Prospective memory and ageing: is task importance relevant?

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Abstract

Memory for activities to be performed in the future, i.e., prospective memory, such as remembering to take medication or remembering to give a colleague a message, is a pervasive real world memory task that has recently begun to attract the attention of numerous researchers. Age effects in prospective memory have been found particularly in complex paradigms requiring participants to remember to switch between several sub-tasks in a limited time period (e.g., Kliegel, McDaniel, & Einstein, 2000). Here, most of the older adults tend to try to complete one or two subtasks and to forget the prospective instruction to work on all sub-tasks. Since recent findings in this context show that one profits from tips regarding the relevant task's salience in complex double-tasks, it seems likely that age effects in prospective memory tasks might also be due to the lack of information about the salience of the prospective task. To test this hypothesis, the salience of the prospective task was varied in the present study with 104 young and old participants by providing motivational incentives to interrupt and switch during the introduction phase (plan formation) as well as during the execution phase. Also, interindividual differences regarding non-executive as well as executive cognitive resources were analyzed, thus allowing estimation of the relationship between these factors and (age-related) performance in complex prospective remembering. The results show age effects in favour of the younger group in all task components of the complex prospective multi-task. In contrast, none of the groups profited significantly from the present experimental manipulation of motivational incentives. Finally, in regression analyses, particularly planning (i.e. intention formation) was found to be a significant predictor of intention execution, explaining most of the age-related variance. In sum, our results specifically highlight the fundamental importance of adequately planning the complex intention and do not support the hypothesis that age-related decrements in performance are reflecting a lack of task salience in the present complex prospective memory paradigm.
COMPLEX PROSPECTIVE MEMORY AND AGING:
THE INFLUENCE OF MOTIVATIONAL INCENTIVES

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Abstract

Memory for activities to be performed in the future, i.e., prospective memory, such as remembering to take medication or remembering to give a colleague a message, is a pervasive real world memory task that has recently begun to attract the attention of numerous researchers. Age effects in prospective memory have been found particularly in complex paradigms requiring participants to remember to switch between several sub-tasks in a limited time period (e.g., Kliegel, McDaniel, & Einstein, 2000). Here, most of the older adults tend to try to complete one or two subtasks and to forget the prospective instruction to work on all sub-tasks. Since recent findings in this context show that one profits from tips regarding the relevant task’s salience in complex double-tasks, it seems likely that age effects in prospective memory tasks might also be due to the lack of information about the salience of the prospective task. To test this hypothesis, the salience of the prospective task was varied in the present study with 104 young and old participants by providing motivational incentives to interrupt and switch during the introduction phase (plan formation) as well as during the execution phase. Also, interindividual differences regarding non-executive as well as executive cognitive resources were analyzed, thus allowing estimation of the relationship between these factors and (age-related) performance in complex prospective remembering. The results show age effects in favour of the younger group in all task components of the complex prospective multi-task. In contrast, none of the groups profited significantly from the present experimental manipulation of motivational incentives. Finally, in regression analyses, particularly planning (i.e. intention formation) was found to be a significant predictor of intention execution, explaining most of the age-related variance. In sum, our results specifically highlight the fundamental importance of adequately planning the complex intention and do not support the hypothesis that age-related decrements in performance are reflecting a lack of task salience in the present complex prospective memory paradigm.
Introduction

In everyday life, remembering to perform actions planned earlier can be highly relevant, especially when one is at the same time busy with a competing activity (Brandimonte, Einstein, & McDaniel, 1996). This is one of the reasons why the number of studies on prospective memory has rapidly increased over the last 10 years (cf. Ellis & Kvavilashvili, 2000). Even though prospective memory, in order to master daily routine, is required at virtually every stage during a life-span (cf. Martin & Kliegel, in press), particularly in old age an intact prospective memory has been found to be a major prerequisite for successful independent living (Kliegel, in press; Martin, 2001). Therefore, researchers’ recent interest focuses on factors able to explain age differences in prospective remembering (Einstein, McDaniel, Manzi, Cochran, & Baker, 2001; Ellis & Kvavilashvili, 2000; Kliegel, McDaniel, & Einstein, 2000; Martin, Kliegel, & McDaniel, this issue).

Current theories of age effects in prospective remembering refer to the structure of the prospective task as well as the involved cognitive processes. For example, Kvavilashvili and Ellis (1996) postulate a range of prospective task characteristics believed to be related to differences in performance. A rather critical factor seems to be the salience of the prospective task, which has been given close empirical attention over the last years. Several studies on younger adults and simple prospective memory tasks have demonstrated that increasing the prospective task’s importance will lead to better prospective memory performance (Kliegel, Martin, McDaniel, & Einstein, 2001; in press; Kliegel & Martin, in press; Kvavilashvili, 1987; McDaniel & Einstein, 2000). Since recent findings in this context show that particularly older adults profit from tips regarding the relevant task’s salience in complex double-tasks (e.g., Hohaus, Shum, & White, 2000), it seems likely that age effects in prospective memory tasks might also be due to the lack of information about the salience of the prospective task. In other words, the importance of actually completing all of the prospective actions planned
beforehand at the proper time may be less obvious to older adults than to younger ones. So far, though, there are no empirical proofs for this hypothesis.

Apart from the idea just discussed, it has further been proposed that several cognitive resources may influence age-related prospective memory performance. While the influence of non-executive cognitive resources such as, for example, verbal intelligence (cf. Cherry & LeCompte, 1999) or retrospective memory (cf. Einstein, Holland, McDaniel, & Guynn, 1992) has been investigated repeatedly over the last years, more recent approaches discuss the effects that executive control processes like planning or inhibition (cf. Baddeley, 1996; Kliegel, Martin, McDaniel, & Einstein, 2002; Martin, Kliegel, & McDaniel, this issue; Martin & Schumann-Hengsteler, 2001; Smith & Jonides, 1999) might have, particularly with respect to complex, i.e., multiple prospective memory tasks. Unlike with simple prospective laboratory tasks, where participants are usually just expected to keep in mind and later realize the intention to perform one single action, several current studies investigate so-called multiple or “complex” (Kliegel et al., 2000; Ellis & Kvavilashvili, 2000) prospective memory tasks. This paradigm requires participants to completely and on their own perform a delayed intention to switch between several similar (sub-)tasks at a certain point once the intention is re-instantiated (Burgess, Veitch, de Lacy Costello, & Shallice, 2000; Kliegel et al., 2000, 2002; Kvavilashvili, 1992; Kvavilashvili & Ellis, 1996; Rendell & Craik, 2000). As a complement to many traditional and fairly simple research paradigms that mainly examine the phases concerning the formation of a prospective intention or its re-instantiation (cf. Brandimonte et al., 1996), quantitatively complex prospective multi-tasks focus, after the phases of intention formation, retention and re-instantiation, on the actual performance of the multiple intention. Particularly in this last phase, strong age effects that are largely independent from re-instantiation (i.e., the point where one remembers and begins with the prospective task) have repeatedly been found (Kliegel et al., 2000, 2002; see also Rendell & Craik, 2000). While most simple prospective paradigms do not seem to involve active
planning processes (Bisiacchi, 1996), delayed execution of an intention to switch between several tasks is believed to be related to active planning during the intention formation phase. In addition, age effects in complex prospective memory tasks are assumed to correlate with older adults’ deficits in planning these tasks (Kliegel et al., 2000, 2002). A further cognitive resource to be mentioned in connection with the described age effects is inhibitory efficiency. In addition to the general finding of older people’s less effective inhibitory mechanisms when performing a cognitive task (Hasher & Zacks, 1988), it seems that, apart from planning complex prospective multiple intentions, older adults also have more difficulties to implement encoded plans adequately and to keep those plans in their working memory while performing competing activity. Therefore, first theoretical speculations suspect that age differences in inhibitory functioning during intention execution would be responsible for this effect (Martin & Schumann-Hengsteler, 2001; McDaniel, Glisky, Rubin, Guynn, & Routhieaux, 1999).

Thus, the goal of the present study was to examine salience as an indirect motivational measure as well as cognitive resources / planning functions, investigating their influence on or relation with age-related performance in a complex prospective multiple task paradigm, respectively.

To test our assumptions, we administered the paradigm developed by Kliegel et al. (2000), since it had consistently revealed reliable age effects for various task components in previous studies (Eschen, Kliegel, & Thöne-Otto, 2002; Kliegel et al., 2000; 2002; Martin et al., this issue; Philipps, MacLeod, & Kliegel, in press). Basically, the idea of this delayed six-elements task (after Shallice & Burgess, 1991) is that, following certain rules, participants have to realize the delayed execution of six intentions. Therefore, they first generate a plan how to complete a set of tasks consisting of six different sub-tasks. Next, they are required to maintain their multiple intentions during a delay period and then, finally, to re-instantiate and perform the six sub-tasks on their own. The latter characteristic fundamentally distinguishes the present task from stimulus-triggered multiple tasks (cf. Kliegel et al., 2000). The main
difficulty with planning and executing the delayed realization of these six sub-tasks is that, within a certain period of time, one must work on every one of the six tasks, although not all tasks can be completely solved, as each one – taken alone – would require too much time. Therefore, participants are forced to interrupt each task at a self-chosen point, so as not to forget to switch between sub-tasks. So far, this necessity has been emphasized by instructing participants that every one of the six tasks must be worked on at least for a short time although not all tasks can be completed, and that within each sub-task earlier items would be given more points than later ones. Previous studies revealed that in spite of these hints, the majority of the older participants less often accounted for this interrupt/switch-necessity in their plans and thus carried out fewer self-initiated prospective switches in their actions. To test the hypothesis that the salience of a prospective task (in this case, the salience of the described necessity to interrupt and switch activity) influences (age-related) prospective memory, the salience of the prospective task was varied in the present study by modifying the salience of the necessity to interrupt and switch during the introduction phase (plan formation) as well as during the execution phase. Also, interindividual differences regarding non-executive as well as executive cognitive resources were analyzed, thus allowing estimation of the relationship between these factors and (age-related) performance in complex prospective remembering.

Method

*Design and participants*

In order to address our hypotheses, we chose a 2 x 2 x 2–factorial design, varying the between-subjects factors task salience during introduction phase (high vs. normal), task salience during execution phase (high vs. normal), as well as age (young vs. old). 13 participants were randomly assigned to each of the eight experimental groups. One younger and four older participants were subsequently discarded because they were not native speakers of German.
The reported analyses included 51 younger participants with an average age of 25 years ($SD = 4.5; \text{min} = 20; \text{max} = 41$) and 48 older participants aged 69.7 on average ($SD = 5.9; \text{min} = 59; \text{max} = 82$). 74.5% of the younger and 66.7% of the older participants were women. The younger participants were mostly students and the older participants were recruited from an older people’s institution for continuing education. Participation was voluntary. In order to ensure comparability of groups with respect to their verbal intelligence, participants were given a vocabulary test (MWT; Lehrl, 1977). Comparing intelligence quotients of both age groups, in test version A groups did not differ, whereas in version B the older group, in fact, did even better than the younger adults ($M = 125.33; SD = 12.61$ vs. $M = 117.38; SD = 14.45$), $F(1,95) = 8.31, p < .01$. On the whole, the older group of participants can be regarded as equivalent to the younger group in terms of verbal intelligence.

Instruments and procedure

General procedure. All participants were given the complex memory task by Kliegel et al. (2000), in a paper-pencil version which had been slightly modified in order to allow manipulating salience. The procedure consisted of three phases: (1) an introduction phase in which participants were instructed in the complex prospective memory task as well as asked to develop a plan; (2) a delay phase during which intention had to be stored and individual difference variables of cognitive resource (e.g., retrospective memory, inhibition) were assessed; and (3) a performance phase in which the prospective intention was to be re-instantiated and executed.

The introduction phase. After a general introduction, the participants were instructed in the prospective task using sample sheets. They were asked to carry out six sub-tasks in a 6-min time period, in a way that would allow them to maximize their overall scores. The six sub-tasks comprised three different task types (word finding, solving arithmetic problems, and picture naming), divided into two similar sets (A and B). Each sub-task was designed so that it would take more than 1 min to complete. Both sets of word finding problems (based on a
German vocabulary test, MWT; Lehrl, 1977) consisted of 37 groups of 5 items. In each group there was a true word (e.g., conceal) and 4 similarly spelled or similarly sounding pseudo-words (e.g., concill, cauncl, concel, caunseal). The participant’s task was to circle the actual word. Each set of arithmetic problems (A and B) contained 10 items (e.g., 300/6 x 4 =); both sets were equivalent in difficulty. Finally, the 20 pictures in each set were pictures of common objects or symbols (e.g., a house). Here, the participant’s task was to name the picture with an appropriate label. The participants were told that there were no perfect answers in this sub-task and that they should write down the first name or title they thought of.

After explaining the sub-tasks, the participants were told where the material for these sub-tasks was stored. Then, using a rule sheet, the rules were explained to the participants. The rules were as follows:

1. Your aim is to maximize your score. (a) Earlier word groups/problems/pictures will be given more points than later ones in each sub-task. (b) You have to remember to work on each one of the six tasks at least for a short time. (c) Each of the six sub-tasks will be given equal weight. (As mentioned above, the purpose of giving instructions about scoring was merely to emphasize the necessity of switching between sub-tasks – cf. Kliegel et al., 2000 – the number of points scored was not analyzed.)

2. You are not allowed to do two sub-tasks (A) and (B) of the same type one after the other.

3. You will have 6 minutes time.

In order to lay further emphasis on task salience, i.e. to once more underline that participants would have to switch between all tasks on their own, rule 1(b) was varied (manipulation of task salience during planning). Half of the participants were given a supplement to rule 1(b), which said: “You have to remember to work on each one of the six tasks at least for a short time. For each correct switch your will be given extra points.”

Afterwards, participants were asked to repeat the rules and any errors or omissions were corrected. Once the participants were able to repeat the rules completely, they were told
that they should start working on the six tasks by themselves after having answered the question about their date of birth in the Participant Information Questionnaire (which was shown to the participants at that point). Finally, the participants were asked to develop a plan for the prospective memory task (intention formation). This plan was reported verbally and recorded on a cassette tape. In line with Kliegel et al. (2000), plan elaborateness was analyzed in terms of a score that took into account three main features: (1) the number of rules named or implicitly included in a participant’s intention for a specific step, (2) the number of specifications a participant made regarding a particular order for performing a task by giving a reason for that step and (3) the number of executable items in the plan. To assess the number of executable items, we noted how many executable steps the participant indicated, i.e., (a) the number of task types he/she planned to initiate (words, pictures, arithmetic problems – 1 point each), (b) whether he/she specified the steps concerning the version (A or B – 1 point each), (c) whether he/she specified the steps concerning the time planned to spend on each task or version (1 point each) and (d) whether he/she specified the number of items he/she planned to complete in each step (1 – point each). The intention-elaboration score was the sum of the number of features (described above) included in a participant’s plan. For example, the plan “… seeing that I must not work on a version A and B of the same task type one after the other, I shall first do the version A word task, then the A pictures, then the A arithmetic problems, then the B words, then the B pictures and at the end the B arithmetic problems. This way at least I will have worked on all tasks for a short time …” would be given 12 points (six executable items as well as six specifications concerning version A and B) plus two rules (rule 1(b) and rule 2 = 2 points), making a total of 14 points. The theoretical minimum of the score is 0, which would indicate that the participant did not plan at all. The maximum score is, in principle, unlimited.
The delay phase. In this phase, participants were busy with distractor-tasks. Among other things, the participants were given a colour-word version of the Stroop task (Houx, Jolles, & Vrelling, 1993) in order to measure inhibition (e.g., Dempster, 1992).

After the Stroop task, the participants had to recall their plans for the prospective memory task. Recollection served as a measure of retrospective memory for the previously formed intentions. Retrospective memory was judged by the accuracy with which a plan was recalled, relative to when it was initially stated (in percent).

Execution phase. After various other distractor tasks, the participants were requested to fill out the Participant Information Questionnaire. As mentioned above, the main objective of this study was to investigate the complete execution of the complex prospective intention (i.e., to switch between all six sub-tasks), which participants had to perform on their own. Participants who neither switched to the prospective memory task when they should have nor later on during the questionnaire, were prompted to do so after having finished the questionnaire (see Kliegel et al., 2000, 2002; Martin & Kliegel, in press). This measure was taken to ensure that the initial re-instantiation of the set of multiple prospective intentions was comparable between participants.

In order to manipulate the salience of multiple, self-initiated switches in the prospective task during the execution phase, there were two versions of task sheets. In the version expected to emphasize task salience, the amount of points that would be given for each item was explicitly indicated, whereas in the normal version it was not. In the high salience version, following rule 1(a), the amount of possible points per item decreased rapidly down the list, thus making it very uneconomical to solve more than two items per sub-task. Half of the participants worked on the normal version (no explicit indication of points) for six minutes, the other half on the ‘high-need-for-switching’ sheets (high salience condition) with points marked behind each item. In accordance with Kliegel et al. (2000; see also Burgess et
al., 2000), *intention-execution* was measured by the number of started tasks (out of six possible ones).

Afterwards, the participants finished the questionnaire. Then, those who had not completed all word finding problems during the prospective memory task were asked to do so at that point (no time limits). At the end of the experiment participants were debriefed.

**Results**

*Age and salience*

2 x 2 x 2-ANOVAS were performed to determine whether the between-subjects factors age (young vs. old), salience during introduction phase (high vs. normal) and salience during execution phase (high vs. normal) had any influence on prospective memory measures such as plan complexity, plan recall and intention execution.

**Plan complexity.** Results showed a significant age effect; younger participants developed more complex plans than older ones ($M = 15.19; SD = 6.45$ vs. $M = 8.17; SD = 6.73$), $F(1, 91) = 26.88$, $p < .01$, $\eta^2 = .23$. However, no differences were found when task salience was manipulated during introduction phase (high-salience: $M = 10.98; SD = 7.45$, vs. normal-salience: $M = 12.58; SD = 7.43$), $F(1, 91) = 1.36$, $p < .3$, $\eta^2 = .02$, or during execution phase (high-salience: $M = 11.39; SD = 7.47$, vs. normal-salience: $M = 12.16; SD = 7.48$), $F(1, 91) = .16$, $p < .7$, $\eta^2 = .002$. There were no significant interactions between factors (all $F < 1$).

**Plan recall.** Younger participants recalled their plans slightly – though significantly – better than did older ones ($M = 94.36\%; SD = 14.37$ vs. $M = 79.25\%; SD = 35.49$), $F(1, 75) = 6.38; p < .01$, $\eta^2 = .08$. As with plan complexity, there were neither reliable effects of task salience, nor significant interactions between factors (all $F < 1$; all $\eta^2 < .01$).

**Intention execution.** Overall, the participants carried out an average of 4.63 sub-tasks ($SD = 1.58$). As Figure 1 indicates, younger adults were found to perform more correct switches between sub-tasks than older ones ($M = 5.47; SD = 1.05$ vs. $M = 3.73; SD = 1.55$),
Both salience conditions had no effects on the number of performed tasks. Further, no reliable interactions were found between factors (all $F < 1$; all $\eta^2 < .01$).

_____________________________
Insert Figure 1 about here
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Cognitive resources

The second objective of this study was to examine whether individual differences in verbal intelligence, retrospective memory, planning, or inhibition can explain parts of the (age-related) variance in executing the complex prospective memory task. For evaluation, we conducted two regression analyses on intention execution as the dependant measure (after Salthouse, 1991; see Kliegel et al., 2000; Martin et al., this issue). In the first regression equation, age as the only predictor explained 32% of the variance. In order to examine whether non-executive or executive measures were associated with this age-related variance, we subsequently conducted a further hierarchical regression analysis. As predictors, the non-executive measures verbal intelligence and retrospective memory were included in a first step. In a second step, we included the executive measures planning and inhibition and, in step three, age. This procedure enabled us to explore the correlates of age-related variance and, furthermore, allowed examination of whether executive coordinative functions would provide further explanation of variance in prospective memory performance than did non-executive, rather basic storage functions. The results are summarized in Table 1.

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Insert Table 1 about here
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Verbal intelligence and retrospective memory did not significantly contribute to the prediction of variance in executing prospective intentions ($\Delta R^2 = .02$). However, individual differences in planning and inhibition did explain a reliable amount of variance in carrying out the prospective memory task ($\Delta R^2 = .33$). By further including age, an additional amount of variance in the prospective measures was yet explained ($\Delta R^2 = .10$). In sum, when all variables were considered in the regression, both planning ($\beta = .29, p < .01$) and age ($\beta = -.43, p < .01$) resulted as significant predictors for prospective performance.

Discussion

The main objective of the present study was to examine the two variables task salience and cognitive resources / planning, both of which are believed to be related to delayed performance of complex multiple intentions. For this reason, prospective task salience was varied both during the planning phase as well as during the execution phase of the complex prospective multi-task proposed by Kliegel et al. (2000). In addition, non-executive and executive cognitive resources were assessed in order to investigate the relationship between interindividual cognitive differences and age effects in complex prospective remembering.

Overall, the results show age effects in favour of the younger group in all task components of the complex prospective multi-task. In contrast, none of the groups profited significantly from the present experimental manipulation of salience. Finally, in regression analyses, particularly planning (i.e. intention formation) was found to be a significant predictor of intention execution, explaining most of the age-related variance.

The present findings do not support the hypothesis that older people perform more poorly on a complex prospective task because the prospective task lacks salience. Remarkably, even combined hinting, i.e., emphasizing the necessity to interrupt/switch during the introduction phase as well as increasing task salience in the execution phase, led to no reliable improvements in older adults’ performance. Although post-hoc questioning – in line
with prior studies – revealed that the participants seriously intended to carry out all six tasks, explicitly increasing the amount of points possible for correct and complete switches between sub-tasks did not lead to significant improvements in performance.

However, interpretation of this result is restricted in several ways. First, there are ceiling effects in the younger group’s data. While the issue of younger people’s performance regarding salience must therefore remain in the dark for the moment, older adults’ data suggest that such manipulations during the instruction phase and the execution phase do not, in fact, improve performance.

Secondly, sample size was rather small and thus set a limit to interpreting data: although big enough to detect large effects (Cohen, 1992), small or medium effects cannot be found with 12 participants per cell and \( p = .05 \). Consequently, interpretation must be qualified in so far as manipulating task salience has shown no large effect.

Finally, seems reasonable to argue that our manipulations, though supposed to, may not have increased salience for switching. At least with older people, indirect hinting by giving points may not have had the desired effect. In order to address this hypothesis, further studies examining the influence of salience should draw on stronger, verbally directed manipulations of task importance as they have been used successfully with younger people (see Kliegel et al., 2001, in press; Kliegel & Martin, in press). Overall, though, the present findings seem to suggest that older adults do seriously intend to perform the delayed switches on their own, but then, actually, are not able to (or do not) do so when the moment arrives.

In the main, the occurrence of age effects in the components of the complex prospective paradigm replicates the findings of Kliegel et al. (2000, 2002) and Martin et al. (2002; see also Einstein et al., 1992). Furthermore, the present study offers important clues as to how these age effects may have arisen: Consistent with our results, an explanation of the mechanisms of the reported age effects may be offered by assuming that executive functions, which are considered responsible for performance on complex tasks (Baddeley, 1996; Smith
& Jonides, 1999) and which decrease with age (West, 1996), are related to older participants’ poorer delayed performance on complex multiple intentions (Kliegel et al., 2002; Marsh & Hicks, 1998; Martin & Schumann-Hengsteler, 2001; Maylor, 1996). Although correlated data do not allow us to infer causal relationships, converging with the paper by Martin et al. (this issue), regression analyses clearly underline that a large part of age-related variance in complex intention execution can be explained by executive measures. A result to further strengthen this conclusion is that non-executive processes, such as verbal intelligence or retrospective memory, do not – in contrast to prior findings (cf. Cherry & LeCompte, 1999; Einstein et al., 1992) – contribute to predicting variance in prospective performance, whereas both executive functions of planning and inhibition do predict prospective performance, even once non-executive variables are accounted for. Although age, considered in a third step, does provide an additional amount of explanation of variance (signalling that further processes not examined here may play a part), regression analyses suggest an important relationship between planning and inhibition processes on the one hand, and complex prospective remembering on the other, the latter causing difficulties – as analyses of means demonstrated – mainly for older adults.

In sum, our results concerning performance of complex delayed intentions specifically highlight the fundamental importance of adequately planning the complex intention. With support from several findings reported in planning literature (see Phillips et al., in press, for an overview), this finding provides empirical evidence for the multiprocess-model of prospective remembering recently proposed by McDaniel and Einstein (2000), with planning of a delayed intention as one of the central processes. Consequently, one of the crucial factors in maintaining or even increasing independence in everyday life appears to be, with both younger and older adults, the sufficiently thorough planning of multiple future activities.
References


Figure 1

Effects of Age and High vs. Normal Salience
(During the Planning and the Performance Phase) on Intention Execution

![Diagram showing the number of sub-tasks executed by young and old adults in different planning and performance conditions.](image-url)
Table 1.
Hierarchical Regression Predicting Intention Execution

<table>
<thead>
<tr>
<th>Predictors</th>
<th>Intention Execution</th>
<th>$\beta$</th>
<th>$R^2$</th>
<th>$\Delta R^2$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Step 1: Non-Executive measures</strong></td>
<td></td>
<td></td>
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<tr>
<td>Verbal Intelligence</td>
<td></td>
<td>.09</td>
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<tr>
<td>Retrospective Memory</td>
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<td>-.09</td>
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<tr>
<td><strong>Step 2: Executive Measures</strong></td>
<td></td>
<td></td>
<td>.35**</td>
<td>.33**</td>
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<tr>
<td>Planning</td>
<td></td>
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<tr>
<td>Inhibition</td>
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<tr>
<td><strong>Step 3: Age</strong></td>
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<td>-.43**</td>
<td>.45**</td>
<td>.10**</td>
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</table>

**p<.01