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# Social importance enhances prospective memory: evidence from an event-based task

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**ABSTRACT**

Prospective memory performance can be enhanced by task importance, for example by promising a reward. Typically, this comes at costs in the ongoing task. However, previous research has suggested that *social importance* (e.g., providing a social motive) can enhance prospective memory performance without additional monitoring costs in activity-based and time-based tasks. The aim of the present study was to investigate the influence of social importance in an *event-based* task. We compared four conditions: social importance, promising a reward, both social importance and promising a reward, and standard prospective memory instructions (control condition). The results showed enhanced prospective memory performance for all importance conditions compared to the control condition. Although ongoing task performance was slowed in all conditions with a prospective memory task when compared to a baseline condition with no prospective memory task, additional costs occurred only when both the social importance and reward were present simultaneously. Alone, neither social importance nor promising a reward produced an additional slowing when compared to the cost in the standard (control) condition. Thus, social importance and reward can enhance event-based prospective memory at no additional cost.

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The ability to plan and carry out an intention at an appropriate moment is termed *prospective memory*. In every-day life, we typically have to remember many intentions and often, some are more important than others. In laboratory research, the prospective memory task is kept as simple as possible. Typically, it involves pressing a key on a computer keyboard when a particular target event occurs (e.g., the presentation of a specific word on the computer screen). Prospective memory performance is assessed as the proportion of correct responses to prospective memory targets. As the prospective memory task is embedded in an *ongoing task* (e.g., a lexical decision task), it is possible to measure whether adding a prospective memory task results in monitoring costs by comparing ongoing task performance with vs. without the prospective memory task (cf. Smith & Bayen, 2004). The presence of monitoring costs indicate resource demands of prospective memory, that is, that successful retrieval needs *attention allocation* (i.e., enhancing monitoring costs; cf. Smith, 2003; Smith & Bayen, 2004). In contrast, no costs are assumed to indicate *automatic retrieval* (cf. McDaniel & Einstein, 2000).

Important intentions are remembered better, at least in laboratory studies. This performance enhancement is typically associated with a performance cost in the ongoing task in which the prospective memory task is embedded (see Walter & Meier, 2014 for a recent review). Importance can be varied by emphasising the prospective memory task relative to the ongoing task (relative importance), by emphasising the prospective memory task per se (absolute importance), by providing a reward, or by providing a social motive (social importance) to perform the prospective memory task. In contrast to other importance manipulations, social importance has been reported to enhance prospective memory performance *without* ongoing task costs. This result was found in time-based prospective memory tasks (i.e., when the prospective memory task has to be performed at a certain time) and in activity-based prospective memory tasks (i.e., when the prospective memory task has to be performed after finishing another activity; cf. Altgassen, Kliegel, Brandimonte, & Filippello, 2010; Brandimonte & Ferrante, 2015; Brandimonte, Ferrante, Bianco, & Villani, 2010). However, the influence of social importance for *event-based* prospective memory (i.e., when the prospective memory task has to be performed when a particular event occurs) has not been tested yet. The aim of the present study was to fill this gap, in particular, to test whether event-based prospective memory performance can be enhanced without an additional ongoing task cost.

Besides of the obvious practical implications, the question whether event-based prospective memory can be enhanced without monitoring costs is also important for

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theoretical reasons. According to the *preparatory attentional and memory* theory, an event-based prospective memory load always comes at a cost in the ongoing task (Smith, 2003; Smith & Bayen, 2004). Thus, increased prospective memory performance for social importance without monitoring costs would be a challenge for this theory. In fact, Brandimonte, Ferrante, Feresin, and Delbello (2001) demonstrated that depending on the emphasis of the instruction, prospective memory retrieval occurred either by strategical monitoring or spontaneously without a cost. The latter kind of retrieval is typically accompanied by a *pop-up* experience and this is probably the most common prospective memory retrieval experience in every-day life (cf. Meier, Zimmermann, & Perrig, 2006). Two routes of prospective memory retrieval are in line with the multiprocess view which suggests that retrieval processes are dependent on characteristics of the prospective memory task, the ongoing task and the individual (McDaniel & Einstein, 2000).

The main method to manipulate the importance of a prospective memory task is to promise a reward for successful prospective memory performance (e.g., Aberle, Rendell, Rose, McDaniel, & Kliegel, 2010; Guajardo & Best, 2000; Jeong & Cranney, 2009; Krishnan & Shapiro, 1999; McCauley et al., 2011; Meacham & Singer, 1977). Typically, promising a reward enhances prospective memory performance, and this improvement is accompanied by ongoing task costs (e.g., Krishnan & Shapiro, 1999). Thus, ongoing task costs are likely due to a change in resource allocation policies which results in enhanced strategic monitoring (cf. Kliegel, Martin, McDaniel, & Einstein, 2004). However, not all of the previous studies also investigated monitoring costs.

In contrast to manipulating importance by promising a reward, recent laboratory studies have used social importance (cf. Altgassen et al., 2010; Brandimonte & Ferrante, 2015; Brandimonte et al., 2010; see also Cicogna & Nigro, 1998; Kvavilashvili, 1987 for investigations of social importance in naturalistic tasks). Brandimonte et al. (2010) compared the influence of social importance and of promising a reward in an *activity-based* prospective memory task in which participants had to sign a form at the end of an experimental block. The ongoing task was to decide whether a verb was regular or irregular. In the reward condition, participants were told that they would receive course credits if they remembered to carry out the prospective memory task. In the social importance condition, participants were told that their results would provide important information for the researcher. In an additional condition, social importance and promising a reward was combined. In the control condition, only the standard prospective memory instruction was given. The results showed that prospective memory task performance was enhanced in the social importance condition compared to both the standard and the reward conditions. In contrast, compared to the standard condition, prospective memory was reduced when both social importance and a reward were present. There were no monitoring costs in any of the prospective memory task conditions compared to the baseline condition (i.e., without prospective memory task instruction), suggesting that social importance enhanced prospective memory performance by spontaneous retrieval. However, an alternative explanation is that the lack of monitoring costs was due to the activity-based nature of the prospective memory task. Strategic monitoring is typically only activated when the appropriate context to perform a prospective memory task is reached (cf. Loft, Smith, & Bhaskara, 2011; Marsh, Hicks, & Cook, 2006; Meier et al., 2006). In an activity-based task, no interruption of the ongoing task is necessary because the appropriate moment is by definition signalled by the end of an activity.

A follow-up study by Brandimonte and Ferrante (2015) further investigated the interplay between social importance and providing a reward (Experiment 1) and type of rewards (Experiment 2). The same activity-based prospective memory task as in the previous study was used. The results showed that prospective memory performance was lower when the additional reward was low (i.e., 1 Euro) compared to a condition with an additional high reward (i.e., 20 Euro) or the social importance alone (Experiment 1). Moreover, prospective memory performance was impaired by an additional non-material reward (disclosure of participant's altruistic behaviour; Experiment 2). Interestingly, the ongoing task was performed faster in the social importance condition compared to a baseline condition (Experiment 1), and the ongoing task was performed slower in the non-material reward condition compared to social importance condition (Experiment 2). Brandimonte and Ferrante (2015) suggested that intrinsic motivation raised by social importance can be modulated by extrinsic motivation (reward) either unconsciously (manipulating the amount of material reward) or consciously (introducing a non-material reward). However, due to the activity-based prospective memory task, the interpretation of faster ongoing task performance is still equivocal.

Altgassen et al. (2010) investigated social importance in a *time-based* prospective memory task. Younger and older participants were engaged in an ongoing visuo-spatial working-memory task and for the prospective memory task they had to press a designated key every 2 min. Half of each group received standard prospective memory task instructions (i.e., control condition). The other half received a social importance instruction (i.e., to perform the prospective memory task would be a favour). The results showed that younger adults generally outperformed older adults. Moreover, for older adults social importance enhanced prospective memory performance while for younger adults it did not. Critically, this enhancement was not associated with monitoring costs or increased time-checking behaviour (see also Niedźwieńska & Barzykowski, 2012 for similar results with an event-based task, but without any measure of monitoring costs). These results further support the assumption that prospective memory performance can be enhanced by social importance without a cost. Moreover, the impact of social importance seems to generalise across *prospective memory task types*, at least activity- and time-based tasks, but differently for older and younger adults (cf. Altgassen et al., 2010; Brandimonte et al., 2010).

The goal of the present study was to test whether the effects of social importance also generalise to event-based prospective memory and whether the expected performance benefit would come without an additional cost. For the prospective memory task, participants were instructed to press a designated key when a word denoting a *musical instrument* occurred. To manipulate importance, participants were assigned to one of four prospective memory instruction groups, that is, standard prospective memory instruction, reward instruction (i.e., that participants would get a reward), social importance instruction (i.e., that it would be important because the experimenter can collect important data), and both the social importance and the reward instructions. An additional group (*baseline condition*) performed only the ongoing task (i.e., without prospective memory task instruction). The design was based on the study by Brandimonte et al. (2010), that is, it included five conditions: social importance, reward, both, standard instruction, and (baseline) no prospective memory instruction.

For the reward condition, we expected that enhanced prospective memory performance would be accompanied by monitoring costs (e.g., Krishnan & Shapiro, 1999 but see Brandimonte & Ferrante, 2015; Cook, Rummel, & Dummel, 2015). Similarly, for the condition with both social importance and a reward, we also expected enhanced prospective memory performance and an ongoing task cost. In contrast and most critically, for social importance, we expected no additional monitoring costs (cf. Altgassen et al., 2010; Brandimonte et al., 2010).

## Method

### Participants

Hundred and sixty-five students from the University of Bern participated in the study ($M_{age} = 22.5$, $SD_{age} = 4.3$; 133 women). Thirty-three of them were promised a reward, 33 were provided with social importance and 33 were given both. One additional group of 33 participants received only the prospective memory task instruction (i.e., *control condition*) and another additional group of 33 participants performed the ongoing task without prospective memory task instructions (i.e., *baseline condition*). Participants were randomly assigned to one of these five experimental groups.

### Materials

Two hundred and eighty-eight words were selected from the CELEX-database for the lexical decision task, consisting of five to eight letters (Baayen, Piepenbrock, & van Rijn, 1993). They were divided into 3 subgroups of 96 words in order to create 3 experimental blocks. The average word-length and word-class frequencies (derived from http://wortschatz.uni-leipzig.de) were similar across subgroups. Moreover, 288 non-words were created by keeping the first and the last letter of a word while randomising the other letters. Thus, each non-word matched a corresponding word of the same subgroup.

Three musical instruments, the German words *Gitarre* (i.e., guitar), *Posaune* (i.e., trombone) and *Klavier* (i.e., piano), were used as prospective memory targets. They had a similar word-length and word-class frequency as the other words in the wordlists and they were randomly assigned to one of the three blocks.

### Procedure

After arrival in the laboratory, participants were seated in front of a computer and gave informed consent. They received the instruction for the lexical decision task, that is, they were asked to press two keys on the computer keyboard, N for a word and B for a non-word with their left and right index fingers (or vice versa; counterbalanced between participants and conditions). In the prospective memory task conditions, participants were additionally instructed to press the Z-key whenever a word denoting a musical instrument appeared on the screen. In the baseline condition only the instruction for the lexical decision task was given.

Importance was manipulated by instructions. In the standard condition, the instruction ended with the sentence "The task will start soon! Remember to press Z whenever a musical instrument occurs". In the social importance condition, the instruction "If you remember to press Z every time a musical instrument occurs, this will generate important information for me" was added. In the reward condition, the instruction "If you remember to press Z every time a musical instrument occurs, you will be provided with 10. – CHF at the end of the experiment"[1] was added. In the third condition, both instructions were given by adding "If you remember to press Z every time a musical instrument occurs, you will be provided with 10. – CHF at the end of the experiment and this will generate important information for me". After reading the instructions, participants were prompted to repeat them in their own words in order to make sure that they understood.

Then, the experiment started with eight practice trials (four words and four non-words). For each trial, a fixation point was presented for 500 ms, followed by a word or a non-word. Each stimulus was randomly selected and remained on the screen for 5 s or until the participant responded by pressing one of the designated keys.

The experiment consisted of 3 lexical decision task blocks including 192 ongoing task trials with a short break between them. The prospective memory targets were assigned randomly (i.e., without replacement) to each block and appeared at the 180th position.

At the end of the experiment, a manipulation check interview was conducted. Participants were asked to describe what they were supposed to do. In addition, they had to rate the importance and the difficulty of both, the ongoing task and the prospective memory task on a 5-point Likert scale (1 = very important/very difficult to 5 = not important at all/not difficult at all). The whole experiment lasted about 25 min.

### Data preparation and statistical analysis

Prospective memory performance was calculated as the proportion of correct prospective memory responses (out of three). Ongoing task performance was assessed as accuracy and as reaction times (RT) to lexical decisions for the word stimuli. In each block, the prospective memory target as well as the 12 trials following the prospective memory target were excluded in order to eliminate potential after-effects of responding to prospective memory targets (Meier & Rey-Mermet, 2012). For the baseline condition, the respective trials were also excluded.[2] For RT analysis, only correct responses were used and overall mean RTs were based on median word RTs for each participant. For the main statistical analyses, a one-way analysis of variance (ANOVA) was used with the between-subject factor *prospective memory instruction* (standard, reward, social importance, both). Moreover, to analyse performance of the prospective memory task and of the ongoing task, planned contrasts were used to compare the four experimental conditions to the *baseline* condition (i.e., without prospective memory task instructions), and, separately, each importance condition to the standard condition. For all analyses an alpha level of .05 was used. We excluded two participants who showed a strong tendency towards a word-response.[3] Another two participants had to be excluded because they did not follow the instructions.

## Results

### Prospective memory performance

Prospective memory performance is shown in Figure 1. The one-way ANOVA with the between-subject factor *prospective memory instruction* (standard, reward, social importance, both) was significant, $F(3, 125) = 4.99$, $p < .01$, $\eta_p^2 = .11$. Planned contrasts between the means showed that in comparison to the standard condition, participants prospective memory was significantly better in the social importance condition ($t(125) = 3.25$, $p < .001$, one-tailed, $r = .28$), the reward condition ($t(125) = 2.97$, $p < .01$ (one-tailed), $r = .26$) and in the combined condition ($t(125) = 3.24$, $p < .001$ (one-tailed), $r = .28$). However, the three importance conditions did not differ from each other ($ps > .05$ (one-tailed)).

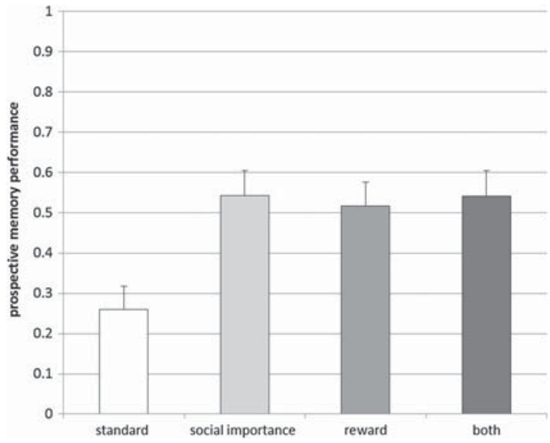


**Figure 1.** Prospective memory performance for each prospective memory instruction condition (proportion of correct responses). Error bars represent standard errors.

### Ongoing task performance

#### Reaction times

Word RT results for lexical decision are presented in Figure 2. The one-way ANOVA with the between-subject factor *prospective memory instruction* (baseline, standard, reward, social importance, both importance) was significant, $F(4, 160) = 2.52$, $p < .05$, $\eta_p^2 = .06$. A planned contrast between the RTs of the baseline condition and the prospective memory conditions revealed significantly faster RTs for the baseline condition, $t(84.74) = 3.29$, $p < .001$ (one-tailed), $r = .34$. However, the separate contrasts between the standard condition and each importance condition showed slower RTs for the condition with both social importance and reward, $t(54.72) = 1.87$, $p < .05$ (one-tailed), $r = .25$, but no effect for the social importance condition or the reward condition alone, $t(57.49) = 1.16$, $p = .13$ (one-tailed), $r = .15$ and $t(61.93) = 0.62$, $p = .27$ (one-tailed), $r = .08$, respectively. These results show that adding a prospective memory task to an ongoing task increased ongoing task costs. However, social importance or the prospect of reward was not accompanied by increased ongoing task costs when compared to the cost incurred in the standard prospective memory condition. In contrast, in the condition with both social importance and reward instructions, the increase in prospective memory performance came at an additional cost.

#### Accuracy

Lexical decision task accuracy was $M = 0.95$ (SD = 0.03) for the baseline, $M = 0.95$ (SD = 0.04) for the standard condition, $M = 0.95$ (SD = 0.04) for the social importance condition, $M = 0.96$ (SD = 0.02) for the reward condition and $M = 0.96$ (SD = 0.03) for the social importance and reward condition, respectively. As performance was close to ceiling we did not further analyse these results statistically.

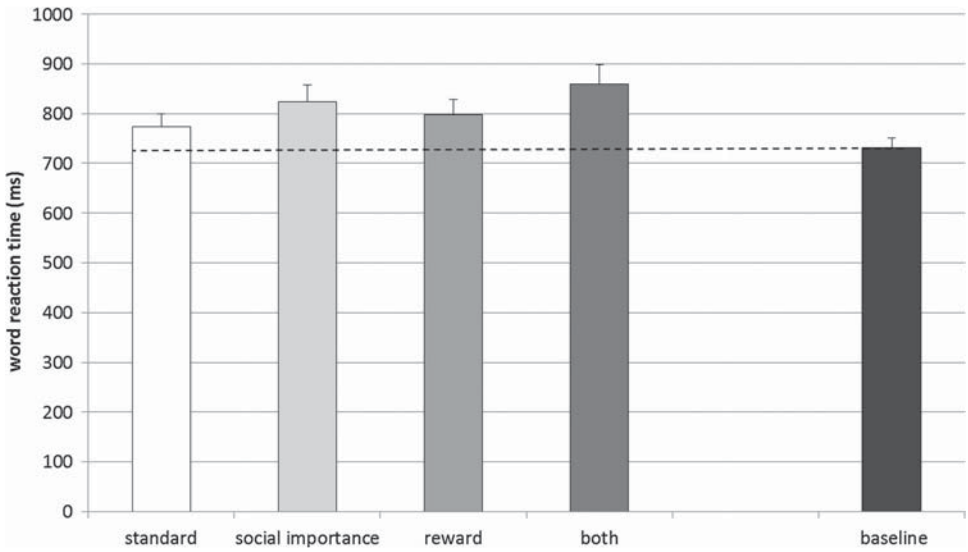


**Figure 2.** Ongoing lexical decision task RTs for each prospective memory instruction condition. Error bars represent standard errors.

### *Manipulation check*

For the manipulation check, two 2 × 4 mixed ANOVAs were calculated for task importance and task difficulty separately, with the between-subject factors *prospective memory instruction* and the within-subject factor *task* (i.e., prospective memory vs. ongoing task; see Table 1). For task importance, the results showed a significant task by prospective memory instruction interaction, $F(3, 125) = 2.97$, $p < .05$, $\eta_p^2 = .07$. However, two further one-way ANOVAs comparing prospective memory instruction conditions for prospective memory task and ongoing task separately showed no significant effect, $F(3, 125) = 2.44$, $p = .07$, $\eta_p^2 = .06$, and $F(3, 125) = 2.42$, $p = .07$, $\eta_p^2 = .06$, respectively. No other effect reached significance, $Fs < 3.81$, $ps > .05$, $\eta_p^2 < .03$.

For task difficulty the results showed a main effect of task, $F(1, 124) = 39.32$, $p < .001$, $\eta_p^2 = .24$[4], indicating that the prospective memory task was rated as more difficult than the ongoing task. No other effect was significant, $Fs < 1.73$, $ps > .16$, $\eta_p^2 < .05$.

**Table 1.** Manipulation check ratings of task importance and task difficulty for prospective memory and ongoing task separately for each condition.

| Prospective memory instruction | Prospective memory task *M* | Prospective memory task SD | Ongoing task *M* | Ongoing task SD |
|---|---|---|---|---|
| *Task importance* | | | | |
| Standard | 2.38 | 1.34 | 2.03 | 0.74 |
| Reward | 2.18 | 1.07 | 2.33 | 1.02 |
| Social importance | 1.66 | 0.79 | 2.25 | 0.92 |
| Both | 2.00 | 1.16 | 2.63 | 0.87 |
| *Task difficulty* | | | | |
| Standard | 2.39 | 1.23 | 3.52 | 0.77 |
| Reward | 2.67 | 1.32 | 3.33 | 0.69 |
| Social importance | 3.13 | 1.31 | 3.53 | 0.84 |
| Both | 2.72 | 1.02 | 3.69 | 0.93 |

Note: Ratings were given on a 5 point Likert scale; 1 = very important/very difficult, 5 = not important at all/not difficult at all.

## Discussion

The goal of the present study was to investigate the impact of social importance and promising a reward on event-based prospective memory performance. Participants performed a lexical decision task as an ongoing task and the embedded event-based prospective memory task was to press a designated key when a word denoting a musical instrument occurred. The results showed increased prospective memory performance for all importance conditions (social importance, reward or both). However, and most critically, this enhancement came at additional ongoing task cost (when compared to the cost in the standard condition) only when both social importance and the prospect of a reward were present. These findings extend previous results by Brandimonte et al. (2010), Brandimonte and Ferrante (2015) and Altgassen et al. (2010) who investigated social importance in an activity-based task and in a time-based task, respectively.

Specifically, the results extend those of Brandimonte et al. (2010) by showing that providing both social importance and a reward in the social importance plus reward condition, increased event-based prospective memory performance. In contrast, Brandimonte et al. (2010) did not find a benefit under these circumstances. They argued that the social importance instruction may have enhanced the "motivation to proceed towards the end" (p. 440) of the ongoing task in order to perform the prospective memory task. The additional prospect of a reward however, may have induced a conflict which reduced the benefit of the importance manipulations. Moreover, Brandimonte and Ferrante (2015) showed that providing social importance and a small monetary reward or a non-material reward can even impair prospective memory performance. They argued that the manipulation of the amount of reward was modulating motivation outside of the awareness of participants whereas a non-material reward produced a "motivation crowding out" (p. 7) based on a conscious process. Similarly, our results may have been caused by colliding motives which the participants were aware of. This was expressed as a cost in the ongoing task due to the different task requirements of an event-based (compared to an activity-based) prospective memory task, that is, in an activity-based task, no interruption of the ongoing task is necessary because the appropriate moment is by definition signalled by the end of an activity.

The results of the present study also extend the findings of Altgassen et al. (2010) by showing that social importance can increase event-based prospective performance for younger adults. In contrast, Altgassen et al. did not find a benefit for younger adults. They argued that, in contrast to older adults, for the social importance instruction (i.e., to do someone a favour) may have interfered with the obligation to perform the prospective memory task. In contrast, the importance manipulation in our study (i.e., to contribute to the success of the study) may have enhanced the obligation to perform the prospective memory task. Thus, the specific social importance instructions may be critical.

Our results also inform the question whether enhancing the importance of a prospective memory task generally changes resource allocation policies and enhance ongoing task costs in event-based prospective memory (cf. Einstein et al., 2005; McDaniel & Einstein, 2000). In fact, this was not necessarily the case. However, the present results showed monitoring costs for the event-based prospective memory task compared to the baseline condition. Thus, participants seemed to have changed their resource allocation policies when instructed for the prospective memory task, but they did not significantly change their allocation policies when provided with social importance or reward (see also Brandimonte & Ferrante, 2015; Guynn, 2003; Smith, 2003; Smith, Hunt, McVay, & McConnell, 2007). This suggests that adding prospective memory load increased monitoring costs (cf. Meier & Zimmermann, 2015), but importance did not necessarily do so (Cook et al., 2015; Walter & Meier, 2015).

On a methodological level, however, it has been argued that analysing monitoring costs in a between-subject design may not be the most appropriate method (see Einstein & McDaniel, 2010 for a detailed discussion). Future studies should consider investigating the influence of social importance and reward in a within-subject design. It is also important to note that despite the significant increase in prospective memory performance in all three motivation conditions, participants' self-rated prospective memory task importance did not reliably differentiate between the standard prospective memory condition and motivation conditions (see Table 1), as motivation was rated uniformly as *high* in all prospective memory task conditions. Our results therefore show that in future studies self-rated prospective memory task importance should be treated with caution.

The present study shows that social importance of an intention or promising a reward can increase prospective memory performance without additional ongoing task costs when compared to the costs in the standard condition. These results are crucial for every-day life because they indicate that the goal of a prospective memory task can influence the resulting monitoring costs (e.g., the *goal focus*, cf. Freund, Hennecke, & Mustafic, 2012). Specifically, when the goal focus is social, for example, when fulfilling the prospective memory task generates important information for the experimenter, spontaneous retrieval of the intention maybe enhanced, similar to implementation intentions or performance predictions (Meier, von Wartburg, Matter, Rothen, & Reber, 2011; Rummel, Einstein, & Rampey, 2012; Zimmermann & Meier, 2010). In contrast, when the goal focus is self-oriented, for example, when fulfilling the prospective memory task leads to obtaining a monetary reward, a change in resource allocation policy is more likely. The investigation of the interaction between goal focus, prospective memory performance and ongoing task costs is thus a promising avenue for future research.

## Notes

1. Participants had to answer to all prospective memory targets in order to get the reward.
2. Four participants showed incorrect prospective memory responses. These ongoing task trials as well as the 12 following trials were also excluded.
3. One participant showed a non-word accuracy of .24 and a word accuracy of 1.00, one participant showed a non-word accuracy of .37 and a word accuracy of 1.00.
4. One participant was excluded due to a missing answer.

## Disclosure statement

No potential conflict of interest was reported by the authors.

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