Age Differences in Prospective Memory for Everyday Life Intentions: A Diary Approach.

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Abstract

The age benefit found in many naturalistic prospective memory (PM) tasks has been taken as evidence that PM performance in real life may be spared from aging. However, this conclusion lacks empirical confirmation. Hence, the aim of the present study was to examine possible age differences in the content of everyday PM intentions and their performance. Everyday PM was assessed in young and older adults using a diary approach. Results confirmed a general age benefit for real life PM tasks. Importantly, this finding was qualified by revealing that the benefit only held true for specific types of intentions such as health and social intentions. Further, moderation analyses showed that the relationships between cognitive functioning and everyday PM were different for young and older adults. While better inhibition, short-term and long-term memory were related with successful PM performance in the young, this was not the case in the older adults. The present findings suggest that the age benefit found in naturalistic experimenter-given tasks extends to real life PM performance, but may differ depending on the type of intention. Furthermore, cognitive functioning predicts performance in the young, but not in the older adults.

Keywords: prospective memory, everyday life, diary, aging

Age Differences in Prospective Memory for Everyday Life Intentions: A Diary Approach.

Prospective memory (PM) describes cognitive processes and skills required to remember the realization of a delayed intention in the future (Kliegel, McDaniel, & Einstein, 2008). Prospective remembering is of high relevance for everyday life, especially in old age (Maylor, 1990) as some PM tasks help to maintain social relations, such as remembering to send a birthday card while others are associated with independence and autonomy (e.g., remembering to pay a bill in time). In addition, older adults often have special health needs which demand intact PM functioning such as remembering to take medication, monitoring indexes of physical functions, or meeting health-related appointments (McDaniel, Einstein, & Rendell, 2008). In line with these observations, Woods, Weinborn, Velnoweth, Rooney, and Bucks (2012) recently reported systematic evidence demonstrating that individual differences in PM performance were related to individual differences in measures of everyday functioning and independence.

The high relevance of PM for older adults' everyday life led to an increasing number of studies on age differences in PM during the past years. Their results have revealed a surprising pattern, introduced as the *age PM paradox* (Rendell & Craik, 2000; Phillips, Henry, & Martin, 2008). This phenomenon is reflected in an age advantage across tasks carried out in the everyday environments of the participants (e.g., remembering to call the experimenter once a day) and a pattern in reverse direction (age deficit) in tasks carried out in the laboratory (e.g., remembering to press a prospective response button upon encountering a specific word in a test session; Henry, MacLeod, Phillips, & Crawford, 2004). In their seminal meta-analysis, Henry et al. conclude that this may indicate that PM performance in real life tasks (i.e., PM 'tasks' that naturally occur in everyday life such as the examples given above) may actually be spared, even if aging was associated with a decline in the basic cognitive processes involved in PM (such as inhibition or switching; see Schnitzspahn, Stahl, Zeintl, Kaller, & Kliegel, 2013). Surprisingly, so far naturalistic studies have always provided

participants with to be remembered tasks by the experimenter (e.g., Kvavilashvili & Fisher, 2007), but not yet investigated naturally occurring intentions. Only one study (Ihle, Schnitzspahn, Rendell, Luong, & Kliegel, 2012) has actually addressed this issue and explored older adults' levels of performance in their actual real life PM behaviour as well as possible influencing factors.

Following up on earlier diary studies on young adults (see, e.g., Ellis, 1988; Ellis & Nimmo-Smith, 1993) Ihle and colleagues (2012) measured PM performance in everyday situations on five consecutive days in young and older adults. Specifically, participants were called every evening to ask them about their intentions for the following day and to verify if they successfully remembered and performed the planned intentions for that very day. In addition, all intentions were rated regarding their importance. Results showed an age benefit in everyday PM performance. However, this only held true for intentions with low to medium importance, whereas performance in both age groups was comparable for intentions rated as highly important. While both age groups seemed to profit equally from the use of reminders and were impaired by everyday stress, older adults' superiority was associated with the strategy to consciously reprioritize initially planned intentions. In sum, the study suggests that the age-related benefit observed in naturalistic, experimenter-given tasks transfers to real everyday PM. The present study set out to replicate and extend these findings. Furthermore, the study from Ihle and colleagues (2012) suggests that individual and age-related everyday PM performance varies in dependence of motivational factors and planning skills. While these findings shed some initial light on the vastly unknown pattern of age-related changes in real world PM performance, several key issues were not targeted. Amongst those we argue that one major source of (age-related) variance in real world PM will stem from the actual contents of the intended actions. This hypothesis is based on given findings showing that older adults prioritize social and emotional goals over instrumental and material goals (Carstensen, Mikels, & Mather, 2006). Hence, one might predict that older adults' PM is

especially functional in everyday life for delayed intentions related to the social domain. Similar predictions may be derived for the health domain, as older adults have a rising number of health-related conditions which increase in importance with advancing age (Park, Willis, Morrow, Diehl, & Gaines, 1994; Steinhagen-Thiessen & Borchelt, 1999). Thus, determining the content of PM tasks which young and older adults actually have to face in their everyday life would be an important next step in order to define to what extent laboratory research or naturalistic PM tasks given by the experimenter actually reflect everyday PM challenges. This would also help to better understand the age PM paradox. Thus, it was the principal objective of the present study to approach this open question and clarify which specific PM situations occur in everyday life, whether young and older adults differ in the content of these intentions and whether age differences in everyday PM performance vary as a function of task content. As in Ihle et al. (2012) a diary approach was used to obtain the necessary information. The time of observation was largely extended to 30 days of repeated assessment to avoid effects of unusual incidents and to assess the full range of daily PM situations. Participants were asked every day about their performance as well as their intentions for the following day. Such a procedure (Ihle et al., 2012) helps avoiding that the obtained PM results are biased by retrospectively forgetting once formed intentions and/or their proper execution, as could be the case when asking participants retrospectively how many intentions they remembered and fulfilled correctly within the last week or month.

In terms of specific predictions, the few previous diary studies focusing on young adults only may give first hints concerning the content of everyday PM tasks. Ellis (1988) revealed two types of daily intentions: (1) "*pulses"*, reflecting personally important intentions that can be realized only within a short period of time, and (2) "*steps"*, describing less important intentions that may be completed within a longer time period. Marsh, Hicks, and Landau (1998) offer a more detailed classification. They asked students to list their plans for the following week and could identify six different types of plans: 1) "commitments and

appointments", 2) "intentions to commit" (e.g., calling to establish an appointment), 3) "intentions to complete" (e.g., having to return something from a friend), 4) "intentions to study", 5) "intentions to communicate", and 6) "miscellaneous intentions" (e.g., feeding a friend's pet). Non-completion rates differed depending on plan category. Higher rates of non-completion appeared in the two categories that were characterized as the participants' uncommitted intentions (i.e., intentions to communicate and intentions to complete). In contrast, previously established intentions characterized by meeting appointments or doing assigned homework, clearly showed lower non-completion rates. Furthermore, intentions rated as slightly more important were successfully completed more often. Additional support for task importance as a critical moderator of PM performance in everyday life comes from a recent study by Penningroth, Scott and Freuen (2011). The authors associated task importance with the content of the tasks by distinguishing between social and non-social PM tasks. Social PM tasks were rated as more important and lead to higher performance rates than non-social ones. Thus, this study supports the assumption that completion rates for PM tasks may differ depending on the content of the planned intention and suggests that social plans might be especially relevant and therefore well remembered.

To sum up, present research on young adults suggests that the content of real life PM tasks influences their performance; yet, virtually nothing is known about naturally occurring PM tasks on such a fine-grained level in older adults' everyday life. The current study aims to fill this gap. The inclusion of older adults enables for the first time to target possible age differences in the contents of real life PM tasks. By examining whether and how the task content is related to actual performance in everyday PM, the present study aimed at enhancing the understanding of the naturalistic side of the age PM paradox. Finally, previous research on medication adherence, a specific example of an everyday PM challenge, suggests that performance in this specific task seems to be more affected by contextual factors than by cognitive variables (Wilson & Park, 2008). Hence, neuropsychological, personality and

contextual variables were assessed in the present study in a comprehensive baseline assessment session. With these individual difference variables we explored which factors are promising candidates for explaining age differences in real life PM.

Concerning the contents of the daily plans, it was predicted that those of young adults may fall in similar categories as in the study by Marsh et al. (1998), but it was also expected that young and older adults may differ in their plan contents and possible age-specific categories may arise (such as health-related plans in the older adults). Additionally, in line with the socioemotional selectivity theory, which states that young adults are strongly motivated to pursue information, while older adults are mainly motivated to pursue emotional satisfaction (Carstensen et al., 2006), older adults were predicted to report more intentions concerning social activities and leisure activities and young adults were expected to report more intentions concerning work. In line with Penningroth et al. (2011) social plans should lead to a high level of everyday PM performance in general, but maybe even more so in older adults.

Method

Participants

The sample consisted of 41 participants: 20 young adults (13 women, M_{age} = 31.30 years, age range: 21-40 years) and 21 older adults (10 women, M_{age} = 66.38 years, age range 61-73 years). Young and older adults did not differ in gender distribution (χ^2 (1) = 1.26, p > .05), education (χ^2 (5) = 5.31, p > .05), self-rated general health (t (39) = -.60, p > .05), self-rated depression as measured with the Center for Epidemiological Studies Depression Scale (CES-D; Radloff, 1977), (t (39) = -.59, p > .05) and chronic stress as measured with the Perceived Stress Scale (PSS; Cohen, Kamarck, & Mermelstein, 1983), t (39) = .30, p > .05. Exclusion criteria were acute physical and mental health problems, current depression (CES-D values > 24) and more than a maximum of 20 % employment for the older adults. All

young adults were recruited from the university environment and were therefore students or employees.

This study was part of a larger longitudinal study. From this larger study, another publication emerged addressing the association of social support and positive and negative affect for older and younger adults on a daily basis (Scholz, Kliegel, Luszczynska, & Knoll, 2012). Although there is some overlap in some of the variables used, the current manuscript investigates a unique research question and displays results not yet covered by the previous publication from the larger project.

Procedure

In an individual baseline session at university which lasted approximately 60 minutes, participants were informed about the study content and signed the consent forms. Afterwards, they performed a face to face version of the Cognitive Telephone Screening Instrument (COGTEL; Breitling et al., 2010; Kliegel, Martin, & Jäger, 2007) and the Stroop Test (Stroop, 1935). Then they filled in some questionnaires assessing socio-demographic information and personality variables (i.e., conscientiousness, depression, chronic stress). Finally, participants received instructions for the diary task they were asked to work on during the following 30 days. In order to avoid technical and compliance issues possibly associated with the use of smartphones in the older cohort, we opted for using a traditional paper-pencil methodology and mailing (see Green, Rafaeli, Bolger, Shrout & Reis, 2006 for studies on the validity of traditional paper diaries). Therefore, 30 empty diaries each provided with the participant code and 30 prepaid envelopes were handed out to the participants at the end of the baseline session. Specifically, participants were asked to fill in one diary every evening at approximately the same time and send it back to the experimenter the following morning. The importance of an immediate delivery was stressed and it was explained to the participants that the postmark would be used as a control.

The first page of each diary summarized the study goals and reminded the participants to directly send it back the day after. The phone number of the experimenter was provided in case of checkbacks. Importantly, participants were asked each day to indicate the date of the diary completion on the second page before filling in the first questionnaire. On the last page of each diary, participants were thanked for their cooperation and they were asked to check the diary for completeness and to make sure that they indicated the date on the second page.

The first diary started with the PM assessment and the importance rating of the planned activities. Then daily stress was measured. The following diaries were similar in structure, but additionally comprised the recall of the PM tasks mentioned the day before and assessed their remembrance, fulfilment or possible reasons for non-fulfilment before asking after the new plans for the following day.

Materials

Everyday PM. The real world PM tasks and their performance were assessed with the help of the diaries. Specifically, participants were asked daily for their plans concerning the following 24 hours. They could list them and directly rate their importance on a 5-point-Likert scale (1 = *not important*; 5 = *very important*). They were instructed not to list habitual behaviour, but such intentions as posting a letter or going to the doctor. All participants were informed that the study aim was to explore naturalistic behaviour and thus it would be very important that they behave in their usual manner and fill in the diary honestly. From the second day on, participants were asked to review all planned intentions they had written down in their diary the day before and to indicate if they actually performed those tasks or not. In the latter case, they were asked to briefly describe the reason why they did not complete the planned tasks.

PM performance was operationalized through the comparison of planned and actually remembered or fulfilled intentions. Thus, two dependent variables are considered in the

following: Firstly, the percentage of correctly remembered intentions and secondly, the percentage of successfully completed intentions.

The number of returned diaries was generally very high (M = 29.32 out of 30 diaries, SD = 1.65) and did not differ for young and older adults, t (39) = -.1.99, p > .05.

Individual difference measures

Neuropsychological measures. Short-term memory, long-term memory, working memory, verbal fluency, inductive reasoning and lab-based PM performance were measured using the COGTEL (Kliegel et al., 2007). The COGTEL is a cognitive test battery which was designed to allow a brief but global assessment of cognitive function among healthy young and older adults. Its six subtests are taken from the Wechsler Memory Scale-Revised (WMS-R; Wechsler, 1987) and the Wechsler Adult Intelligence Scale-Revised (WAIS-R; Wechsler, 1981).

In addition, inhibition was measured using the Stroop interference task (Stroop, 1935). Here, participants have to work on three consecutive tests without making errors and as fast as possible. In the first test they are asked to read aloud colour names printed in black. In the second test coloured squares are displayed and the participants are instructed to name the depicted colours. Finally, in the third test, the participants have to name the print colour of coloured words while ignoring the colours named by the words; e.g. the word 'red' printed in green has to be called 'green'. The performance variable used in the later analyses was the difference in overall naming time between the third and the second test.

Conscientiousness. Conscientiousness was measured with the conscientiousness subscale of the German translation (Borkenau & Ostendorf, 1993) of the NEO Five-Factor Inventory (NEO-FFI; Costa & McCrae, 1992). The scale comprises 12 self-report items and uses a five-point Likert response format (1 = *not at all*; 5 = *very much*).

Everyday stress. Stress was measured on a daily basis with a modified version of the Daily Inventory of Stressful Events (DISE; Almeida, Wethington, & Kessler, 2002) for

written use (Sliwinsky, Smyth, Hofer, & Stawski, 2006). The DISE allows assessing the number of stressors per day by asking if one or multiple stressful situations were experienced (i.e., argument or disagreement with someone; incident one could have argued or disagreed about; stressful event happening to a close friend or relative; stressful event regarding own personal health; any other incident that most people would consider stressful). The mean number of stressors per day during the testing period was used in the later analyses as measure of everyday stress.

Data preprocessing / PM task categorization

To ensure assessment of the full range of naturally occurring PM tasks in real life, we decided to not provide predefined categories such as in Marsh et al. (1998) but assess daily intentions completely free from any preconditions and categorized all answers post-hoc using qualitative content analysis (Bortz & Döring, 2006). By doing so, the five following categories could be identified: 1) social intentions (e.g., "Pick up grand-child after kindergarten", "Have dinner with my parents and my boyfriend"), 2) work-related intentions (e.g., "Work on tax return", "Prepare power point presentation"), 3) health-related intentions (e.g., "Do one hour of walking"), 4) organizational intentions and housekeeping (e.g., "Iron the shirts"), 5) leisure time intentions (e.g., "Visit museum").

Similarly, the provided reasons for failing to complete an intention were categorized as well. The following classes of reasons could be identified: 1) forgetting, 2) self-determined change of plans, 3) lack of motivation, 4) lack of time, 5) illness, 6) weather, 7) unforeseen incidents, 8) required interaction partner not available.

Results

If not indicated differently, the alpha level was set at .05 and it was tested two-tailed. Effect sizes were calculated for every significant *t*-test result as Cohen's *d* (Cohen, 1988), who defines effect sizes of 0.2 as small, 0.5 as medium, and 0.8 as large. Mean values were

summed up across all diaries and divided through the number of returned diaries to obtain overall mean values of PM performance, intention importance and everyday stress.

Age differences in real life PM performance

To test the prediction that older adults outperform young adults in real life PM tasks, separate t-tests were run, both concerning the remembering and the fulfillment of the planned intentions. As predicted, older adults better remembered their planned intentions than young adults, $t(39) = -2.04$, $p = .024$ (one-tailed), $d = -0.64$ and completed them more often, $t(39) = -2.01$, $p = .025$ (one-tailed), $d = -0.63$ (see Figure 1).

Age differences in the number of intentions per category, importance ratings of the intentions per category and reasons for failing an intention completion

To address the question if young and older adults may differ in their plan contents, separate t-tests were run comparing the total number of plans in young and older adults for each intention category. To avoid an inflated Type I error rate, the alpha level for the following analyses was set at .01 according to the number of performed tests (i.e., .05 / 5 = .01). As can be seen in Figure 2, young and older adults did not differ in their number of planned social intentions, $t(39) = -0.29$, $p > .05$, and in the number of health-related intentions, $t(36) = 0.15$, $p > .05$. As expected, young adults reported a higher number of work-related intentions, $t(39) = 2.85$, $p = .008$, $d = -0.90$, while older adults reported significantly more organizational and housekeeping intentions, $t(39) = -2.95$, $p = .005$, $d = -0.92$, and a trend for a higher number of leisure time intentions, $t(39) = -1.80$, $p = .080$, $d = -0.56$.

Age differences in the subjective importance of the planned intentions between young and older adults only reached significance for social intentions, $t(39) = -2.76$, $p = .009$, $d = -0.87$. Older adults ($M = 4.49$; $SD = 0.50$) rated their social intentions as more important than young adults ($M = 4.08$; $SD = 0.44$). The intentions in all other categories were rated as equally important in both age groups, all ps > .21. Mean values between 3.92 ($SD = 0.61$) and

4.49 (*SD* = 0.44) show that our participants reported personally rather important intentions (maximum: 5 = very important).

The reasons for non-completions of planned intentions were mostly comparable between young and older adults, all *p*s > .062 (the alpha level for these analyses was set at .006 as 8 separate t-tests were run). The only exception was that older adults reported more often than young adults that they could not complete their intentions because of the weather, $t(39) = -3.46$, $p = .002$, $d = -1.18$. However, this reason was mentioned very rarely in both age groups (for 0.21 % of all non-completed intentions in the young and for 5.04 % of all non-completed intentions in the elderly). The main reason for non-completed intentions in both age groups was forgetting (young: 49.18 %; old: 41.40 %), followed by a lack of time (young: 20.60 %; old: 14.87 %). Changes of plans (young: 7.34 %; old: 10.32 %), a lack of motivation (young: 10.10 %; old: 7.47 %) and that the required interaction partner was not available (young: 5.66 %; old: 10.90 %) were also mentioned rather frequently. Illness (young: 3.94 %; old: 3.21 %) and unforeseen incidents (young: 2.96 %; old: 6.79 %) were rarely mentioned as reasons for non-completion.

Age differences in real life PM performance depending on the category of the intention

Comparing performance between young and older adults separately for each intention category revealed that the overall age benefit in real life PM performance reported above did not hold. Using an alpha level of .01, there were only trends for age differences concerning the number of correctly remembered health-related intentions, $t(36) = -2.19$, $p = .040$, $d = -0.71$, and correctly remembered, $t(38) = -2.64$, $p = .012$, $d = -0.84$, and fulfilled organizational intentions, $t(38) = -2.11$, $p = .042$, $d = -0.66$ (see Table 1 for all descriptive values). Importantly, these trends for age differences remained when intention importance was entered in the analyses as a covariate. Furthermore, as predicted, social intentions were tendentially better fulfilled in older than young adults, $t(39) = -1.94$, $p = .030$ (one-tailed), $d = -0.60$. This

trend was no longer observed, when intention importance was entered as a covariate, F (1, 38) = .97, $p > .05$.

Exploratory analyses: Age differences in possible predictors of PM performance

To obtain first insights if possible relations between neuropsychological, personality and contextual variables and everyday PM performance differ between young and older adults, several moderation analyses were conducted using *PROCESS* (Hayes, 2008). Specifically, it was tested if age group served as a moderator of possible relationships between the cognitive constructs measured with the COGTEL (i.e., short-term and long-term memory, working memory, verbal fluency, inductive reasoning and PM), inhibition, conscientiousness and mean everyday stress during the testing period and the percentage of correctly remembered and fulfilled intentions. Results (see Table 2 for details of all significant moderation analyses) showed that age group only moderated the relationships between some of the neuropsychological variables (i.e., short-term memory, long-term memory and inhibition) and correctly remembered and fulfilled intentions. In the young adults, there was a significant positive relationship between short-term memory and correctly fulfilled intentions, b= 3.74, t = 2.10, p = .042, while there was only a trend for a negative relation in the older adults, b= -2.60, t = -1.74, p = .090. Furthermore, there were significant positive relationships in the young adults between long-term memory and correctly remembered, b= 5.74, t = 2.70, p = .010, as well as correctly fulfilled intentions, b= 5.98, t = 3.00, p = .005. In the older adults, both relations did not approach significance, ps > .48. Finally, there was a significant negative relationship in the young adults between inhibition and correctly remembered intentions, b= -1.43, t = -3.46, p = .001, while the relation was not significant in the older adults, b= 0.23, t = 0.71, $p > .05$. Similarly, there was a significant negative relationship between inhibition and correctly fulfilled intentions, b= -1.17, t = -2.81, p = .008, in the young, but not in the older adults, b= -0.07, t = -0.22, $p > .05$. These results show that the relationships between cognitive functioning and PM are different for young and

older adults. Specifically, PM performance in the young adults increases when the level of inhibition, short- and long-term memory increases, while the levels of inhibition and memory were not related to PM performance in the older adults.

Discussion

The present study for the first time examined possible age differences in everyday PM performance with a particular emphasis on the content of daily intentions that young and older adults form in their everyday life. At first glance, results confirm the overall prediction of older adults' superior everyday PM performance. However, this finding was qualified by revealing that trends for age benefits were only observed for specific intention categories such as health and social intentions. Results also suggest that in many dimensions everyday occurring intentions as well as the reasons for non-fulfillment are remarkably comparable between young and older adults; yet, with some conceptually important exceptions. Finally, in terms of possible predictors, everyday PM performance in young and older adults seems to be differentially associated with cognitive factors. While performance in the young was related to inhibition and short- and long-term memory, this was not the case in the older adults.

To discuss the present findings in detail, concerning the total number of intentions built per content category, only a few age differences emerged. As to be expected, young adults reported a higher number of work-related intentions than older adults which is not surprising given the differences in the embeddedness into a working environment. Accordingly, older adults reported a higher number of organizational or housekeeping intentions and a trend for more leisure time intentions. Besides no other age differences in the number of intentions were observed, not even for social or health related intentions as initially expected. It is possible that this finding is related to our participants´ group. Perhaps more age differences would emerge when old-old adults would be included in the sample of older adults. In our study only young-old adults between 61 years and 73 years participated, who did not differ in their self-rated general health from young adults (yet, note that this age range

represents the major target group for most laboratory and naturalistic PM studies so far conducted – see Henry et al., 2004 and Ihle, Hering, Mahy, Bisiacchi, & Kliegel, 2013 for meta-analyses). Accordingly, the number of reported health-related intentions was relatively low in both age groups. Future studies are needed to test if different everyday intentions are reported in old-old adults who maybe face other challenges and more health problems. Taken together, results clearly suggest that it is not the *quantity* of intentions in specific categories that makes the critical difference between age groups. Rather our findings point to crucial *qualitative* differences, especially in particular content categories such as social intentions. Here, remarkable age differences emerged: Older adults rated social intentions as more important than young adults and tended to complete them more often than young adults. These findings are in line with predictions from the socioemotional selectivity theory (Carstensen et al., 2006) suggesting that social intentions should be especially important in aging. The present study is the first to demonstrate this effect for real life PM intentions.

Besides the relatively similar number of intentions in the different categories, interestingly, the reasons for the non-fulfillment of intentions were also largely comparable between the two age groups. The main reason in both age groups was forgetting. It accounted for nearly half of all PM failures. This result importantly shows the significance of memory or cognitive processes in everyday PM situations and underlines the need for developing or applying effective interventions, strategies, or reminder to prevent forgetting. Other reasons for non-completion were either accounted for by the situation (i.e., lack of time and missing interaction partner) or by the participants themselves (i.e., lack of motivation and changes of plans). Thus, non-fulfillment of delayed intentions in everyday life seems to mainly be caused by memory failures, yet, also including motivational and contextual factors, and this for both young and older adults.

The finding of a general age benefit for everyday PM performance when considering the total of planned intentions independent from their specific content is in line

with the first aging study on real life PM from Ihle and colleagues (2012), thereby supporting the conclusion that PM in real life tasks may indeed be spared by aging. More precisely, everyday PM may not only be spared by aging, but performance even seems to improve. Yet, the present study also offered a more fine-grained pattern showing that this age benefit may not be true for all types of intentions, but especially for intentions concerning one's health, organizational/ housekeeping and social issues. Importantly, trends for significant age differences remained for health and organizational or housekeeping intentions after statistically controlling for the importance of the intentions. Thus, while former studies suggest that importance plays a major role for PM task remembering and fulfillment in everyday life (Marsh et al., 1998) as well as for explaining age differences (Ihle et al., 2012), the present study suggests that other factors besides intention importance seem to influence everyday PM differently in young and older adults in certain situations. Possible candidates could be a greater experience how to deal with the tasks best, as it is plausible to assume that older adults in general have more experience with health related PM tasks and also with organizational or housekeeping tasks as they do not work full time anymore and probably spend more time at home. This idea is supported by the age differences found in the present study for the number of plans in each category, as older adults reported a higher number of organizational or housekeeping related plans. Thus, they probably had more opportunities to develop routines or strategies than young adults. In addition, they could probably develop a better metacognitive awareness for their PM abilities in their familiar environment and thereby can use reminders more effectively. A good metacognitive awareness as well as the use of reminders have been shown to be related with better PM performance in naturalistic tasks (Ihle et al., 2012; Schnitzspahn, Ihle, Henry, Rendell, & Kliegel, 2011).

Exploring neuropsychological, personality, and contextual variables for their role in predicting the percentage of correctly remembered and fulfilled everyday intentions in young and older adults revealed an interesting dissociation in the patterns of associations. While

better PM performance in the young adults was related to higher neuropsychological functioning (i.e., better inhibition and memory performance), this was not the case for older adults. This difference might give a first hint why an age benefit is usually found in everyday PM performance despite the general cognitive decline in aging and PM age deficits found in most laboratory tasks (Henry et al., 2004; Kliegel, Jäger, & Phillips, 2008). It seems that cognitive factors become less important for the fulfillment of everyday intentions in older adults. This finding is in line with research on medication adherence suggesting that performance is more affected by contextual factors than by cognitive variables (Wilson & Park, 2008). Further research is needed to identify those non-cognitive factors influencing daily PM performance, as the ones tested in the present study (i.e., conscientiousness and everyday stress) did not show relationships with PM that were moderated by age group. Furthermore, the present study showed that only some, but not all of the measured cognitive abilities were related with everyday PM performance in the young adults. Thus, future studies are also needed to further specify the relevant cognitive constructs, as it seems that daily PM performance is rather associated with distinct abilities than with general cognitive functioning.

The present results allow some conclusions concerning the age-PM paradox or more precisely the age benefit usually found when young and older adults were asked to perform experimenter-given naturalistic tasks in their everyday environment (Henry et al., 2004). These tasks were often social tasks like sending a letter, phoning or texting the experimenter at given times. Given the observed age benefit for everyday social intentions and the finding that older adults rated social intentions as more important than young adults, one may conclude that older adults were at an advantage over the young adults in former studies using naturalistic tasks, as the chosen tasks represent everyday intentions that older adults consider as important and perform very well in real life. It will be interesting to vary the types of naturalistic tasks in future studies on everyday PM and aging to test if the present result of

differing age effects depending on the intention type also occurs for tasks that are not formed by the participants themselves and instead are provided by another person.

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Table 1

Percentage of correctly remembered and correctly fulfilled everyday PM intentions in young and older adults depending on the category of the intention

	Young adults		*Older adults*	
Intention category	*M*	*SD*	*M*	*SD*
Social				
Remembered	82.75	17.39	90.66	16.32
Fulfilled	72.39	19.22	83.03	15.79
Work				
Remembered	84.89	15.34	81.37	26.34
Fulfilled	75.82	16.83	65.91	24.79
Health				
Remembered	76.49	32.50	93.56	9.75
Fulfilled	72.46	30.96	84.97	11.67
Organization				
Remembered	80.69	13.62	90.87	10.70
Fulfilled	67.36	16.87	77.41	13.21
Leisure				
Remembered	82.98	25.55	89.04	13.36
Fulfilled	71.50	23.98	77.64	12.47

Table 2

Results of the moderation analyses with age group as possible moderator, short-term memory, long-term memory and inhibition as possible predictors and correctly remembered and fulfilled intentions as outcome variables.

	Outcome variable									
	Correctly remembered intentions					Correctly fulfilled intentions				
Main and interaction effects	*b*	*SE*	*T*	*p*	R^2	*b*	*SE*	*t*	*p*	R^2
Short-term memory	9.66	4.07	2.37	.023		10.09	3.86	2.61	.013	
Age	42.74	14.57	2.93	.006		43.25	13.81	3.13	.003	
Short-term memory x Age	-6.24	2.45	-2.54	.015		-6.35	2.33	-2.73	.010	
					.23					.25
Long-term memory	12.54	4.58	2.74	.009		13.10	4.30	3.05	.004	
Age	51.44	17.39	2.96	.005		53.09	16.34	3.25	.003	
Long-term memory x Age	-6.80	2.73	-2.49	.017		-7.12	2.56	-2.78	.009	
					.25					.28
Inhibition	-3.10	0.89	-3.48	.001		-2.27	0.89	-2.54	.015	
Age	-7.35	6.23	-1.18	.246		-1.71	6.26	-0.27	.787	
Inhibition x Age	1.66	0.53	3.16	.003		1.10	0.53	2.08	.045	
					.32					.25

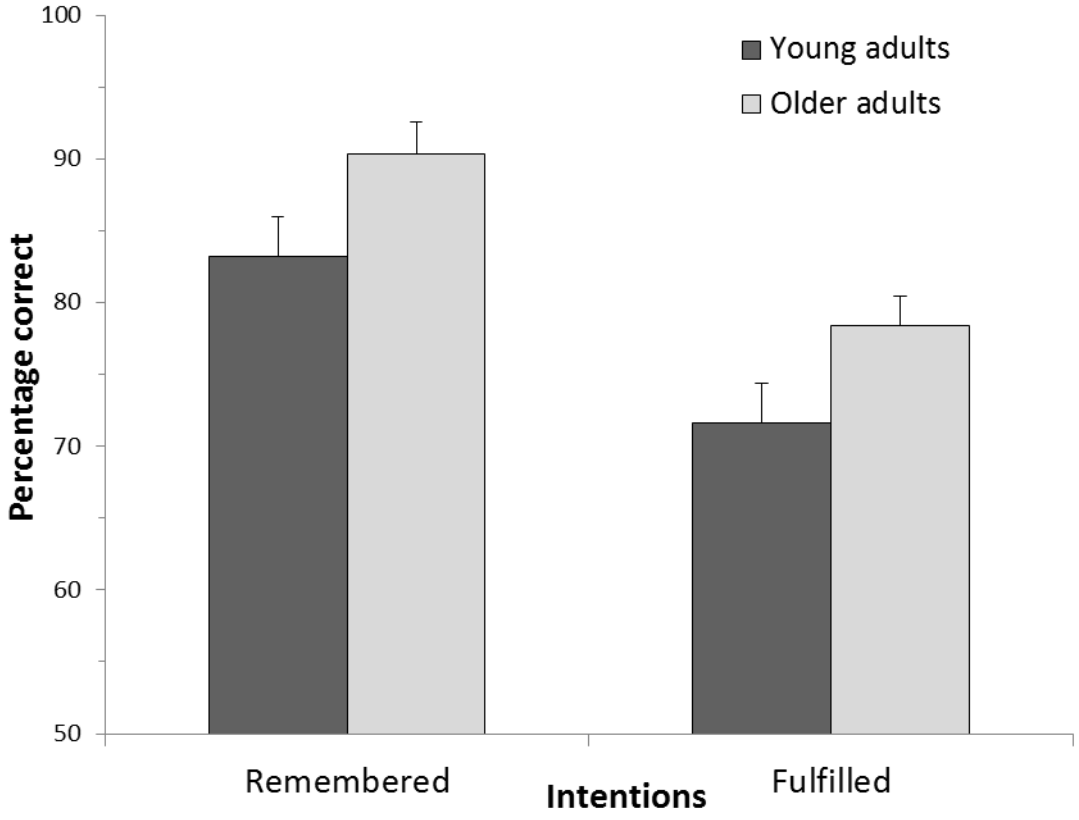

Figure 1. Real life PM performance (proportion of correctly remembered and fulfilled intentions) in both age groups. Standard errors are represented in the figure by the error bars attached to each column.

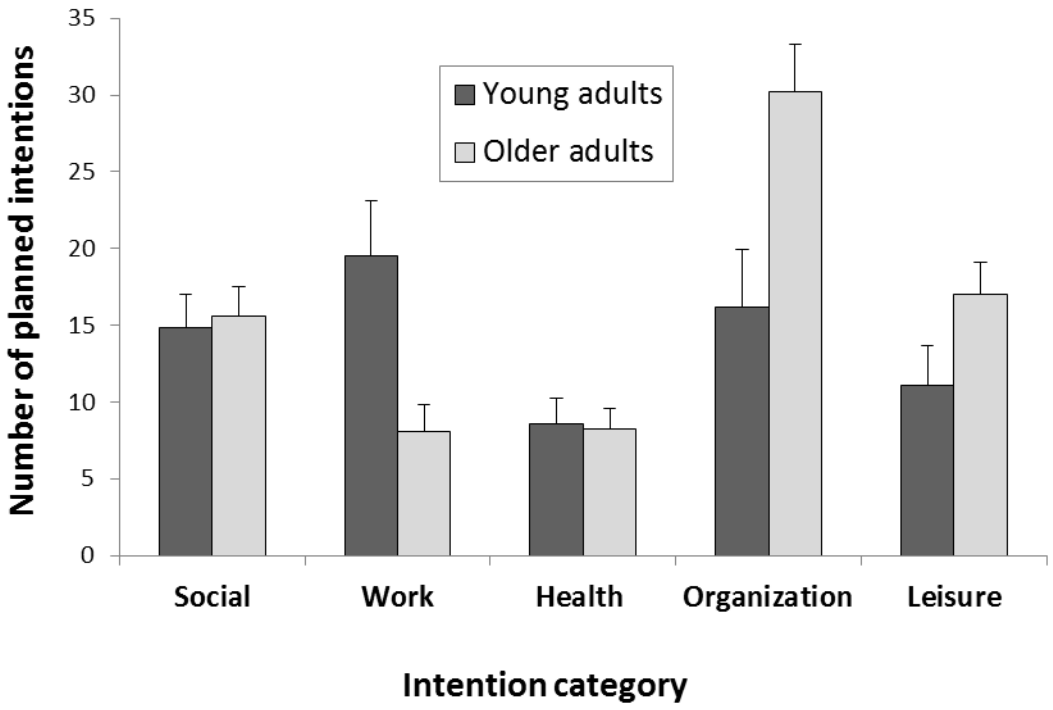

Figure 2. Number of planned intentions in each of the five categories in both age groups. Standard errors are represented in the figure by the error bars attached to each column.