is no expected minimum or maximum number of recorded strategies, as you may use very few or quite a lot. People vary greatly in this respect. If, for some reason, you do not use any memory compensation strategies at all, that's fine, too. If you find that you are running out of diary pages, please contact me and I will send you an extra booklet.

Please remember that it is essential that you carry the diary booklet with you all the time throughout the day, so that you can record every strategy immediately after its use, or immediately you realise you forgot to record it. However, we appreciate that this may not be feasible on every occasion, for example, you will not be able to record strategies while you are driving or in the middle of a meeting or conversation. In such cases, please record the memory strategy at the earliest opportunity after its occurrence, or realisation that it occurred. If by the time you can record the strategy use, you have already forgotten the essential details, then you do not need to record it in the diary by filling in the questions.

Instead, you can acknowledge the use of this strategy by ‘ticking’ a box on a grid provided at the end of these instructions.

For each strategy use that you notice, you will have to answer 6 questions presented on one page of the diary. Some are structured (you need to select the appropriate response), others are open (you need to describe something with your own words).

Further explanation for these questions are provided below:

1. Write down the date and the exact time when you used a strategy. Also, please write down when you recorded it.
2. Describe for what purpose you used this strategy (e.g. to remember appointment, to recall someone’s name, to find something, etc.)
3. Describe the strategy you used by providing relevant details.
4. Indicate on the scale if this strategy was effective. For example, YES (if it helped you to remember), NO (If it didn’t) and “I don’t know yet” if for example you wrote something on a sticky note, but it is meant to be used for later.
5. Please provide any other comments that you think might be informative in relation to the particular strategy you recorded.

If you have any problems or questions while you are recording your memory strategies, please contact the chief investigator.

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Please use this section to acknowledge any strategies you were unable to record

If you used a memory strategy but were unable to record it at a time and later forgot some details (i.e., what happened, what you were doing at the time, etc.), then please acknowledge using this strategy by ticking a box below for each such unrecorded use.

DAY 1										
DAY 2										
DAY 3										

Diary Page 1

1. **When did you use this strategy?** **Time** _____ **Date** _____

2. **When did you record it?** **Time** _____ **Date** _____

3. **What did you use this strategy for?**

4. **Please briefly describe your strategy:**

5. **Was this strategy effective? (Circle your answer)**

YES

NO

Don't Know

5. **Any other comments?**

Appendix VIII: Post Diary of Strategies Compliance Questionnaire (Study 1b, Chapter 2)

Below is a list of questions that relate to your experiences of keeping a diary of memory strategies for 3 days. For each question, please select the answer that best applies to you. The purpose of this questionnaire is to find out whether the use of a diary method worked well or not and if you felt this was a useful or interesting experience. *There are no right, or wrong answers so please answer honestly.*

1. Did you keep your diary with you every day of the 3 diary days?

- Yes No

If your answer was NO, on how many days did you not have the diary? Please be specific

2. If you did not keep your diary with you all the time, were there reasons for this and if so please write what the reason was/were? (Did you forget? Was it inconvenient or inappropriate?)

3. How did you find keeping your diary with you at all times?

- Very easy Somewhat easy Somewhat Very difficult
difficult

4. What percentage, out of all memory strategies over the 3 days, do you think you recorded and acknowledged (on the days when you had the diary with you all the time)?

5. How did you find recording memory strategies using the diary provided?

- Very easy Somewhat easy Somewhat Very difficult
difficult

If you found it difficult, what made it difficult for you?

6. Do you think that keeping a diary had any effect on your mood and how you feel?

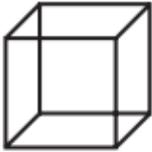
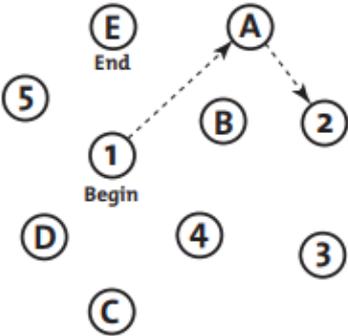
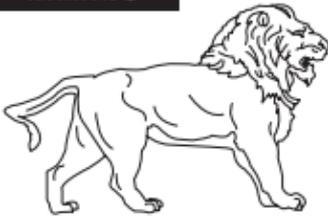
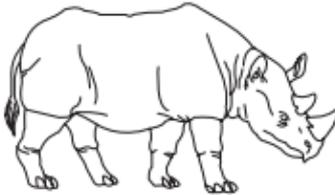
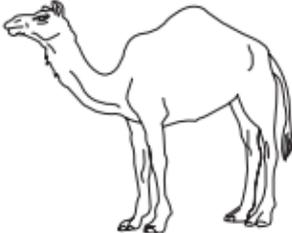
1	2	3	4	5	6	7
Made me feel			No effect			Made
me feel						
A lot worse						a lot
better						

7. Any other comments?

Appendix IX: Montreal Cognitive Assessment (Study 1a, Chapter 2)

MONTREAL COGNITIVE ASSESSMENT (MOCA)

NAME : _____
 Education : _____ Date of birth : _____
 Sex : _____ DATE : _____

VISUOSPATIAL / EXECUTIVE			Copy cube	Draw CLOCK (Ten past eleven) (3 points)	POINTS			
		[]	[]	[] [] [] Contour Numbers Hands	___/5			
NAMING		  			___/3			
MEMORY	Read list of words, subject must repeat them. Do 2 trials. Do a recall after 5 minutes.	[] FACE [] VELVET [] CHURCH [] DAISY [] RED 1st trial [] 2nd trial			No points			
ATTENTION	Read list of digits (1 digit/ sec.). Subject has to repeat them in the forward order [] 2 1 8 5 4 Subject has to repeat them in the backward order [] 7 4 2				___/2			
	Read list of letters. The subject must tap with his hand at each letter A. No points if ≥ 2 errors [] FBACMNAAJKLBAFAKDEAAAJAMOFAB				___/1			
	Serial 7 subtraction starting at 100 [] 93 [] 86 [] 79 [] 72 [] 65 4 or 5 correct subtractions: 3 pts, 2 or 3 correct: 2 pts, 1 correct: 1 pt, 0 correct: 0 pt				___/3			
LANGUAGE	Repeat : I only know that John is the one to help today. [] The cat always hid under the couch when dogs were in the room. []				___/2			
	Fluency / Name maximum number of words in one minute that begin with the letter F [] _____ (N ≥ 11 words)				___/1			
ABSTRACTION	Similarity between e.g. banana - orange = fruit [] train - bicycle [] watch - ruler				___/2			
DELAYED RECALL	Has to recall words WITH NO CUE	FACE []	VELVET []	CHURCH []	DAISY []	RED []	Points for UNCUED recall only	___/5
Optional	Category cue							
	Multiple choice cue							
ORIENTATION	[] Date [] Month [] Year [] Day [] Place [] City				___/6			
© Z.Nasreddine MD Version November 7, 2004 www.mocatest.org		Normal ≥ 26 / 30		TOTAL _____ /30 Add 1 point if ≤ 12 yr edu				

*Appendix X: Manual for Coding Everyday Memory Failures/Errors
(EMFs) (Study 1a and 2, Chapters 2 and 3)*

MANUAL FOR CODING EVERYDAY MEMORY FAILURES (EMFs)

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The coding scheme described in this manual has been adapted from the scheme originally developed by Kvavilashvili et al. (2009) and subsequently expanded by Niedzwienska and Kvavilashvili (2019) to include sub-categories of retrospective, prospective and absent-minded failures.

February 2021

1. THE INITIAL CATEGORIZATION OF EVERYDAY MEMORY FAILURES

While the distinction between prospective and retrospective memory is one of the key distinctions made in laboratory research on episodic memory, more naturalistic research on everyday memory has shown that people also experience types of cognitive failures which are based primarily on attentional lapses than malfunctioning of episodic memory per se. This became apparent when Kvavilashvili et al., (2009) asked their participants to state what was their last memory failure before they came to a laboratory session. When coding participants' narratives of memory failures, many of them fell easily into the categories of either retrospective memory or prospective memory, because participants were either reporting forgetting the information from the past or carrying out intended actions in the future, respectively. However, there was also a substantial number of memory failures that did not fit into these two broad categories and instead referred to minor slips of action, forgetting and momentary confusion. In line with naturalistic research on everyday attentional failures and action slips by Reason (1984), these failures were coded as absent-minded failures.

Subsequent diary studies on everyday memory failures have confirmed the existence of these three types of everyday memory failures in people's daily lives (Brazauskienė, Markostamou, Ashaye, & Kvavilashvili, 2020; Laughland, 2017; Niedzwienska & Kvavilashvili, 2019; Niedzwienska et al., 2020). For this reason, the coding scheme proposed in this document involves classifying everyday memory failures into three main categories: Prospective memory (PM) failures, Retrospective memory (RM) failures and Absent-minded memory (AM) failures.

1.1. RETROSPECTIVE MEMORY (RM) FAILURES

Unlike PM, where the focus is on remembering in the future, RM enables us to remember information from the past. This is what often both laypeople and psychologists have considered memory to be about, i.e., a person's ability to recall previously acquired information. As such, RM failure occurs when an individual is unable to retrieve previously acquired information at a given time. For example, forgetting where an item

was placed some time ago, or not remembering the name of a well-known person or a place.

RM has predominantly been studied as part of a larger memory system (i.e., declarative memory) comprised of episodic memory, autobiographical memory and semantic memory. Episodic memory refers to our ability to mentally travel back in time and relive our experiences. According to Tulving (2002), episodic memory, while different from other memory systems, still shares some features of semantic memory, which is responsible for storing the factual knowledge about the world. Indeed, this similarity between episodic and semantic memory is further supported by a recent review by Renoult et al., (2019) showing that the neural networks, relating to episodic and semantic retrieval, overlap.

Another area of research into RM is focused on studying autobiographical memory. This memory system is responsible for creating a mental representation of our past personal experiences. This form of memory goes beyond simple retrospective recollection of events (i.e., a fact that something happened) by adding a sensory-perceptual element and contextual detail to the experience (Conway, 2001). For example, rather than just remembering visiting a certain place (i.e., pure fact that we have been there), we remember it in rich detail such as how we felt, who we spoke to, perhaps even the smell in the air and so on.

It is worth noting that up until the 1980s, laboratory studies of episodic memory had been mostly conducted on RM using verbal information (e.g., short story recall), paired-associates, line drawings or occasionally images. Although these laboratory tests used meaningful stimuli (e.g., in a paired-associate recall, one must learn numerous word-pairs and then recall the second word in a pair after being presented with the first), they are testing the limits of one's memory ability. Considering that in everyday life people benefit from having more control over the environment, which is full of memory cues, and have lower demand on retrieval process when compared to the lab setting, results from the laboratory tests may not fully represent memory functioning that occurs outside the laboratory setting (but see results on Unsworth et al., 2012).

To better understand how memory functions in everyday life (i.e., outside the laboratory), researchers started to use self-report measures such as metamemory questionnaires from the 1970s onwards. Most of these metamemory questionnaires include

RM related questions such as remembering names, the content of books/articles, misplacing things, remembering phone numbers (see review by Herrmann, 1982). It is important to note that in order to answer questions one must have a good RM of how their memory functions in everyday life. For example, how accurately can we remember the frequency with which we forget where we had placed something some time ago? Or how often do we fail to remember the name of a person we were just introduced to? And even if we could remember accurately, since the answers generally are presented on a scale from *never* to *very often*, one can argue that an undefined selection for “often” can have a different meaning to different people (Morris, 1984).

Consequently, more recent studies have opted to use a diary method and investigate everyday RM failures together with other types of memory failures as and when they happen in day-to-day life (Laughland, 2017; Niedzwienska & Kvavilashvili, 2019; Niedzwienska et al., 2020). In such diaries, a participant is asked to describe any everyday memory failure as soon as they experience one, thus eliminating a person’s reliance on their retrospective remembering.

1.2 PROSPECTIVE MEMORY (PM) FAILURES

PM refers to a person’s ability of remembering their future (delayed) intentions, i.e., remembering to complete a planned action at a particular point in time (Kvavilashvili & Ellis, 1996). A failure of PM will result in the action not being carried out as planned. PM tasks are formed when the intention cannot be carried out immediately, and therefore the intention is stored temporarily in our memory until it can be retrieved at a particular time and place in the future – a process often referred to in the literature on PM as “remembering to remember” (Heathcote et al., 2015).

Whilst prospective memory is different from RM in that PM refers to self-cued remembering of our intentions in the future, it is important to note that PM always contains a retrospective component, i.e., memory for the content of our intention (Kvavilashvili et al., 2009). As such, we not only need to remember to complete an intended task at a given time, we also need to retrieve the information about what the intention was about.

Within the PM literature, it has been customary to class future intentions/PM tasks into event-, time- and activity-based tasks (Kvavilashvili & Ellis, 1996). An example of an event-based PM task would be to pass on a message to a friend when one sees them next

time. However, if we form an intention to meet this friend specifically in 20 minutes, it becomes a time-based task. An example of an activity-based task could be taking your medication before or after the meal. PM tasks can also be classed into habitual and episodic memory tasks (Harris, 1984). Habitual tasks involve remembering to do things which are done routinely, such as brushing one's teeth each morning and evening or other actions which are completed regularly. The episodic PM memory tasks are also known as "one-off" tasks which are completed infrequently or on a very irregular basis (e.g., posting a letter on the way to work). Despite these classifications and different types of PM tasks, a single and most important feature of PM is that a clear intention is made to complete an action in the future in the absence of explicit prompts to remember at retrieval. If a PM memory failure occurs, this action will not be completed. However, if a PM task is remembered on time, this does not mean that the intention will be carried out obligatorily, as the person may change their mind and either postpone or even cancel their intention.

1.3. ABSENT-MINDED MEMORY (AM) FAILURES

AM memory failures occur when the information needed for completing an intended action is forgotten immediately before or while executing a specific action. In cognitive literature, AM memory failures encompass a variety of different forgetting instances whereby some are described as slips of action (Norman, 1981) and others as actions-not-as-planned (Reason, 1979).

While PM and AM failures are similar in the sense that in both cases an intention to carry out an action is formed, the underlying difference between the two is the timing and the content of forgetting. In case of PM tasks, the formed intention is delayed, even if it is only for a few minutes (e.g., after finishing dinner, I have to call a friend), while in case of AM errors there is no delay as the person decides to do something and immediately starts carrying out the planned action. It is at this point that AM errors occur (Kvavilashvili & Ellis, 1996). As such, a failure in PM results in completely forgetting an intended action (e.g. missing an appointment), whereas the AM failures occur at the start of the initiated action or during the performance of such action.

There are many types of AM memory failures and often, some of them can easily be miscoded as PM failures. Kvavilashvili and Ellis (1996) pointed out three types of AM failures which are most likely to be mistaken for failures of PM. According to these

authors, one of the most common AM error is when an intended action is replaced by an unintended one. For example, going to get something specific from the room and instead ending up getting something else. This cannot be classed as a PM error as the intention to get something was not forgotten rather the intended item was replaced by an unintended one.

Another very common AM failure occurs when we start an intended action and suddenly forget what we were intending to do. A good example of this would be walking into a room to get something and whilst there, completely forgetting the reason we came in there, or opening the cupboard and forgetting what we needed to get from it. This is sometimes referred to as “what I’m doing here experience”.

The third type of AM failures results from an incorrect judgement of the positioning in the sequence of actions. Reason (1984a) described these failures as “place-losing errors” and stated that these failures involve either omission or repetition of the action. A good example of such failure may be starting a washing machine, but forgetting to add laundry detergent (i.e., omission error) or attempting to add laundry detergent and realizing that you have already done this (i.e., repetition).

In summary, while both prospective and retrospective memory failures are based primarily on one’s memory abilities, the absent-minded failures are not purely memory-based, rather they are more attentionally based. However, the reason why AM failures are still considered as memory failures is that essentially, they are based on malfunctioning of a person’s everyday working memory while completing mundane tasks and chores (Byrne & Bovair, 1997; Unsworth et al., 2012).

2. SUBCATEGORIES OF RM, PM AND AM

The retrospective, prospective and absent-minded failures refer to broad categories and they consist of numerous subcategories. We have adapted a coding system developed by Laughland (2017) and Niedzwienska and Kvavilashvili (2019) while adding a few subcategories where, based on our data, it was deemed necessary. Numbers in brackets next to each of the subcategory represent the codes used in the SPSS.

2.1 SUBCATEGORIES OF RM

All retrospective memory failures were coded into 15 separate subcategories which are listed below together with a brief explanation of each and some relevant examples from participants' diary entries. While some of these categories refer to general semantic memories (e.g., 1, and 3), personal semantic memories (e.g., 2, 4 and 15), or episodic and autobiographical memories (5 to 9, 12 and 13), others involve instances of procedural memory (11) or a mixture of examples of episodic and semantic memory (10).

(1) Forgetting names of celebrities, historical figures, book characters, etc. (2000).

Such errors include names of people and characters who you do not know personally.

“Couldn't recall celebrity name - Natalie Portman.”

“Retelling facts of a book I am reading to someone and forgetting names e.g., Mary Queen of Scots and Mary Tudor.”

“Having a discussion about theatre productions I had seen – Noel & Gertie and another starring Pauline Collins. Racked my brains. Resorted to searching through theatre programmes, found Patricia Hodge's name and then suddenly remembered the show 'Shirley Valentine'.”

“Couldn't remember Fat Boy Slim's real name.”

(2) Forgetting names of people you know (2001). This category includes names of people you know personally (relatives, friends, lecturers, group leaders, etc).

“Forgot brother-in-law's dad's name.”

“Couldn't immediately remember a friend's name. It quickly came to mind saying goodbye to a friend after lunch - wanted to be remembered to her friend.”

“I could not remember my scrabble group leader's name even though I have played her many times. Had to check her emails to remember.”

“Forgot the name of friend and where he moved to in Dorset.”

“I was chatting with my friend and mentioned my classmates in the former school. I suddenly couldn't remember her name, only remembered her last name. It felt familiar, but just couldn't remember.”

(3) Forgetting words and names of objects, animals, plants and places, etc. (2002). A failure to recall either a random word or the name of things, animals, geographical places when needed (e.g., during a conversation or whilst solving a crossword). In the literature, this is often referred to as “word finding difficulty”.

“Could not remember town in Kent.”

“Couldn't remember the names of some plants when showing my friend round the garden. We reminded each other of names.”

“Trying to remember type of bread - eventually remembered sourdough.”

“I was trying to remember the name of a book I've been listening for about 3 weeks - I knew it was an unusual name and thought it began with "i". It came back to me after about a minute (going through the alphabet) - Olive Kitteridge.”

“Talking to a friend about the weekend away in April. Forgot the name of the place where I was going.”

(4) Forgetting passwords, dates, phone numbers (2003). This section also includes forgetting someone's address.

“Forgot my printer code at work.”

“I tried to remember a friend's birthday.”

“In the LRC at university, I've forgotten the password to my laptop.”

“Forgot daughter's address. Moved there 6 months ago.”

(5) Entire autobiographical event (2005). Forgetting that something happened in your past, or that you have done a specific action in your earlier life.

“I was speaking to a friend about yesterday and I could not remember anything about what I did or where I went”.

“I am due to attend a cardiac rehab class today at the hospital. I cannot recall the first session or whereabouts in the hospital it is located. My wife reminded me that I attended the first session on 4th September, but I cannot recall it”.

(6) Forgetting where you put away/hide something (2006). This type of memory error is different from when we are misplacing something temporarily, which in turn would constitute an AM error (see below). It involves a person putting something away some time ago, i.e., an item which is NOT in constant use such as, for example, your house keys, or a TV remote control.

“Forgot where I placed my ring.”

“Forgot where I had put receipts for Hall hire.”

“Can't find a particular shopping bag.”

“Couldn't remember where I put my tea tree oil.”

“Came out of Tesco's and could not remember where I had parked the car. Took two minutes to remember.”

(7) Forgetting some content of intention (i.e., date/time of a meeting or other particular aspect of it) (2007). A person remembers the intention itself, i.e., that they need to do something, but is unable to recall some parts of it or what it was that they needed to do that day. Because the intention to perform an action is remembered, it cannot be coded as PM failure, rather this would represent the inability to remember the retrospective content of the PM task.

“I forgot when my meeting was.”

“I went to the wrong place for my meeting. It had been rearranged the previous week and I had forgotten.”

“I forgot the exact time of my lecture.”

“I had to do 2 phone calls before 3 pm. Needed to go and find the note about it. I remembered one but not the other.”

“Told friend on phone I was going out at 16:30 instead of 17:30.”

“I knew I had something to do but I forgot what it was.”

(8) Forgetting that a particular intention had been formed⁹ (2008). This type of error involves forgetting what a person is supposed to do during the day. A failure occurs when a person retrospectively forgets that a particular intention was formed and overwrites that intention with a new one making new plans.

“I forgot that I was working on Saturday and was trying to schedule something in there until I realised.”

“I received a text from my mum asking if I was still going for a dinner, but I had forgotten and made other arrangements.”

(9) Forgetting one or more items when shopping (2010). In several previous studies, forming an intention to go and buy something and later forgetting to buy an item in the shopping list, has often been attributed to a PM failure. However, this example represents instances when the intention to go to the shop is remembered, however, a person fails to retrospectively recall a particular item they were planning to buy. In other words, the person is in the shop, and if they do not have a shopping list, then their task is to recall retrospectively all the items that they wanted to buy.

“I just went to the supermarket and forgot to buy chocolate (and I cannot live without chocolate).”

“Forgot to buy makeup remover when I went to Superdrug.”

“Went shopping - no shopping list. Bought items for holiday - arranged currency. Bought several cards but forgot 2 of the most needed ones.”

“Forgot what I needed for shopping - only remembered 3 items and there were 5/6 in my head.”

(10) Content of a book/TV programme or other factual information (e.g., general rules; spelling of known words) (2011). Forgetting information which you had already read or seen, or facts acquired through life experience (e.g., reduced parking fine if paid within 14 days).

⁹ In a paper by Niedzwienska and Kvavilashvili (2019), this error was classified as “Forgetting their intentions for the whole day”.

“I wanted my husband to read an article in the paper which was relevant to us. Forgot what it was about, but eventually found it.”

“Forgot some of a tale I was telling a friend. Remembered 5 minutes later.”

“Could not remember who had been buried at Chatham (Kent). Thought it was Minnehaha, but later remembered it was Pocahontas.”

“I knew I needed to pay a parking fine, but I thought I had 21 days of grace before it doubled. When I read the paperwork again, I realised I only had 14 days. So it had to be paid today.”

(11) Forgetting factual information from well-learned procedures (e.g., dance moves; how to operate an appliance, etc.) (2013). A failure to retrieve previously learned information in relation to specific actions.

“Whilst working in a cafe I had to clean the 1st coffee machine which is just by pressing a choice of buttons. I got it correct first time but when I had to do the 2nd machine I forgot what button to press and done the wrong wash.”

“In a Pilates class using equipment for 2nd time needed correction on the way I balanced on a full-length roller.”

“Going to dance class often. Cannot remember steps even when showed 5 minutes earlier.”

(12) Forgetting actions – thinking you have not done something, but you had, or the opposite, thinking you had done something but you had not (2014). This error occurs when a person thinks that the action in question was not completed and attempts to complete it again (i.e., a failed recollection of the completed action in the past).

“Looked for telephone in the bedroom - thought I had brought it upstairs but found it in its cradle on the hall table.”

“I went to spray myself with some perfume but realised I'd already sprayed some earlier.”

“While thinking what to have for dinner I forgot that I cooked soup the night before.”

“Forgot we had bought black pepper and added it to the shopping list.”

“I forgot I had taken my drink upstairs.”

(13) Being unsure whether an action was completed (2015). In this instance, a person simply cannot remember (i.e., has no recollection) whether an action was completed or not.

“Set off to a meeting, got halfway there and couldn't remember if I'd locked the door. Had to return to satisfy myself that the house was locked up. The result - a little late for a meeting.”

“I'm in the library right now and can't recall if I have turned off the lights of my room.”

“Couldn't remember if I had done morning exercises before breakfast.”

“Couldn't remember if I had already exported my utility bills to my spreadsheet.”

(14) Some other content/piece of episodic information (2017) This category includes instances of forgetting some specific details of an episodic event rather than the whole event (i.e., subcategory Nr. 5).

“I remember going to a concert but cannot recall who I was with.”

“At university, I was asking new acquaintance questions that I'd remembered asking before just not the answers to those questions.”

“Picked up a shopping list to go to Tesco. Seeing 'green sticks' but couldn't recall what or why I wanted them.”

“I forgot that the side of the main building door was blocked and attempted to get in through, that was on my way to a seminar so had to go a longer route.”

“I realised that I forgot why I was sad, so I remembered it and understood that it was not worth being sad about and started feeling a bit better.”

(15) Forgetting routes and locations (2018) Forgetting to recall well-known routes, i.e., how to get to a known place or where such a place is located.

“Forgot location of cafe where I was meeting a friend.”

“Driving to collect people for a walking group I forgot the route I had planned and missed the turn.”

2.2 SUBCATEGORIES OF PM

All PM failures were coded into 9 distinct subcategories which, together with some examples, are presented below.

(1) Appointments (1001). Failing to attend prior agreed appointments. The appointments can be any type of meetings agreed ahead of time which includes agreeing to meet friends, family members, specialists, job interviews, etc. This type of error is different from the RM error “forgetting some content of intention” or “forgetting that a particular intention had been formed” as in former, the intention of having to meet someone would be remembered, just not the time or a place. In the latter, the intention to meet would be forgotten completely and overwritten by a new plan for that day. By contrast, PM failure to attend the appointment or meeting involves clearly intending to carry out this action at the appropriate moment only to realise at a later point that the forgetting had occurred.

“Scrabble - I totally forgot to attend the group (with the organiser's scrabble set) - she had to phone me! (I had been gardening)”

“At home whilst sat watching TV I remembered that I had forgotten to go to my GP last Saturday morning to receive my flu job despite going to book it face to face and getting reminders on my phone.”

“Forgot about the class that was at 04:00 pm while I am doing my assignment at the library.”

“I received a call from estate agents because they were outside flat with people to view it.”

“My friend asked me where I was as I had made plans to do work in the library and had forgotten.”

(2) To take medication/vitamins/food supplements (1002). This is a good example of habitual PM. Forgetting to take medications or vitamins, or food supplements will be considered an error only if they are taken fairly regularly. If one forgets to take a one-off medication, this would be an example of a failure described in (10) below.

“I forgot to take vitamins.”

“Got up early - usual morning routine. Later after coffee felt dizzy and realized had forgotten to take medication.”

“Forgot to prepare my daily routine protein shake before leaving home”

“I forgot to give my son his daily supplements.”

(3) To make a phone call/send a message/email (1003). Such error occurs when previously made intention to correspond with someone is forgotten at the right moment.

“Forgot to reply to a text message.”

“I forgot to call the hospital to book an appointment.”

“Forgot to send over a document to my boss via email.”

“Forgot to contact the patient at work.”

“I forgot to call the energy company.”

“Promised to call back the person (relative) I spoke to but forgot to call/text him later.”

(4) To buy/order/collect something or post a letter (1004). Forgetting a specific intention which requires a person going to a specific location to get/do something (i.e., go to a shop, bank, ATM machine, order something online or go to a post office). This would also include forgetting to pay/transfer money to another person.

“Forgot to go to the bank even though I was very near it.”

“Forgot to go chemist and buy eye drops.”

“I forgot to get money out of the ATM.”

“I was going to go and collect something from someone before work, but I only remembered when I was leaving for work.”

“I forgot to buy tickets for the Tower of London for a friend.”

“Forgot to pay an invoice I received from a plumber yesterday - planned to do it today before I took my mum to opticians but only remembered when I was cooking. Put it into diary for next day.”

(5) To pass on a message or an object, attach a file in an email or ask a question (1005). This error occurs when a person forms an intention (e.g., plans to either tell something to another person when they see them or plans to ask them a question) but forgets to complete planned action when the time comes.

“I had forgotten to pass a message onto someone, regarding a client at work.”

“I went to KFC for lunch. I ordered food for myself and my younger brother. I forgot to customise this order e.g., no BBQ sauce.”

“Forgot to ask my sister about the key to her oil tank.”

“I signed for my friend's parcel and picked that but forgot to tell her about it until she came to me being worried.”

“Somebody owed me money and I forgot to collect it from them.”

(6) Do something after a certain period of time (e.g., burn rice when cooking) (1006).

An error occurs when a person forgets that they had an intention to complete an action after a self-set time frame.

“I put a casserole in the oven at 9.30 and forgot to check that it was ok!”

“Turned on outside tap to top up pond. Forgot to turn it off. Overflowed somewhat.”

(7) Taking something extra from home (or work) needed for that day (1008). This category only includes things which people do not take with them when leaving home on a regular basis.

“Was meant to bring coloured pens to lecture but forgot to pack them the night before.”

“I forgot my USB stick to do work in a library.”

“Forgot painting things for an overnight stay at sister's house.”

“I forgot my water bottle when I went to the gym.”

“Forgot to take printouts that I am supposed to take.”

(8) Completing regular duties at home or at work (e.g., locking doors/closing windows) (1009). This type of failure comprises of instances where a person forgets to complete a habitual prospective memory task. Such tasks involve actions which are performed on a very regular bases either daily, weekly or monthly. The most important aspect of this type of failure is the regularity with which the actions are completed without a need for additional planning (i.e., done automatically).

“Forgot to replenish some tablets ready for 18th January.”

“I forgot to submit my monthly claim for my hours.”

“Forgot to clean my teeth at the same time.”

“Forgot to scan ID card.”

“Forgot to do homework with my daughter as I was busy talking on a phone.”

“Got home and started sitting up at my dresser to do some studying when I heard singing...Looked at my window and found that I had not shut it properly before leaving.”

(9) Completing one-off activity (1010). A one-off activity is a task that cannot be considered as a habitual (i.e., routinely performed) action. This category includes any one-off PM tasks which could not be classified into above categories i.e., making phone calls, buying things, etc.

“I was cooking and forgot to leave out the meat to defrost.”

“Forgot to print some documents for my passport renewal at the post office, I was supposed to print the documents before the post office closed at 17:00.”

“Forgot to put away gooseberries cooked and left to cool. Found them the next morning.”

“I forgot that I had an online quiz to do.”

2.3 SUBCATEGORIES OF AM

Everyday absent-minded failures were coded into a total of 12 subcategories to account for different types of failures described by the study participants.

(1) Forgetting what you wanted to say during the conversation, what you just thought/wanted to write down or look up (3001). These types of errors relate to the intentions for the very near future (seconds from now). The experience is commonly known as “losing train of thought”.

“I was having a conversation with my friend in the library and had completely forgotten what I wanted to say.”

“Planned to look something on the iPad but couldn't remember what it was.”

“At home, I had thought up some ideas surrounding my interprofessional education group work but could no longer remember them a few moments later.”

“I was writing emails and just as I went to write the 5th I couldn't remember what it was. After about 3 seconds I recalled it.”

“I was going to send my friend a link to an Instagram page. I opened Instagram and became distracted, after a few mins I forgot why I opened the app in the first place.”

(2) Forgetting why you came into a certain location (3002). A memory failure caused by a temporary loss of the content of one's own intention. In this situation, an intention is formed, and a person immediately starts performing an action but seconds later can't remember the content of this intention, i.e., “why am I here or what did I wanted to do in this particular location” experience. It requires a person to physically move from one location to another.

“Went to collect something from another room but forgot what.”

“Walked into sisters' room to get headphones - forgot why I walked into the room.”

“Opened larder. Forgot why. Looking for gloves that were actually somewhere else.”

“Opened the fridge: no idea what I wanted. Took 3 seconds to remember it was carrots.”

(3) Temporary disorientation regarding date/time/place (3003). A momentary inability to recall what day or time it is.

“While out with the dog I thought tomorrow was Thursday.”

“I was excitedly talking about tuning into the Apprentice all day and went online to check what time it was on and realised it was Tuesday today, not Wednesday when it's usually on.”

“Suddenly noticed that I had put the wrong date on my second forgetting error. Put the 24th May instead of 22nd May.”

(4) Omitting an action in the sequence of actions but NOT the last action (3004). This is known as an omission error. A failure occurs when a person misses a step in regularly performed procedural action.

“Forgot to put concealer on before powder.”

“Went back to the table after lunch to wipe mats but without a cloth.”

“Forgot to put washing powder soap in the washing machine.”

(5) Not finishing the sequence of actions – forgetting to perform the last action (3005). Starting an action but forgetting to finish it.

“Made a cake and took it from the oven around 11:30 am. Walked into the kitchen at 12:30 and found had not turned off the oven.”

“Made a cup of tea and forgot to drink it.”

“Kitchen. Cooking dinner left drained broccoli on heat instead of turning the heat off.”

“Forgot to put a bin liner in a bin.”

(6) Action swap: doing another thing instead of intended action (3006). An error occurs when a person specifically plans to do something but instead, they do something

else. The important element here is that the replaced action was not intended, i.e., this action is not associated with the original intention to do something specific.

“Put a paintbrush in my tea instead of water.”

“Supposed to drive to the university library - instead drove home.”

“In the afternoon, I just finished my lecture and walked to the student union shop. However, I have no specific things to buy, I don't know why I walked into the shop. I felt strange and suspicious about my behaviour.”

“Making introductions to a new member of a group and said X instead of Y. X was sitting next to new member so I was facing them both. Everybody found it amusing.”

(7) Distraction: just before carrying out an action or while doing it, being distracted and forgetting to complete it (3007).

“Went to pick up the phone from the kitchen. Got side-tracked. Left kitchen without it.”

“I was in the kitchen preparing my meal and I suddenly remembered that I had to fill the water in my bottle. While going back to my room I came across some letters from my bank. After reading those letters I went to my room and I forgot to grab a water bottle.”

“Made myself toast and a drink. Started talking to flatmate in the kitchen then went back into my room forgetting food and drink.”

“Left walking socks on the bed ready to pick it up and bring downstairs to put away but left them behind.”

(8) Forgetting to take usual things from home that you always take with you (i.e. wallet, keys, handbag, a watch, etc.) (3008). Unlike the category of forgetting to take something extra from home (a PM failure), forgetting to take usual things from home does not require extra planning or forming a specific intention. Taking things like keys or wallet when you leave a house is a habitual and automatic process.

“Left my purse at home.”

“Forgot to take my house keys with me when I left for uni.”

“Left phone on the kitchen counter and left house - was in the car ready to leave.”

(9) Losing things that are in constant use at home/office/car or have their usual location (3009). Misplacing things which are regularly used.

“Misplaced my keys and pendant.”

“Mislaidd my glasses.”

“Busy doing several things at once whilst getting ready to go out. Looking for my phone, which I'd had in my hand all the time.”

“Forgot where I placed TV remote control.”

“I don't know where my phone is, so I asked my husband to search for it for me (I forgot where I put it).”

(10) Leaving something behind that was in sight most of the time (e.g. purse when buying something) (3010).

“I left my phone on the side of the university toilet and had to go back in to get it.”

“Forgot my car keys in the university canteen while having lunch. Got them back.”

“Brought the phone charger to the kitchen in order to charge the phone and watch a cooking video in it while I'm experimenting on food. Forgot the charger in the kitchen after eating the food I made along with the phone.”

“Going to the hospital - given a lift - left handbag in the car with glasses, phone etc--- Luckily lady lent me phone to phone husband!”

(11) Forgetting what you have just said/done (3012). While this error contains a retrospective element, since it happened just moments ago, it is an AM error.

“I usually take about 10 prunes a day. And I thought oh, I've had five already. But a few seconds later, when I ate a few more, I completely forgot how many I had already eaten.”

“I was giving someone a lift and stalled the car at the traffic lights - I forgot what gear it was in.”

“Forgot who was to deal when playing cards.”

(12) Forgetting having already done something moments ago (3013). An action repetition/commission error (performing the same action again). This involves examples when a person completed an action and just moments later, they are attempting to complete the same action again, thinking that this was not yet done.

“I went to get another handkerchief from my drawer and had already got one out previously.”

“Multitasking and adding a more complicated bit to my meal in a rush, I put a plate out for myself (having already got one out).”

“Forgot that I have already washed my hands before eating at home. I remembered when I came close to the sink and saw the tap.”

3. ADDITIONAL CONSIDERATION FOR DIFFICULT CASES

Although in most cases coding is fairly straightforward, occasionally, coders may come across error descriptions which are ambiguous which may lead to discrepancies in coding. Therefore, it is very important that participants provide as much detail in a description of each failure as possible. For example, rather than just asking participants to state what they have forgotten or could not recall, ask them to describe the memory error in terms of *what happened*, *when it happened* and *where this happened*, thus allowing the researchers to obtain a better picture of an error.

By far the most difficult task for the researchers is to decide between PM and AM failures as the description of a failure could be either the PM or AM, depending on circumstances in which the error occurred. For example, Hass et al. (2020) treated “forgetting what one was looking for” or “wanted to do” as a retrospective component of a person’s future intention and therefore considered these to be PM errors. However, previous research has already demonstrated these to be failures in action and therefore should be considered as AM failures (Kvavilashvili & Ellis, 1996). In the same study, forgetting to take essential objects (i.e., wallet, keys or a mobile phone) was, too, categorized as PM failure. However, this example should not be treated as a failure in PM as taking essential items from home, such as a wallet, keys and mobile phone (especially in this day and age) is a highly automatic behaviour for which we rarely form a specific intention and thus it is more of an absent-mindedness rather than failure in PM.

Indeed, this problem with incorrectly assigning specific memory failures to different types of memory appears to exist even in well-known memory questionnaires. For example, in the Prospective and Retrospective Memory Questionnaire (PRMQ), developed by Crawford et al. (2003), different examples of memory failures are assigned to either a PM or RM. Given the extensive use of this questionnaire in cognitive research, the importance of selecting correct items to represent either RM or PM cannot be underestimated. However, upon further examination, few of the items appear to be questionable. For example, questions “Do you mislay something that you have just put down, like a magazine or glasses?”, or “Do you look at something without realising you have seen it moments before?” are both assigned to RM category. As per earlier discussion in this manual, both examples are a better fit for an AM failure rather than the RM failure.

It is also worth noting that some researchers in the past have assigned common AM failures to RM error category. For example, Unsworth et al., (2013) listed “*forgot what one was doing or looking for*” and “*forgot what one was going to tell someone*” as belonging to a failure in RM. However, as pointed out by Kvavilashvili and Ellis (1996), the former is a clear example of a failure in action and therefore should be categorised as AM error. The second example may be more difficult to decide and that is where the importance of asking participants to provide a more detailed description of a memory error comes in. If a person forgot what they wanted to say in the middle of the conversation, it should be categorised as AM failure. However, if a person plans to tell something to another person when they meet them, this description would indicate that they forgot the content of their intention, i.e. they knew they had to tell them something (the intention is remembered) but forgot the content. In turn, this would indicate a person is committing RM error. Finally, we will consider a few ambiguous descriptions of memory failures taken from our participants’ diary entries.

Difficulty of distinguishing PM and AM

Example 1. A participant recorded a memory failure: “*Washed clothing but did not hang out to dry until after I had been out.*”

Initially, this entry was coded as a PM error because it was assumed by the researchers that the participant had an intention of taking the laundry out of the washing machine and hang it to dry. However, since there is no clear indication that such intention was made by a participant, it was decided to code this as AM error because the participant simply did not complete a sequence of actions. If, on the other hand, participant would have said they were meant to hang the washing before they left but forgot to do so, that would indicate a clear intention to complete this action and therefore would be coded as PM error.

Example 2. *“I misplaced my keys yesterday. I was supposed to look for them in the morning however I forgot. This meant that I couldn't open my house door unless I called my mum.”*

This is a good example when PM error could be miscoded as AM. In most cases, *misplacing your keys*” is an indication of absent-mindedness as keys belong to a category of items which are in constant use or have a designated place at home. However, in this example, the description of error clearly indicates a prior formed intention to look for the keys in the morning, making this a PM error as the intended action was not completed.

Example 3: *“Came home from a training session at 16:30. Saw that washing machine needed to be emptied when I was clearing out cat's litter tray. Forgot to empty the machine before coming upstairs to work at PC.”*

It appears as a PM failure because a person makes an intention to empty the washing machine after they have finished the first task. However, judging by the description of the participant, this extra thought to do something came whilst doing something else (i.e. with a focus being on the task at hand) and within a brief moment, this intention was forgotten. For this reason, such description is a better fit for an AM failure.

Example 4: *“I forgot to put a banana in my granola which I said I was going to do before I made it, remembered at the end of the bowl.”*

The difficulty in coding this errors lies in deciding whether this error is PM or AM. It depends on whether the decision to use banana in granola was made right at the beginning as she started preparing granola, or the person had made this decision much earlier and forgot about it once she came to prepare her meal. If former, due to lack of delay between the intention and action, it is an example of AM error. However, if there is a delay between the intention and the action then it would be PM error. After discussions, it

was decided to code this as an AM error (code 3004) because it seemed that everything happened in a very short time i.e. “...which I said I was going to do before I made it...”.

Difficulty of distinguishing RM and AM

Example 5. “Put my roving phone down somewhere and then could not find it. Luckily it was in my bedroom, so it wasn't long before I discovered where I had left it.”

In this example, it may be argued that forgetting where you have put something constitutes an RM error. Nevertheless, a roving phone (i.e., cordless landline phone) is something that is in constant use at home and has its usual place thus it cannot be placed in the same category as things you put away because you don't need to use them for a certain time. As such, this description refers to an AM error whereby a person simply misplaces an item that is used frequently.

Example 6. “I went to get another handkerchief from my drawer and had already got one out previously”

This can easily be confused with RM failure as it seems that this person forgot that they have already done something previously. However, a failure as such cannot be coded as RM if a person did not even register that they have done it i.e. a person was not paying attention to what he/she was doing. For this reason and the fact that such instances are more habitual, this memory error is coded as belonging to the AM category (in the literature it would be referred to as RM).

Difficulty of distinguishing PM and RM

Example 7: “I had to do 2 phone calls before 3 pm. Needed to go and find the note about it. I remembered one but not the other”

While remembering to make calls is a PM task, the memory error as described cannot be coded as PM error. The person remembered the intention to make 2 phone calls, but they can't remember who the second call was to. Therefore, it is the content of the intention that is forgotten (i.e. the retrospective component of PM task) and not the intention itself, making this a good example of RM error.

Example 8: “I tried to remember a friend's birthday.”

Many researchers categorise “forgetting birthdays” as PM failure. For example, in a study by Hertzog et al, (2000), some items from the Memory Functioning Questionnaire were used to assess metamemory of participants. The researchers assigned the frequency of forgetting birthdays to PM questions. However, we argue that “forgetting birthdays” can actually be either PM or RM, based on the description of the failure, i.e., the context in which it occurs. If a person describes a failure as they have forgotten to send a birthday card to someone – that is a PM failure as forgetting a birthday is accompanied by an intention to do something. However, in our example it is evident that a person simply could not remember the birthday date of a particular person therefore this is categorised as a RM failure.

Example 9: “I received a text from my mum asking if I was still going for a dinner, but I forgot and made other arrangements.”

One may argue that this memory error should be coded as PM error as the person forgot the arrangement to go for dinner. However, because the person entirely forgot the initial arrangement and overwrote that appointment with a new one, the error is now coded as RM error. The person did not just simply miss the appointment, they entirely forgot making this arrangement in the first place and therefore treated that day as fully available for making a new arrangement.

Difficulty of deciding on subcategory of RM

Example 10: “At cinema - interval in live broadcast with friend (D) spoke about attending an evening event with another mutual friend (E). D told me I had been with her.”

This is a very good example showing how, due to unclear/ambiguous description of a memory error, researchers may have difficulty in deciding which subcategory of RM this error belongs to. The decision for coding very much depends on whether the person is talking about attending event in the future only for the friend to say that she has already been to that event with her. Or, is participant talking about attending an event in the past and just forgotten which friend she was with? If former, the memory error would belong to “forgetting an entire autobiographical event” (2005). If latter, the person only forgot specific detail about that event (2017). After long discussions within the research team it was decided to code this as the latter.

Difficulty of deciding between a regular versus one-off activity of PM task

Example 11: "I was cooking and forgot to leave out the meat to defrost."

In this situation, while the error description is a clear example of PM error, it can be difficult to decide which subcategory to assign this to. For a person who is very regularly cook meals using frozen meat, this would be PM error of forgetting to complete regular activity. However, for a person who mostly cooks using fresh meat and only occasionally uses the meat from the freezer, this would be classed as forgetting to complete a one-off activity (code 3010). It is a very good example when a person's description of an error without an extra information (i.e. if they do use frozen meat regularly) can be difficult to code without some level of subjectivity. There is always an ambiguity in PM tasks whether something is a one-off activity or a regular occurrence/chore. However, after long discussion, the agreement has been reached to code it as a one-off activity because we cannot assume that the person regularly uses frozen meat for cooking.

Examples which cannot be coded as everyday memory errors

Sometimes, some of the descriptions provided by participants cannot be coded as everyday memory errors and there can be a number of reasons for this. Most common reasons that the descriptions can fall into this "not an error" category are:

1. There is not enough information provided to make any judgement whether it is a prospective, retrospective or absent-minded error i.e. it is hard to differentiate what type of error it should be coded as or if an error actually occurred.

"I was out shopping in my local Sainsbury's and when I was at the checkout and realise, I had lost my token to get my £1 for the carpark back."

2. The description is very inaccurate, vague and/or bizarre so that it is very difficult to make any sense of the description. Hence, rather than creating yet extra category saying that this is encodable, a separate category can be created "Not an error".

"I had to be reminded about a zoom meeting at 9:30; context = the meeting was arranged during the days when I don't work (I am part time) and this is my first day working this week, so was not up to speed with what was happening."

3. Sometimes people are overly meticulous and so they report something as forgetting when effectively they haven't forgotten. For example, people report something that they almost forgot.

“Almost forgot to wish B-day to a friend.”

“Walking out of friend's house, when I realised, I was once again about to leave without the piano learning books for the child I look after.”

4. Reporting something as a memory error when in fact it is just a mistake.

“When filling in a form completed the information on the wrong lines.”

“Lost my way driving (unfamiliar territory), took opposite turn.”

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*Appendix XI: The Cognitive Telephone Screening Instrument (Study 2,
Chapter 3)*

Cognitive Telephone Screening Instrument (COGTEL) VERSION A

Prospective Memory

At a later point in time during this test, there will be a task in which you should name jobs or professions. Thus, when I later say Please try to name as many jobs and professions as possible during 1 minute, please unsolicited tell me your year of birth. Do you have any questions about this task? Read twice
Y/N

Verbal Short-Term Memory

Now I will read a couple of word pairs to you. After that, I will name the first word and you should recall the associated second word. Let's suppose I say east-west and gold-walk, then when I later say east, you should say west. And when I say gold, you should respond walk.

Metal-iron
Baby-cry
Hustle-dark
School-baker
Rose-flower
Obey-yard
Fruit-apple
Salad-pen

Which word was associated with . . . ?

	Answer	Wrong/don't remember/right
fruit		
obey		
rose		
baby		
salad		

metal		
school		
hustle		

Later, I will ask for these word-pairs once again, so don't forget them.

Working Memory

Now I will read a couple of digits to you. When I have finished, you should repeat these digits in reverse order. For instance, when I say 2-8, then you should say (let the participant give the answer). Read twice Y/N?

(If the participant does not say 8-2): No, I said 2-8, so you should say 8-2. Please try to repeat the following digits in reverse order: 3-6.

	Right or wrong?		Right or wrong?
5-1		3-8	
4-9-3		5-2-6	
3-8-1-4		1-6-9-5	
6-2-9-5-2		4-8-5-2-6	
9-1-5-2-8-6		8-3-1-9-6-4	
4-5-3-9-1-2-8		8-1-2-9-3-6-5	

Verbal Fluency (Executive Functioning)

Now please try to name as many words as possible that begin with the letter A during 1 minute. You should not repeat any words and you should not say any names, for instance, Anna is not valid. Read twice Y/N? [STOP WATCH needed]

Number of named words:	
Number of proper names:	

Number of repeated words:	
---------------------------	--

Now please try to name as many professions as possible during 1 minute. You should not repeat any words and you should not name any words in an altered form. For instance, if you had said physician, then the word physicians is not valid.

Participant named his/her year of birth:	
Number of names:	
Number of repeated words:	

Inductive Reasoning

Now I will present you with sequences of numbers that are built up after a specific rule. Each sequence of numbers can be continued by applying this rule. Your task is to continue each sequence of numbers. In each case, I will present you with 5 numbers and you should add the sixth number. For instance, when I present you with the sequence 1–2–3–4–5, then the rule would be +1 and you should add the number 6. Do you have any questions about this task?

Read twice Y/N?

	Answer	Right or wrong?
3–6–9–12–15–	___ (18)	
2–5–8–11–14–	___ (17)	
63–91–65–94–67–	___ (97)	
25–13–27–16–29–	___ (19)	
10–2–11–4–12–	___ (6)	
2–4–7–11–16–	___ (22)	
8–10–13–17–22–	___ (28)	
21–20–18–15–11–	___ (6)	

Verbal Long-Term Memory

A short while ago, I read some word pairs to you. Now, I will again name the first words of each word pair and you should try to recall which words were associated with the words I name.

Which word was associated with . . . ?

Word	Answer	Correct Answer	Wrong/Don't remember/Right
salad		(pen)	
baby		(cry)	
metal		(iron)	
school		(baker)	
rose		(flower)	
hustle		(dark)	
fruit		(apple)	

obey		(yard)	
------	--	--------	--

Appendix XII: Perceived Stress Scale (Study 2, Chapter 3)

	Almost Never	Never	Sometimes	Fairly Often	Very Often
1. In the last month, how often have you been upset because of something that happened unexpectedly?	<input type="radio"/>				
2. In the last month, how often have you felt that you were unable to control the important things in your life?	<input type="radio"/>				
3. In the last month, how often have you felt nervous and “stressed”?	<input type="radio"/>				
4. In the last month, how often have you felt confident about your ability to handle your personal problems?	<input type="radio"/>				
5. In the last month, how often have you felt that things were going your way?	<input type="radio"/>				
6. In the last month, how often have you found that you could not cope with all the things that you had to do?	<input type="radio"/>				
7. In the last month, how often have you been able to control irritations in your life?	<input type="radio"/>				
8. In the last month, how often have you felt that you were on top of things?	<input type="radio"/>				
9. In the last month, how often have you been angered because of things that were outside your control?	<input type="radio"/>				

10. In the last month, how often have you felt difficulties were piling up so high that you could not overcome them?

Appendix XIII: Irrational Procrastination Scale (Study 2, Chapter 3)

<i>Very Seldom or Not True of Me</i>	<i>Seldom True of Me</i>	<i>Sometimes True of Me</i>	<i>Often True of Me</i>	<i>Very Often True, or True of Me</i>	Score	
1. I delay tasks beyond what is reasonable.						
1	2	3	4	5	_____	
2. I do everything when I believe it needs to be done.						
5	4	3	2	1	_____	
3. I often regret not getting to tasks sooner.						
1	2	3	4	5	_____	
4. There are aspects of my life that I put off, though I know I shouldn't.						
1	2	3	4	5	_____	
5. If there is something I should do, I get to it before attending to lesser tasks.						
5	4	3	2	1	_____	
6. I put things off so long that my well-being or efficiency unnecessarily suffers.						
1	2	3	4	5	_____	
7. At the end of the day, I know I could have spent the time better.						
1	2	3	4	5	_____	
8. I spend my time wisely.						
5	4	3	2	1	_____	
9. When I should be doing one thing, I will do another.						
1	2	3	4	5	_____	
					Total Score	_____

*Appendix XIV: Initial Telephone Interview with Health Questions (Study 2,
Chapter 3)*

Before we can proceed further, I need to ask you some demographic and health questions, which will determine whether you will be able to take part? Will that be OK with you?

What is your Age: _____

Years of Education _____

Is English your first language: _____

If not, how fluent are you in English? _____

Due to the needs of the study, we require volunteers who are in good health. May I ask you if you have suffered from any of the following conditions, because if you have, I am afraid you will not match our criteria for participant selection. I do not need to know which or any details, but please could you tell me if any one of the following would exclude you from this testing programme.

- Previous head/brain injury
- Stroke
- History of alcohol abuse or dependence
- Recurrent substance abuse or dependence
- Mental health problems (diagnosed by a doctor)
- Memory problems (diagnosed by a doctor)

(i) How would you rate your current health?

Poor Below Average Average Good Excellent

(ii) How would you rate your health in comparison to your peers?

Poor Below Average Average Good Excellent

(iii) How would you rate your memory?

Poor Below Average Average Good Excellent

(iv) How would you rate your memory in comparison to your peers?

Poor Below Average Average Good Excellent

(v) Compared to the time before this pandemic, would you say your memory is:

Worse Slightly worse About the same Slightly better Much better

*Appendix XV: Everyday Memory Error Questionnaire (Study 3a and 3b,
Chapters 4 and 6)*

INSTRUCTIONS

In this survey, you will be presented with several questions each describing a particular type of everyday memory error, followed by real-life examples, recorded by participants in our previous diary study of everyday memory errors.

Once you've carefully read the question and the examples, please estimate how frequently, on average, you experience this type of memory error **IN A TYPICAL MONTH** by selecting an appropriate response from options provided. A **typical month** is a month which is uninterrupted by any major events like extended holidays, lockdown, etc.

You will then be asked to estimate the frequency of the same memory error in people who are in their 20s, 40s, 60s and 80s. Sometimes you may feel unsure about rating others, but please try to provide your best estimate. If you are still unsure, you will also have an option "Don't know".

REMEMBERING PAST INFORMATION

This section contains **12 questions** that refer to your ability to remember information, facts and episodes from the past. Please rate how often (if ever) do you experience each of these memory errors **IN A TYPICAL MONTH** and how often do you think other people of

different ages might experience the same errors. A typical month is a month which is uninterrupted by any major events like extended holidays, lockdown, etc.

Q1A: How often do you have trouble remembering where you put or left something a while ago? *For example: Can't remember where you put your receipt, lottery ticket or documents, etc. Can't remember where you parked your car; Can't remember where you put a piece of jewellery*

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q1B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2A:

How often do you forget names of people you know personally? *For example,*

forgetting the name of a relative, friend, lecturer/teacher or a member of the club/group that you are part of.

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q2B:

Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3A: How often do you forget the names of celebrities, famous people or the characters (from films and books) that you knew before?

For example: Can't remember the name of a pop star, actress or a writer; When

describing the contents of a book you've read, you can't recall the names of the characters (e.g. *Mary Queen of Scots* or *Mary Tudor*, etc).

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q3B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4A: How often do you find yourself unable to recall a specific word or the names of things and places that you are familiar with?

For example:

Can't find a specific word you are looking for during a conversation;

Can't remember the name of a food item or a plant in your garden;

Can't remember the name of a place or a town you've visited before;

Can't remember the name of a specific flight company;

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q4B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5A: How often do you struggle to recall some details of your past experiences? *For example: You remember asking someone a question but cannot recall the answer; You*

met a person who looks familiar but are not able to recall where you know them from; You can't remember where you had stayed last year while visiting a different town, etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q5B: Now please rate how often do you think an average person in each of the age categories might experience this:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q6A: How often do you forget how to do something that you had been able to do many times before?

For example:

Can't remember how to operate an appliance at home or at work;

How to use equipment in a gym/exercise class;

Can't remember the steps in a dance class.

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q6B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q7A: How often do you forget some details of planned or scheduled activities?

For example:

Can't remember the exact time of a meeting or a class;

Can't remember where you were supposed to meet someone;

You forgot that the time or place of an appointment had changed and adhered to the original one instead, etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q7B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q8A: How often do you have trouble remembering passwords, pins, and dates or addresses that you knew before? *For example: Can't remember your computer password or a printer code at work; Can't recall the address of a relative/friend; Unable to recall a friend's birthday, etc.*

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q8B: How often do you think an average person in each of the age categories might experience this type of forgetting?

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9A: How often do you forget (cannot recall) something you have read or other pieces of information that you knew before? *For example: You wanted to tell someone about something you had read in a newspaper but forgot what it was about; You are*

trying to tell a story to a friend but can't recall some parts of it;

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q9B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q10A: How often do you forget to buy one or more items when shopping? *For example:*

Buying most items in a supermarket except eggs and toothpaste;

Going to a coffee shop to buy coffee and a sandwich for lunch but only getting a sandwich or a cup of coffee, etc.

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q10B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11A: How often do you find yourself thinking that you have NOT DONE something only to find out that you have done it? Or you think you have done something, but you have not?

For example:

Forgetting that you had already bought an item and adding it to the shopping list;

About to spray some perfume and suddenly realizing that you had already done it earlier;

Thinking that you had paid for the stay in the car park but receiving a parking fine later for not paying.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q11B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12A: How often do you find yourself wondering whether you have done something or not? *For example: You have left the house and cannot remember if you had locked the door; Can't remember if you have turned the lights off before leaving; Can't remember if you have done your exercises today, etc.*

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q12B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

REMEMBERING TO DO THINGS IN THE FUTURE

In this section, there are **8 questions** and you will be asked to rate how often, **in a TYPICAL MONTH** you forget to carry out tasks in the future that you intended to do, and then rate how often do you think other people of different ages experience the same errors. **A typical month** is a month which is uninterrupted by any major events like extended holidays, lockdown, etc.

Q1A: How often do you forget to take your medicine/vitamins or food supplements which you take regularly?

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)
- Not applicable** (Not taking any medications/supplements)

Q1B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2A: How often do you forget to complete routine tasks that you have performed regularly in the past?

For example:

Forgetting to charge your phone;

Forgetting to submit a monthly claim for hours worked;

Forgetting to feed your pet or to do laundry;

Forgetting to take out the rubbish bin for collection or bringing it back after collection, etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q2B:

Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3A: How often do you forget to attend an appointment or a meeting?

For example:

Forgetting an appointment with a doctor;

Forgetting about meeting with someone (a friend or a family member) you had agreed to meet;

Forgetting to attend an activity (could be a club meeting, an online course, a training session or a lecture), etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q3B:

Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4A: How often do you forget to make a phone call, text a message or send an email to someone?

For example:

Forgetting to call someone back;

Forgetting to send a document/information to someone by email or a text message;

Forgetting to reply to a text message, etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q4B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5A: How often do you forget to pass on a message to someone or ask someone a question when you see them? *Examples of this could be: Forgetting to tell something to your relative/friend when you have a conversation with them; Forgetting to pass a message regarding a client at work; While ordering takeaway forgetting to ask for the*

burger to have no salad; Signing a parcel for someone else and forgetting to tell that person that the parcel was delivered, etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q5B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q6A: How often do you forget to buy, order or collect something, or post a letter/parcel?

For example:

Forgetting to do grocery shopping;

Forgetting to pick up prescription/form from a GP surgery;

Forgetting to buy tickets for an attraction or getting money out of an ATM, etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q6B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q7A: How often do you forget to take things with you which you know you will need on that particular day? (Not the things you always take with you, e.g. purse or keys) *Examples of this could be: Leaving something that you intended to take with you (e.g., umbrella, laptop) behind at home; Forgetting to take the water bottle out of the car*

with you for the day; Forgetting to take your shopping list with you when going to a supermarket.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q7B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q8A: How often do you forget to complete any other non-regular tasks which were not mentioned in the previous questions?

For example:

Forgetting to set an alarm for an early appointment;

Forgetting to print off a paper or a document;

Forgetting to book an appointment;

Forgetting to repair a chair with a superglue.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q8B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

ABSENT-MINDED ERRORS

In this section, there are **12 questions** and we would like you to tell us how often you experience the so-called absent-minded errors where your memory fails you momentarily (perhaps due to distraction or lack of attention to tasks at hand).

Please rate how often you experience these types of errors in **a TYPICAL MONTH** and rate how often do you expect people of different ages to experience these errors. Please remember, that a typical month is a month which is uninterrupted by any major events like

extended holidays, lockdown, etc.

Q1A: How often do you forget why you walked into a specific room or location?

For example:

You walked into the utility room to get something and forgot what it was that you wanted;

You walked into the lounge and suddenly had no idea why you were there;

You opened the fridge and forgot what for, etc.

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q1B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2A: How often do you forget what you just wanted to say or do?

For example:

In the middle of the conversation, forgetting what you wanted to say;

*Wanting to look something up online and forgetting what it was;
 About to write an email and suddenly forgetting what you wanted to write.*

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q2B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3A: How often do you forget what you just said or what happened moments ago in the task that you were doing (i.e., losing your bearings)?

For example:

While talking with someone, you forgot what you were just saying to them;

While playing cards with friends, you forgot whose turn it was to deal;

While waiting at the traffic light, you forgot what gear your car was in, etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q3B:

Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4A: How often do you start doing something but realize or find out that you have just done it moments ago?

For example:

You were going to get a plate from the cupboard, but then notice that you had already got it out;

*After the shower, you started using a deodorant but realized that you had already used it;
 Looked at your watch for the time and seconds later looked at it again.*

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q4B: Please rate how often do you think an average person in each of the age categories might experience this problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5A: How often do you mislay things that are in constant use or have their usual location?

For example, you can't find your glasses, mobile phone, keys or a phone charger, etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q5B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q6A: How often do you forget to take the usual things from home, which you always take with you?

This could be your keys, wallet, bag/purse, mobile phone, etc.

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q6B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q7A: How often do you leave behind something of yours that was in sight most of the time?

For example:

Leaving your phone in a public toilet;

Leaving your car keys behind at the till;

Forgetting to take your handbag/bag out of the car, etc.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q7B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q8A: How often do you get temporarily disoriented about what *time* or *day* it is?

For example:

Putting a wrong date when signing a document;

Thinking that tomorrow is Thursday when it is Wednesday;

Getting ready to watch your favorite show and then realizing that today is not the day when the show is on.

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q8B: Please rate how often do you think an average person in each of the age categories might experience this type of error:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9A: How often do you miss a step in the sequence of a well-practiced habitual activity?

For example:

Forgetting to empty the washing machine or the tumble dryer;

*Forgetting to put washing liquid/tablets in the machine before starting it;
Forgetting to get a towel ready before you step into the shower.*

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q9B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q10A: How often do you start doing something, get distracted, and then forget to finish the task?

For example:

You are doing something when someone calls, and you forget to finish your task after ending the call;

You are going to check your post, get side-tracked on the way and end up without checking the post;

You go to a shop to get something specific only to get other things but not what you went there for.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q10B: Please rate how often do you think an average person in each of the age categories might experience this type of problem:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11A: How often do you forget to finish the last step in the sequence of a well-practiced habitual activity?

For example:

Forgetting to turn the oven off after taking the food out;

Forgetting to lock the door upon leaving the house;

*Putting clothes in the washing machine, but forgetting to turn the machine on;
You've made yourself tea or coffee but forgot to drink it.*

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q11B: Please rate how often do you think an average person in each of the age categories might experience this type of forgetting:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12A: How often do you find yourself doing something other than what you intended to do?

For example:

Intended to drive to the library but drove home instead;

Putting a paintbrush in your tea cup instead of a cup with brushes.

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q12B: Please rate how often do you think an average person in each of the age categories might experience this type of error:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Appendix XVI: Everyday Memory Strategy Questionnaire (Studies 4a and 4b, Chapters 5 and 6)

INSTRUCTIONS

In this survey, you will be presented with several questions, each describing a particular memory strategy, together with real-life examples of that strategy, recorded by our participants in a previous diary study of everyday memory strategies. Once you've carefully read each question and the examples, please estimate how frequently you use this memory strategy **IN A TYPICAL MONTH** by selecting an appropriate response from options provided. You will then be asked to estimate the frequency of using the same strategy by people who are in their 20s, 40s, 60s and 80s. Again, please select only **ONE** answer. Here, in addition to standard response options, you also have an option "Don't know".

In total, there will be 13 questions, covering a variety of strategies used by people in their daily life to help them to remember information and upcoming tasks.

Q1A: How often do you write PAPER notes to yourself to remind you of something that needs to be done in the near future? Examples of these could be sticky notes, shopping lists, to-do lists, etc., written on paper (there will be a separate question about electronic notes).

For example:

Used a notepad that I have on my reading desk. Noted down all the tasks and things that need to get done this week;

Wrote a message on a post-it note;

Made a shopping list.

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q1B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q2A: How often do you write your upcoming appointments or things that need to be done in a PAPER calendar/diary such as a wall calendar or a diary/weekly planner?
(there will be a separate question about electronic calendars)

For example:

I put a note in my diary to buy golf balls during a trip to Portugal;

In order to remember coursework submission deadlines, I noted them down in my wall

calendar.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q2B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q3A: How often do you write ELECTRONIC notes to yourself to remind you of something that needs to be done in the near future? This category can include notes, shopping lists or to-do lists written on a smartphone, PC note app or a Tablet app (but not the e-calendar)

For example:

Wrote a note on a digital sticky note on my computer;

Used my mobile notepad to make bullet points of the key things to change;

Wrote a shopping list on my phone.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q3B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q4A: How often do you enter your upcoming appointments or things that need to be done in the ELECTRONIC calendar such as on your smartphone/PC/Tablet?

For example:

Used Google calendar on my iPhone;

Put an entry in the calendar on my phone and the computer;

Created a new task in the Outlook.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q4B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q5A: How often do you use electronic reminders? An electronic reminder can be any device that makes a specific sound/voice alert to prompt you to do something, such as alarm clock, phone reminder, kitchen timer, Alexa, Siri, etc. **Please, do not include instances when you use these for waking up.** For example: *I have set a reminder on my phone to remind me to do my quiz; I set reminders with alarms on my phone; Asked Alexa to remind me at a specific time.*

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q5B:

Now please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q6A: How often do you rely on items or objects in your environment, or the environment itself, to remind you of something?

For example:

To remind me that I need to vote I took the voting cards from my kitchen board and put them in a prominent place;

I put letters next to the front door so that I would remember to post them;

I went downstairs to do something but forgot what it was! I then returned to the place I

had first thought of it and remembered what it was.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q6B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q7A: How often do you rely on another person to remind you of something? Relying on another person means either asking another person to tell you the information you

cannot recall or asking them to remind you of something at a later time.

For example:

I asked people I was with, to remind me to pick up my friend from the train station;

To remember the name of a singer, I asked my friend by describing him as “the guy who sings that song you like”;

Couldn't remember the last date of the issue book from the library, so I emailed the library people to ask about it.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q7B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q8A: How often do you mentally retrace your steps in order to remember important information such as where you have put something, or what you have done so far?

For example: Couldn't find my keys. Had to rethink about where I left my keys last when I

left my house; To remember where I parked my car, I thought backwards like tracing my steps; Going through the steps in my head of what I need to do before I leave the house.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q8B:

How often do you think an average person in each of the age categories might use this strategy?

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q9A: How often do you form an internal visual image to help you to either assist with learning new information or help recall information from the past?

For example:

When doing Crossword, I pictured spelling in my eyes of the word `h e t e r o g e n e o u s`;

To know what to do next, I imagined what I have to do at home, and I pictured all my future actions in my mind;

To try and remember biomechanics of the elbow, I closed my eyes and visually went through the movement as a reminder.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q9B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q10A: How often do you rehearse/repeat the information to yourself in order to make sure you will remember it later?

For example:

To make sure I sent an email, I kept repeating the task in my head in between other thoughts;

To make sure I did not forget to bring a kitchen towel to the kitchen, I was whispering out loud what I needed to do (take a towel) while moving from one room to another;

I was given a new 7-digit password at work. I chunked the digits into 3 and repeated them

over and over again in my head.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q10B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q11A: How often do you go through an alphabet in order to remember a name of a person/place/event or a name of something else (e.g., name of specific plant, disease, etc.)

For example:

I'd forgotten the name of an ointment I used to use. Quickly went through an alphabet for a clue;

While solving a quiz, I went through the alphabet to find the name of the author;

Forgot patient's name – face was familiar. I tried to remember the name by using the

alphabet.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q11B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q12A: How often do you make links between or associate different pieces of information in order to remember something?

For example:

To remember the information, I made up a story so that I could remember it faster;

For a number of clues in the crossword, I tried to link details with associated places/people;

I am going on a day trip to Sandwich and keep forgetting the name of the town so I thought of something which would remind me of “Sandwich “(in Kent) – i.e. my lunch.

- Never/Almost never**
 - Rarely** (About once or twice per month)
 - Sometimes** (About once a week)
 - Often** (About 2-3 times per week)
 - Very often** (Almost daily)
-

Q12B:

Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

Q13A: How often do you use two or more memory strategies simultaneously to assist you in retrieving information from the past or to ensure you will remember a specific task in the future?

For example:

Wrote a shopping list on my phone and put a reminder on for me to look at the list so it would remind me while I was in the shop;

Memorizing my dance steps: I wrote down the type of steps and visualized them with music in my mind.

When trying to solve a puzzle, I used more than one strategy: Trying to jog memory by

going through the alphabet, associating idea with other ideas, looking at maps to try and trigger places.

- Never/Almost never**
- Rarely** (About once or twice per month)
- Sometimes** (About once a week)
- Often** (About 2-3 times per week)
- Very often** (Almost daily)

Q13B: Please rate how often do you think an average person in each of the age categories might use this strategy:

	Never/Almost Never	Rarely (About once or twice per month)	Sometimes (About once a week)	Often (About 2-3 times per week)	Very often (Almost daily)	Don't know
A person in their 20s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 40s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 60s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>
A person in their 80s	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>	<input type="radio"/>

