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Do verbal reminders improve preschoolers' prospective memory performance? It depends on age and individual differences



Caitlin E.V. Mahy*, Tessa R. Mazachowsky, Jacqueline R. Pagobo

Brock University, Canada

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ABSTRACT

Prospective memory (PM) involves both a retrospective memory component (i.e., remembering the content of a future intention) and a prospective component (i.e., detecting the appropriate cue and carrying out that intention). The current study was the first to test the effect of a single verbal reminder on 4- to 6-year-olds' PM performance. Children were randomly assigned to: (1) a reminder about the content of an intention (retrospective memory reminder), (2) a reminder to pay attention (executive reminder), or (3) no reminder to test the predictions of the Executive Framework of PM Development (Mahy et al., 2014b) that posit a key role for executive function in PM development once retrospective memory reaches a sufficient level. Children also completed independent measures of retrospective memory and executive control. We predicted that an executive reminder should help children's PM by increasing cue detection, whereas a retrospective memory reminder should not affect PM because by 4 children should be able to encode and store simple future intentions. Results showed that: (1) PM performance improved with age, (2) age interacted with the reminder condition, and (3) children with better executive functioning had better PM after receiving an executive reminder. These results suggest that age and individual differences play an important role in the impact reminders have on children's PM performance.

1. Introduction

Young children often have difficulty remembering to carry out their future intentions, an ability known as prospective memory (PM; Einstein & McDaniel, 1990). For example, a preschooler might have difficulty remembering to bring an item to show-and-tell the following day. While most children can report the general intention to bring a show-and-tell item to school, the main challenge for preschoolers lies in *acting* on the intention at the appropriate time (such as placing the item in their backpack before leaving for school; Kliegel & Jäger, 2007). Being able to successfully act on future intentions has important consequences for children's independence as they develop (see Mahy, Moses, & Kliegel, 2014b). For example, a forgetful child is less likely to be able to function without adults' reminders and input and thus, reliable PM is a critical developmental achievement. Importantly, young children still rely on parents, teachers, and other caregivers to scaffold their PM by providing reminders (see Kliegel & Jäger, 2007; Mahy et al., 2014b; Somerville, Wellman, & Cultice, 1983). Children who are able to take advantage of these reminders to the benefit of their PM might be able to avoid some of the negative consequences associated with forgetting future intentions.

There are two main types of PM: event-based PM involves an intention that must be accomplished after a certain event has occurred (e.g., feeding a pet goldfish after school) whereas time-based PM involves an intention that must be accomplished at a

* Corresponding author at: Department of Psychology, Brock University, 1812 Sir Isaac Brock Way, St Catharines, ON, L2S 3A1, Canada.
 E-mail address: caitlin.mahy@brocku.ca (C.E.V. Mahy).

particular time or after a certain amount of time has passed (e.g., feeding a pet goldfish at 5 pm or in 20 min). Given young children's difficulty with telling time, most studies with preschoolers have focused on event-based PM, which is also the focus of our current study.

How do we capture young children's event-based PM ability in the laboratory? Typically, an event-based PM paradigm includes: (1) an ongoing task, and (2) a PM task (see [Kvavilashvili, Messer, & Ebdon, 2001](#)). First, a child is provided with instructions for an ongoing task such as sorting cards based on their colour or size. Once the child has demonstrated an understanding of the ongoing task rules, they are given instructions about the PM task that needs to be carried out when a specific cue appears (e.g., put specific card into a box). After the ongoing and PM instructions, a delay period is introduced when the child engages in a distractor task. Once this delay period is over, the child begins the ongoing task and has the opportunity to carry out the PM task at the appropriate time. After performing (or forgetting to perform) the PM task, the child is asked a control question to ensure that he or she remembers the task instructions (the retrospective memory component of the PM task).

If the child forgets to perform the PM task at the appropriate time, it is likely for two main reasons: (1) due to a retrospective memory failure (i.e., where the child has forgotten what they were supposed to do when the PM cue appears) or (2) due to a true prospective failure which we suggest are mostly executive failures (i.e., where the child remembers what they were supposed to do, but fails to do so at the appropriate time perhaps because of a failure of attention, inhibition, or working memory; see [Mahy et al., 2014b](#)). Typically, PM studies focus on children with true PM failures (where children can remember what they have to do but do not carry out the intention at the appropriate time) rather than those with retrospective memory failures for the intention (who are often excluded from the analyses). Thus, in order to successfully complete a PM task, young children's retrospective memory ability must at least support memory for the content of their intention over a short period of time.

Past research has shown that two thirds of 2-year-old children's PM failures are due to difficulty remembering the content of their future intention ([Kliegel & Jäger, 2007](#)). However, by the time children reach the age of 3 or 4, their ability to remember what they have to do greatly improves (e.g., [Ford, Driscoll, Shum, & Macaulay, 2012](#); [Guajardo & Best, 2000](#); [Mahy & Moses, 2011](#)). For example, in Mahy and Moses (2001) only 10% of children aged 4 to 6 had difficulty reporting the content of the PM intention. However, despite that the vast majority of children are able to remember the prospective intention, preschoolers still have trouble carrying it out at the appropriate time (e.g., [Kvavilashvili et al., 2001](#); [Kerns, 2000](#)). Thus, timely and relevant reminders provided by caregivers might allow children to have more successful PM performance. Next, we review the literature on the effect of reminders on children's PM.

1.1. Effect of reminders on children's prospective memory

Most studies that have examined the effect of reminders on young children's PM have focused on reinforcing the retrospective memory content of the intention (i.e., reminding children what they have to do or what cue they are looking for). Research on the impact of visual reminders on children's PM, however, has revealed mixed findings. For example, [Kliegel and Jäger \(2007\)](#) found that visual reminders based on the content of the intention (e.g., an apple to remind children to look for an apple cue) were effective in helping 2- to 6-year-olds remember to carry out their intention. Similarly, the presence of a visual cue depicting the PM target (i.e., a picture of a frog) during the ongoing task improved 3- to 7-year-olds' PM ([Cheie, Miclea, & Visu-Petra, 2013](#)). Further, [Meacham and Colombo \(1980\)](#) showed that a clown cue helped 6- to 8-year-olds remember to open a surprise box. In contrast, [Guajardo and Best \(2000\)](#) found no effect of visual reminders (a picture of the target cue) on 3- and 5-year-olds' PM performance. Given the limited research on the effect of visual reminders on young children's PM, this area is in need of further exploration.

In comparison to explicit reminders focusing on the content of the intention (i.e., the retrospective component of PM), little is known about the effect of more subtle reminders such as implied memory strategies (e.g., executive planning or monitoring) on PM performance. However, [Kvavilashvili and Ford \(2014\)](#) examined the effect of two implicit verbal reminder stories on 5-year-olds' PM performance after children made predictions about whether they would remember to carry out the PM intention. Prior to completion of the PM task, children either heard a story about a forgetful spider (reminder story) or a clumsy alligator (neutral story). Results revealed that children who received the reminder story and who also predicted that they would remember to carry out the PM response had marginally better PM than children who received the neutral story. This suggests that reminder stories with implied memory strategies might have a less powerful effect on PM performance (given the marginal result) compared to explicit visual reminders, yet still boost PM performance.

In adult samples, explicit visual reminders ([Einstein & McDaniel, 1990](#)), some explicit verbal reminders ([Guynn, McDaniel, & Einstein, 1998](#)), and self-initiated reminders ([Henry, Rendell, Phillips, Dunlop, & Kliegel, 2012](#)) have been found to improve PM performance. [Guynn et al. \(1998\)](#) found that reminders that referred to only the intended activity did improve PM but verbal reminders that referred to the target event *and* the intended activity (i.e., participants were reminded of the words that were the PM cues and the button they should press if they saw any of those words) were most helpful to PM performance. Interestingly, reminders that referred only to the target event failed to improve adult's PM.

To date, however, no research has examined the effect of *explicit verbal reminders* from an experimenter on young children's PM performance (e.g., "remember to put the card in the box when you see an animal on it"). Moreover, no study has provided children with verbal reminders that specifically target the retrospective and prospective/executive components of PM. Thus, an unanswered question is, do *explicit verbal* reminders focusing on the retrospective memory or executive components of PM improve preschooler's PM performance?

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