



Contents lists available at SciVerse ScienceDirect

## Cognitive Development



# A naturalistic study of prospective memory in preschoolers: The role of task interruption and motivation



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### ARTICLE INFO

*Keywords:*

Prospective memory  
Memory development  
Preschoolers  
Motivation  
Task interruption  
Inhibitory control

### ABSTRACT

We conducted two naturalistic experiments to investigate preschoolers' development of event-based prospective memory (PM) and to examine the effects of motivation and interruption of an ongoing task. Children aged 2–6 years were asked to perform familiar PM tasks while engaged in their habitual kindergarten play. PM performance improved systematically across the preschool years. The type of PM response (motor or verbal) did not affect performance. High motivation was necessary for 2-year-olds to perform well, and it remained an important factor that increased performance across the entire preschool age range. The need to interrupt an ongoing activity decreased performance in 3-, 4-, and 5-year-olds, but not in children aged 2 or 6 years. The pattern of results is consistent with explanations for interruption effects that highlight the role of inhibitory control.

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Prospective memory (PM) is the ability to remember to perform an intended activity at a particular point in the future. Retrospective memory, in contrast, is memory of past information. Even young children experience PM demands, such as remembering to convey a message to a caregiver or to pick up their things to take home from kindergarten. A challenge to success in PM tasks is that remembering an intended activity must be self-initiated upon encountering a prospective target (e.g., the caregiver) while one is typically engaged in other activities (Einstein & McDaniel, 2005). Despite this difficulty,

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several authors have argued that because accurate PM is rewarded socially it may manifest itself very early in development (Meacham & Colombo, 1980; Winograd, 1988).

Despite the relevance and importance of PM to the everyday functioning of young children, there is a paucity of findings with respect to the earliest age at which the ability to succeed in everyday PM tasks can be observed, as well as how this ability develops across the preschool years. To our knowledge, the only published study of preschoolers' PM performance in everyday settings is that of Somerville, Wellman, and Cultice (1983). They found significant PM abilities in children aged 2–4 years who were asked to remind their mothers to perform a specific action after a short (one- to five-minute) or long (four- to eight-hour) delay.

We designed the present study to examine preschoolers' success in naturalistic event-based PM tasks that involved remembering to do something in response to a designated event. Like Somerville et al. (1983), we assumed that the PM abilities of very young children might be most obvious in tasks and situations familiar and well understood by them. Employing a naturalistic paradigm, we also wished to investigate effects of variables that have been proposed as important for preschoolers' PM performance in a number of laboratory studies (Guajardo & Best, 2000; Kliegel, Brandenberger, & Aberle, 2010; Kvavilashvili, Messer, & Ebdon, 2001; Mahy & Moses, 2011; Wang, Kliegel, Liu, & Yang, 2008). Specifically, we address four research questions: (a) Are children as young as age 2 able to remember to perform intended actions after a delay? (b) What is the developmental trajectory of PM across the preschool years? (c) How does the need to interrupt an ongoing activity to perform a PM task influence the performance of preschoolers of different ages? (d) What are the effects of motivational incentives on the performance of preschoolers of different ages?

Data on PM ability of 2-year-olds are scarce and contradictory. The study by Somerville et al. (1983) indicated considerable competence at this age in real-life situations, especially in tasks of high interest to the child. Two-year-olds were able to remember high-interest, short-delay tasks (e.g., "Remind me to buy candy at the store") 80% of the time without prompting. This proportion dropped to 20% for low-interest, short-delay tasks (e.g., "Remind me to bring in the washing"). In contrast, in the only follow-up study that included 2-year-olds (Kliegel & Jäger, 2007), the laboratory-based PM success of 2-year-olds did not exceed chance.

With regard to the developmental trajectory of PM, some researchers have found age differences among preschoolers (Guajardo & Best, 2000; Wang et al., 2008, Study 1), whereas others have not (Kliegel et al., 2010; Kvavilashvili et al., 2001; Somerville et al., 1983; Wang et al., 2008, Study 2). Kvavilashvili, Kyle, and Messer (2008) concluded that developmental changes in PM during early childhood are modest and sometimes difficult to identify. Given the hypothetical increase in PM with age may not be linear, the presence of developmental differences may depend on which age groups are compared. In sharp contrast to the aforementioned studies, which covered shorter developmental age spans and detected few developmental differences, Kliegel and Jäger (2007) studied PM performance across the entire preschool age range and found substantial age effects ( $\eta^2 = .33$  and  $.20$ ). Importantly, in their study, the 2- and 3-year-olds performed significantly less well than the 4-, 5-, and 6-year-olds, with the two youngest groups performing similarly and the three oldest groups performing similarly.

With regard to task interruption, in three laboratory-based studies, preschoolers' PM was inferior when the ongoing task had to be interrupted to complete the prospective action than when the task was completed first and then followed immediately by the PM task (Ford, Driscoll, Shum, & Macaulay, 2012; Kvavilashvili et al., 2001; Wang et al., 2008). For instance, in the study of Kvavilashvili et al. (2001), children aged 4, 5, and 7 years old were asked to name pictures in stacks of cards and to remember to hide the card in a box when they saw a card that depicted an animal. PM performance was inferior when the target picture was placed in the middle of the stack (interruption condition) than when the target was the last card in the stack (no interruption condition). Wang et al. (2008) attributed the negative effects of task interruption on PM performance to deficits in children's executive functions, especially those involving inhibitory abilities. They suggested that it is difficult for preschoolers to withhold a dominant response in an ongoing activity to carry out a novel, prospective action. In contrast, when a task is completed before the action needs to be performed, the inhibitory component is removed. The role of inhibitory abilities in preschoolers' PM performance was further supported by a study by Ford et al. (2012) in which children were asked to name pictures of animals (the ongoing task) but to refrain from naming and to remove from view any pictures of dogs (the PM task). There was a robust influence

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