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ORIGINAL INVESTIGATION

Revisiting the age-prospective memory-paradox: the role of planning and task experience

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Abstract The present study aimed at investigating age-related differences in prospective memory performance using a paradigm with high ecological validity and experimental control. Thirty old and 30 young adults completed the Dresden Breakfast task; a meal preparation task in the lab that comprises several subtasks including event- and time-based prospective memory tasks. Participants were required to plan how to perform the task. Results showed that young adults outperformed old adults: they completed more subtasks, showed better event- and time-based prospective memory performance and planning quality. In contrast, old adults adhered to their plans more closely than young adults. Further exploratory gender-specific analyses indicated that old women did not differ from young men in time-based prospective memory performance, general task performance and time monitoring in contrast to old men. Possibly, differences in experience in breakfast preparation might account for these differential findings.

Keywords Age-prospective memory-paradox · Planning · Meal preparation · Experience · Ageing

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Prospective memory (PM) refers to the ability to remember to execute planned actions in the future. PM tasks require individuals to plan actions in advance, to retrieve them at the appropriate moment in the future and to then successfully execute them (e.g. remembering to buy vegetables on the way home for dinner; Kliegel and Jäger 2006). Two task types are differentiated: event-based tasks request remembering the intention when a particular event occurs (e.g. remembering to send a letter when passing a post box), while time-based tasks require remembering the intended action at a particular time or after a certain time has elapsed (e.g. remembering to attend a meeting at 4 p.m.; Einstein and McDaniel 1990). Moreover, PM tasks can vary in their complexity. Simple tasks may only consist of a single action to be performed, such as remembering to press a key at a specific time or event. In contrast, complex tasks may comprise several subtasks with multiple actions whose performance individuals need to plan and coordinate and which may, thus, put higher demands on individuals' executive control processes (Kliegel et al. 2000).

In terms of disentangling the process of prospective remembering, Kliegel et al. (2002) suggested to distinguish between four phases: the first phase comprises *intention formation* and mainly relies on planning abilities. The second phase, *intention retention*, requires keeping the intention in mind while being engaged in other ongoing activities. When the appropriate moment for *intention initiation* arises (third phase) these other activities have to be inhibited and the individual needs to switch to the intended action. In the fourth phase (*intention execution*) the planned action is executed, according to the previously stated plan. Thus, mainly retrospective memory and executive functions (planning, switching, inhibition) are involved in prospective remembering (e.g. Kopp and Thöne-Otto 2003; Salthouse et al. 2004). Importantly, there is evidence for age-related

impairments in executive control processes and retrospective memory. Compared to young adults, old adults demonstrate reduced executive functioning abilities (Cepeda et al. 2001; Zelazo et al. 2004) and reduced retrospective memory (Kvavilashvili et al. 2009; Luo and Craik 2008; Spencer and Raz 1995). These impairments in cognitive processes that have been related to PM suggest deficits in prospective remembering in old adults. Indeed, studies on age-related differences in PM show a general trend of declined performance in old age compared to young adults (e.g. Luo and Craik 2008; Mäntylä and Nilsson 1997; Maylor 1996; Park et al. 1997; West and Craik 2001).

Most PM research targeting age differences has focused on the phases of intention initiation and execution as well as on the interplay of executive control processes (e.g. time-monitoring, task inhibition and task switching) within these two PM phases (e.g. Cohen et al. 2003; Kliegel et al. 2004; Raskin et al. 2011). In contrast, the phase of intention formation has rather been neglected. This lack of research is surprising given that the quality of planning of the intention has been suggested to impact later performance of delayed intentions. Moreover, planning shows age-related declines, especially for novel and more complex tasks (e.g. Andrés and van der Linden 2000; Gilhooly et al. 1999; for an overview see Phillips et al. 2005); but deficits have also been reported for more realistic planning tasks (e.g. Garden et al. 2001; Kliegel et al. 2007; Phillips et al. 2006).

Importantly, age differences in PM have been related to tasks' planning demands (Henry et al. 2004). While simple PM tasks require little to no planning, planning may represent a prerequisite for effective PM performance in complex tasks with high demands on executive control processes. Research shows that the complexity of plans for intended actions decreases with age (Kliegel et al. 2000). Given the suggested relation of planning quality and later performance of the intended action (McDaniel and Einstein 2000), one aim of the present study was to focus on the intention formation phase, and to assess PM performance in old adults using a task with a strong planning component.

Another relevant and intriguing aspect for age-related differences in PM refers to the setting, in which the experiment takes place. While in naturalistic settings, old adults perform equal to, or even better than their young counterparts (e.g. Martin 1986; Rendell and Thomson 1999), in laboratory conditions, young adults outperform old adults (e.g. Einstein and McDaniel 1990; Einstein et al. 1992). These inconsistencies remain even if the same participants are tested in both naturalistic and laboratory settings (e.g. Schnitzspahn et al. 2011; Rendell and Thomson 1999). The effect of age-related deficits in laboratory-based PM tasks and age-related benefits in naturalistic settings has been labelled the age-PM paradox (Rendell and Craik 2000; for a meta-analytic review Henry et al. 2004).

These paradoxical findings have been related to differences in experimental control and task representativeness between naturalistic and laboratory-based settings. Laboratory-based PM tasks permit high experimental control and may enable identification of cognitive processes involved in PM, but they often present novel and unfamiliar situations and leave little control of task performance to the participant (e.g. Einstein and McDaniel 1990; Einstein et al. 1992). Old adults might be more affected by tasks' novelty and arbitrariness than young adults who are often students that participate regularly in such experiments (Altgassen et al. 2010). In contrast, naturalistic PM tasks tend to be more realistic and more familiar for all participants, but may only offer limited experimental control (e.g. participants might make use of reminders when these tasks are performed outside the lab). Therefore, the present study aimed at developing a paradigm which combines the benefits of experimental control with the familiarity of naturalistic PM tasks. Previous research has used board games or virtual reality situations to mimic real-life settings in laboratory conditions (e.g. Craik and Bialystok 2006; Rendell and Craik 2000). However, these studies did not find age-related performance benefits but replicated the general result of age-related decline in PM performance despite the more realistic task content. Since these paradigms were mostly computer-based or artificial (e.g. board games) they showed only a limited degree of real life simulation. The implementation of a real life-like task, as it is usually performed in everyday life might be more beneficial in further exploring the age-PM paradox. Here, meal preparation tasks have been suggested to represent good examples of real life tasks (Shallice 1982; Ward 2005). To this end, we developed a new PM paradigm, the *Dresden Breakfast task* which requires participants to prepare breakfast for four people (Altgassen et al. 2012). Participants have to complete various subtasks following certain rules and time restrictions. The advantage of the Dresden Breakfast task lies in the realistic operation of the experimental demands. Although the task is assessed in the laboratory ensuring experimental control, participants perform an everyday life PM task in real time resulting in high ecological validity.

Thus, we set out to explore whether a novel laboratory-based task that closely mirrors everyday life-like contextual situations may eliminate age-related deficits in PM or even result in age benefits in line with evidence from studies using naturalistic tasks assessed outside of the laboratory (e.g. Martin 1986; Rendell and Thomson 1999; Schnitzspahn et al. 2011). In contrast, age-related deficits

were expected in a standard laboratory event-based PM task (Red Pencil test; Zeintl et al. 2007). Furthermore, we hypothesized that better planning leads to better PM performance. Especially for old adults the influence of planning quality on PM performance should be pronounced. With respect to general task performance of the Dresden Breakfast task two possible outcomes were predicted. Given, previous evidence of age-related deficits in complex multitask paradigms (e.g. Kliegel et al. 2004, 2000; Martin et al. 2003), old adults might perform poorer than young adults. On the other hand, given the naturalistic character of the task also age benefits or comparable performance rates of the two age groups might be possible.

Method

Participants

In total, 60 adults participated in the present study: Thirty young ($M_{age} = 20.87$, SD = 4.15) and 30 old adults ($M_{age} = 67.70$, SD = 4.72). Twenty-four young adults and 18 old adults were men.[1] Groups were parallel for years of school education (old adults: $M = 11.57$, SD = 1.59, young adults: $M = 11.07$, SD = 1.24; $F(1, 54) = 1.67$; $p = 0.202$; $\eta_p^2 = 0.03$). Old adults performed better than young adults in verbal and nonverbal ability tests (cf. Table 1). All participants were individually tested and each session lasted about 90 min. To recruit young and old adults the subject database of the department was used and flyers were distributed at the local community of Dresden, Germany and surrounding areas. Participants were only included in the experiment if they spoke German as their first language and had no history of psychiatric disorders, alcohol or substance abuse, and no current physical conditions that might affect cognitive performance. Furthermore, the young adults group was not composed of university students. All participants had normal or corrected-to-normal vision.

Materials

General cognitive abilities

General cognitive abilities were assessed with two subtests of the Wechsler Adult Intelligence Scale—Third Edition (WAIS-III; Wechsler 1997; German version: Wechsler Intelligenztest für Erwachsene; von Aster et al. 2006): the vocabulary test and the matrices test. The vocabulary test measures participant's verbal ability. The participant is asked to explain the meaning of different words that increase in difficulty. Raw scores were converted into age-normative scores. The matrices test measures nonverbal cognitive abilities and consists of 26 patterns. Out of a choice of five, the participant has to find the missing piece to complete the fragmentary given pattern. Items increase in difficulty. Raw scores were converted into age-normative scores.

Standard, laboratory-based PM task

The Red Pencil test (Zeintl et al. 2007) was used to assess standard laboratory-based PM performance. In the Red Pencil test participants were required to remember to say 'Red Pencil' whenever the experimenter mentioned the words 'Red Pencil', which occurred twice over the course of the study (see also Salthouse et al. 2004). No potentially misleading lure phrases were given.

The Dresden Breakfast task

The Dresden Breakfast task (Altgassen et al. 2012) is a laboratory-based paradigm designed to capture realistic complex prospective remembering performance. Comparable to the approach of Craik and Bialystok (2006) participants were requested to prepare breakfast for four people. Importantly, the specific characteristic of the present task is that the task is not computer-based but breakfast has to be made with real material. The task consisted of six subtasks with different complexity levels (e.g. setting the table, making tea), which had to be completed within 7 min following specific rules. These rules reflected general restrictions that occur while preparing meals (e.g. putting first the table cloth and then the tableware). Two event- and time-based PM tasks were included. Event-based PM tasks were remembering to prepare the tea immediately after the water boiled and the kettle went off and to switch off the egg cooker when it beeped (±20 s). Time-based PM tasks were remembering to take the teabag out of the tea after 3 min, and to put the butter on the table 6 min prior guests' arrival (±30 s).

The experimental sessions took part in one of the testing rooms at the Technische Universitaet Dresden. The room was separated into two areas, one representing the kitchen and one the dining room. Successful task completion required the participant to flexibly switch between tasks and room areas (see Fig. 1). Participants could monitor the time by checking a timer that was placed in the dining area. Participants were first instructed to the task and its rules. Then, the experimenter illustrated all tools and materials and made sure participants knew how to use the egg cooker and kettle. Thereafter, participants were asked to develop

[1] Further analyses indicate that within the age groups there were no statistically significant differences between women and men in verbal and nonverbal ability measures.

Table 1 Group comparisons for cognitive abilities, performance in the standard laboratory-based PM tasks and the Dresden Breakfast task

	Young adults		Old adults		*F* (*df*)	*p*	η_p^2
	M	SD	*M*	SD			
General cognitive abilities							
Vocabulary test	10.80	2.07	13.50	1.94	27.07 (1, 58)***	0.000	0.318
Matrices test	11.67	1.83	12.72	1.77	5.10 (1, 57)*	0.028	0.082
Standard lab-based PM task							
Red pencil test	1.67	0.66	1.07	0.69	11.80 (1, 58)**	0.001	0.169
Dresden Breakfast task							
General task performance (%)	95.27	6.43	89.09	6.72	13.03 (1, 57)**	0.001	0.186
PM performance							
Event-based	1.57	0.57	1.10	0.67	8.18 (1, 57)**	0.006	0.125
Time-based	1.57	0.63	1.07	0.59	9.81 (1, 57)**	0.003	0.147
Planning							
Plan quality	12.30	1.66	10.48	1.75	16.77 (1, 57)***	0.000	0.227
Plan adherence (%)	42.36	11.26	50.58	11.41	7.76 (1, 57)**	0.007	0.120
Switching	39.73	4.08	40.45	5.40	0.33 (1, 57)	0.567	0.006
Rule adherence	3.50	1.20	3.07	1.16	1.97 (1, 57)	0.166	0.033
Time monitoring	5.03	2.22	3.03	2.72	9.60 (1, 57)**	0.003	0.144

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. Excluding the young women did not change the pattern of results

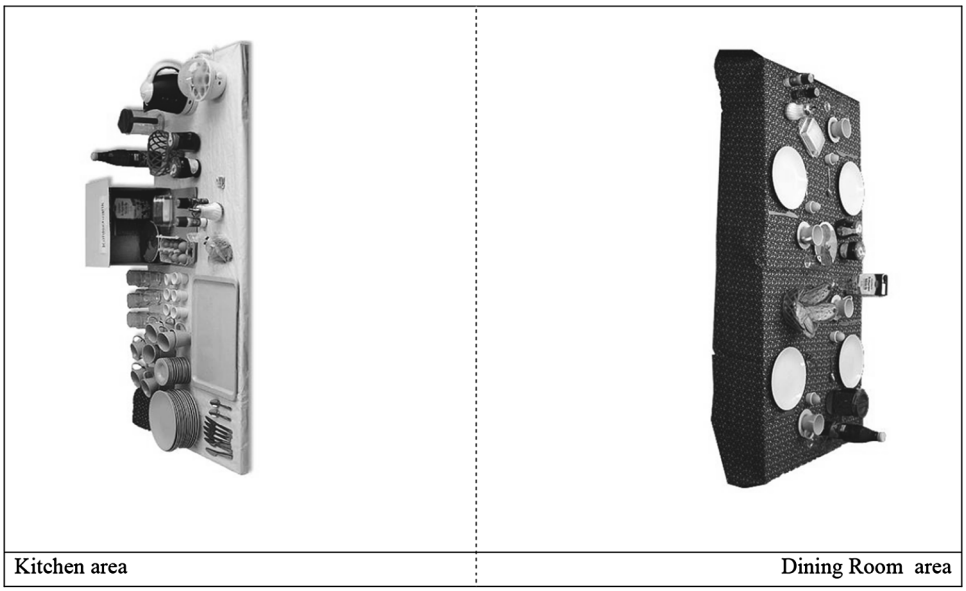

Fig. 1 Kitchen and dining room

(in writing) a plan on how to complete the different subtasks. Participants were explicitly instructed to consider switching between the subtasks to finish the breakfast within the given time. At the end of the planning phase, participants were asked to verbally report the plan. Plans were recorded for later scoring. After a filled delay participants were prompted to perform the Dresden Breakfast task. Participants' performance was videotaped for later scoring.

As for our dependent variables: PM performance was assessed separately for both *event- and time-based PM tasks* (max. two points). Overall task performance was indicated by the variable *general task performance* (number of completed breakfast task items in %; excluding PM tasks). The dependent variable *rule adherence* referred to the number of rules participants followed during testing. *Time-monitoring* represented the number of clock checks and *switching* was operationalized as the number of switches between tasks and room areas. To measure planning performance two separate outcome measurements were collected. *Plan quality* indicated the quality of the previously formed plan based on a composite score of

prioritization (number of tasks that were mentioned in the plan), rule description (number of rules that were mentioned in the plan), specification of actions (number of specified subtasks and number of specifically elaborated orders of tasks that were mentioned in the plan). The obtained score could result in a maximum of 20 possible points. *Plan adherence* indicated plan fidelity as concordance (in %) between the previously stated plan and the actual course of action. Plans were rated by two independent trained raters. Inter-rater reliability was high (planning performance $r = 0.95$; plan adherence $r = 0.93$).

Statistical analysis

First, analyses of variance (ANOVA) were applied to test for age differences for the different dependent variables of the Dresden Breakfast task and the standard laboratory PM task. Age group served as independent variable and was entered as between subject (2x: young adults, old adults). Second, linear regression analyses were run separately for young and old adults to test for the influence of planning on PM performance in the Dresden Breakfast task.

Given, the small number of young women, we decided to conduct further exploratory analyses using post hoc tests only to test for gender differences in the old adults group compared to the male young adults' group. Young women were excluded for those exploratory gender-specific analyses given the small subsample size of $N = 6$. Alpha-level was set to 0.05.

Results

Standard, laboratory-based PM task

ANOVAs indicated that young participants performed significantly better than old adults in the Red Pencil test (cf. Table 1). Exploratory post hoc tests (Tukey-Test) showed that young men outperformed old men as well as old women. Old men and old women did not differ significantly in their performance (see Table 2).

The Dresden Breakfast task

In a first step, we investigated possible age-effects[2] (see Table 1). We found significant age differences in favour of young adults for general task performance, event- and time-based PM, plan quality and time monitoring. Young adults completed more subtasks, showed more correct time- and event-based PM responses, developed more detailed plans, and monitored the time more frequently than old adults. In contrast, regarding plan adherence, the analysis revealed a significant difference in favour of the old age group. Old participants followed their own plans more closely than young adults. Switching and rule adherence did not yield any significant age-related differences.

In a second step, separate linear regression analyses for event- and time-based PM as dependent variables and plan quality and plan adherence, as predictor variables were conducted for both age groups. For old adults, plan adherence was a significant predictor for event- ($\beta = 0.627$, $p = 0.004$) and time-based PM performance ($\beta = 0.643$, $p = 0.003$), whereas plan quality did not significantly contribute to either PM performance (event-based: $\beta = -0.202$, $p = 0.311$; time-based: $\beta = -0.279$, $p = 0.167$). The regression models explained 24 % of the variance for event-based PM performance ($R^2_{corr} = 0.243$, $R^2 = 0.297$, $F(2, 26) = 5.483$, $p = 0.01$), and 24 % of the variance for time-based PM performance ($R^2_{corr} = 0.242$, $R^2 = 0.296$, $F(2, 26) = 5.465$, $p = 0.01$). Regarding young adults, neither plan quality nor plan adherence were significant predictors for event- and time-based PM performance (event-based: $R^2_{corr} = 0.122$, $R^2 = 0.183$, $F(2, 27) = 3.016$, $p = 0.07$; time-based: $R^2_{corr} = 0.023$, $R^2 = 0.091$, $F(2, 27) = 1.347$, $p = 0.277$).

Furthermore, we ran additional exploratory post hoc analyses using Tukey-Tests comparing young men, old men, and old women (see Table 2). Regarding time-based PM performance, time monitoring and general task performance post hoc analyses indicated that old women did not differ from young men. In contrast, old men significantly differed from young men indicating that old men showed impaired time-based PM performance, completed fewer tasks and checked less often the time as compared to young men. There were no performance differences between old women and old men in their time-based PM performance and time monitoring. However, old women outperformed old men in general task performance. Regarding plan quality young men outperformed old men as well as old women. Interestingly, there were no differences in plan adherence between old women and old men; however, old women as well as old men significantly outperformed young men. Hence, old adults executed their plans with higher fidelity than young men. Event-based PM, switching and rule adherence revealed no significant performance differences between young men, old men and old women.

Discussion

The primary aim of the present study was to further explore the age-PM paradox. To this end, we developed the

[2] Confidence intervals was adjusted with Bonferroni correction.

Table 2 Post hoc comparisons (Tukey-Test) for performance in the Dresden Breakfast task

	Young men		Old men		Old women		p^a	p^b	p^c
	M	SD	*M*	SD	*M*	SD			
Standard lab-based task									
Red Pencil test	1.67	0.64	1.06	0.73	1.08	0.67	0.015	0.046	0.993
Dresden Breakfast task									
General task performance (%)	95.40	5.91	86.69	5.77	93.02	6.52	0.000	0.526	0.022
PM performance									
Event-based	1.50	0.59	1.11	0.68	1.09	0.70	0.138	0.198	0.996
Time-based	1.50	0.66	0.94	0.64	1.27	0.47	0.016	0.575	0.355
Planning									
Plan quality	12.00	1.45	10.44	1.65	10.55	1.97	0.010	0.046	0.986
Plan adherence (%)	40.36	10.00	48.94	9.51	53.27	14.08	0.036	0.005	0.550
Switching	39.50	4.37	40.67	5.47	40.09	5.52	0.737	0.944	0.951
Rule adherence	3.46	1.18	2.89	1.18	3.36	1.12	0.271	0.973	0.542
Time monitoring	4.88	2.03	2.83	2.92	3.36	2.46	0.027	0.217	0.838

[a] Comparison of younger men and older men

[b] Comparison of younger men and older women

[c] Comparison of older men and older women

Dresden Breakfast task to examine age differences in PM performance with a lab-based everyday-life like task. Based on the empirical findings of the age-PM paradox, we hypothesized that age-related deficits in PM would be eliminated in the contextual Dresden Breakfast task, while age deficits would emerge in a standard lab-based PM task. Further, following McDaniel and Einstein's (2000) postulation of a relation of planning quality and later performance of the intended action, we predicted that better planning leads to better PM performance, and that this should particularly evidence for old adults. Regarding general task performance two possible outcomes were identified. Given, previous evidence of age-related deficits in complex multitask paradigms (e.g. Kliegel et al. 2004, 2000; Martin et al. 2003), old adults might show poorer general task performance compared to young adults. However, given the naturalistic character of the task age benefits or comparable performance rates of the two age groups might also be possible.

As expected, we observed age-related decline in the standard event-based PM task with worse performance of old adults compared to young adults (e.g. Kliegel et al. 2008; Zeintl et al. 2007). Similarly, regarding performance in the Dresden Breakfast task prospective remembering was negatively affected in old adults as compared to young adults in both event-based and time-based tasks. At first view this result may be seen as somewhat surprising, given that the Dresden Breakfast task mimics everyday life requirements, and provides a familiar but experimentally controlled task setting. In naturalistic settings which are characterized by high familiarity, old adults typically perform better than young adults (e.g. Devolder et al. 1990; Henry et al. 2004; Moscovitch 1982). However, other studies also using more realistic tasks in a laboratory setting found similar results. Rendell and Craik (2000) as well as Craik and Bialystok (2006) reported better PM performance of young adults compared to old adults. Both studies used tasks with everyday contents, simulating activities of a week or preparing breakfast. Possibly, old adults' poorer performance may be due to the high executive control demands of these tasks. For example, Craik and Bialystok (2006) showed increasing PM impairments in old participants with increasing executive control loads (e.g. working memory, monitoring and switching). Hence, only rising the ecological validity of the task does not seem to be sufficient to eliminate age-related performance decreases in PM and to explain the age-PM-paradox. This conclusion is supported by earlier findings of Dickerson and Fisher (1997), who found reduced performance in old adults in simple cooking tasks of high ecological validity. Similarly, young adults also showed better general task performance than old adults. These findings are in accordance with previous research applying complex multi-task paradigms like the six-elements-task (Kliegel et al. 2000). Here, participants have to perform a set of several intentions and in line with our results young adults outperformed their old counterparts.

As indicated above, planning has been suggested to be an important predictor for successful complex PM task performance (Kliegel et al. 2002). In line with previous evidence (e.g. Craik and Bialystok 2006; Kliegel et al. 2003), young adults showed better planning performance than old adults. Possibly, old adults' large experience with

such a familiar task might have reduced their (subjective) need to specify how they want to proceed in preparing the breakfast (e.g. in our study some old adults said when they orally reported their plan"…and the rest of the tasks will sort themselves out…"). Moreover, there is evidence that old adults may be impaired in verbalising their plans (Gilhooly et al. 1999). Using the Tower of London, Gilhooly and colleagues asked participants to think aloud while planning how to move the discs. Although old adults made more errors and formulated shorter plans than their young counterparts, groups did not differ in the number of moves they used to solve the problems. Hence, a planning deficit without a subsequent performance deficit was found. In contrast in the present study, we observed an age benefit for plan adherence. Here, old participants adhered to their plans more closely than young adults.

Looking at the predicting relevance of planning for PM performance, regression analyses showed that plan adherence was a significant predictor for event- and time-based PM performance in old adults; explaining around a quarter of variance. Adhering to previously formed plans may set free cognitive resources and therefore, facilitate task completion. Surprisingly, plan quality was no significant predictor of time- or event-based PM in old adults. For young adults, neither plan quality nor plan adherence significantly explained PM performance. Possibly—as indicated above—the familiarity of the task reduces the subjective need to plan later task performance. Future studies should further focus on the planning components by experimentally varying planning demands, and taking into account individual planning experience with the applied task to further disentangle the role of planning and task experience on task performance.

Importantly, exploratory additional analyses indicated task relevant gender differences in completing the Dresden Breakfast task in the old adult group. Only, old men—but not old women—showed reduced time-based PM performance in comparison to young men. Moreover, regarding general task performance old women did not differ from young men, but old men completed fewer tasks than old women and young men. Possibly, this is due to old women being more familiar with preparing breakfast than old men given that in this generation in Germany women typically were in charge of taking care of the household. Moreover, there is empirical evidence showing that old women tend to solve everyday problems in female-stereotyped domains, such as meal preparation more often alone than men who prefer to complete such tasks in collaboration. This may further indicate the socialisation of gender-specific skills and responsibilities within this cohort (Strough et al. 2002).

Regarding plan quality old women and men did not differ and the young men group outperformed both. Regarding plan adherence the opposite pattern was found: old men as well as old women outperformed young men, and both old adults groups did not differ from each other. However, it is important to note, that these analyses were only conducted on an exploratory basis a posteriori to address the different gender distributions within the two age groups. Given, the small number of young women it was not possible to test for gender differences within the young adults' group. Furthermore, one major limitation of the present study is that task experience with preparing breakfast in everyday life was not assessed. Differences in experience in task content of the Dresden Breakfast task and thus, differences in novelty of the task may have influenced participants' performance. Future research should directly assess the possible impact of task experience in everyday life in explaining the observed gender differences in this lab-based everyday life like task to account for potential gender-specific cohort influences.

Regarding the other dependent variables of the Dresden Breakfast task and in accordance to the results on PM performance, young adults monitored the time more frequently than old adults. No age effects were found for switching and rule adherence. Further gender-specific analyses indicated that regarding time monitoring old women did not differ from young adults. In contrast, old men checked the time less often than young adults. Old adults groups did not differ in time monitoring.

Taken together, age deficits emerged in a standard lab-based PM task and the contextual Dresden Breakfast task. Furthermore, we showed gender differences in task performance in the old adults' group for the Dresden Breakfast task. Old women performed comparably to young adults in time-based PM, and general task performance. Thus, task experience and familiarity may play an important role in overcoming age-related differences in PM.

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