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The development of prospective memory in preschool children using naturalistic tasks

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ABSTRACT

The development of prospective memory (PM) in 3-, 4-, and 5-year-old children ($N = 123$) was assessed in two experiments using several naturalistic game-like tasks that varied in the explicitness of the cues for retrieval that they provided. The goals of the study were to evaluate age differences in PM (a) with the effects of retrospective memory (RM) factored out and (b) as a function of increasing retrieval cue specificity. Results from Experiment 1 showed that there were age differences in PM on a simulated Shopping Trip task that favored older children after age differences attributable to RM were identified in a hierarchical regression. PM and RM components followed the same developmental trajectory. Because the Shopping Trip task provided a visual cue for retrieval, a second naturalistic PM task that was incidental to the Shopping Trip task (i.e., to ask for stickers at the end of the shopping trip) was included but provided no explicit cue other than the end of Shopping Trip task itself. A binary logistic regression showed that age did not predict children who succeeded and those who did not succeed. Because the end of the Shopping Trip task might have cued PM, two new tasks without any explicit cues for retrieval were examined in Experiment 2. Logistic regressions revealed that age predicted PM success on both tasks. With additional cues following failure to retrieve the PM intention, nearly all children succeeded, but the number of cues needed increased with age. The joint and separate contributions of PM and RM to successful task performance are discussed.

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Introduction

From the early preschool years, children are routinely instructed to "remember to remember" a host of daily activities from feeding the fish every morning to packing their gym clothes for school, delivering a note from the teacher, and reminding a parent of a promised treat. Remembering to carry out intended actions in the future, or *prospective memory* (PM), is an important cognitive achievement and a marker of developmental advances in memory, attention, and executive functions such as planning, working memory, and inhibition. Common observation and a growing literature indicate that children of all ages (like adults) struggle with PM tasks in some situations but are remarkably successful in others. Moreover, anomalies in the emergence of PM can have clinical significance because children in certain special populations (e.g., autism, attention deficit/hyperactivity disorder [ADHD], developmental delay, traumatic brain injury) have particular difficulties with PM tasks. The significance of PM increases during adolescence and adulthood where failure to perform intended actions can have major consequences in workplace and everyday situations (Dismukes, 2012). For these reasons, researchers have attempted to describe and explain the developmental course of PM and to identify the variables that affect task performance across and within age. Although this literature goes back more than two decades, it is relatively sparse and there is not a clear consensus on these questions (Kvavilashvili, Kyle, & Messer, 2008).

Prospective memory can be contrasted with *retrospective memory* (RM), or remembering previously learned information or events. In contrast to PM, there is an extensive literature on RM in children and its developmental trajectory, and the structures and processes that affect it are fairly well understood (e.g., Courage & Cowan, 2008; Rovee-Collier, Hayne, & Colombo, 2001; Schneider & Pressley, 1997). A critical operational difference between PM and RM is that for RM retrieval is typically cued by a specific request to recognize or recall, whereas for PM retrieval is often not explicitly cued. After an intention to remember an action has been set and ongoing activities are resumed, the individual must become aware of the need to retrieve the delayed intention and to act on it at the appropriate point. Exactly how this "awareness" arises is the subject of some debate (e.g., McDaniel & Einstein, 2000, 2007; Smith & Bayen, 2004). This does not mean that the PM retrieval is uncued given that all retrieval is cued at some level (Craik, 1986); it simply means that the PM retrieval must be self-initiated. Clearly, PM and RM are not independent and PM tasks are not "process pure" (Graf & Uttl, 2001). In the Einstein and McDaniel (1996, 2005) multiprocess framework, PM tasks consist of a relatively automatic *noticing* component (remembering "that" something needs to be done at a particular point) and a more strategic RM *search* component (remembering "what" needs to be done), with the relative weights of the two depending on task characteristics (Einstein & McDaniel, 2005; McDaniel & Einstein, 2000). In addition to the requirement for RM, PM tasks can be resource demanding to the extent that their success requires cognitive control processes (e.g., monitoring), especially over extended delays between setting the intention and noticing and acting on the retrieval cue. Einstein and McDaniel contended that in order to minimize a potentially maladaptive load, the cognitive system uses a number of spontaneous processes (e.g., reflexive associations) that facilitate the deployment of resources during the retention interval.

Developmental differences in prospective memory: What we know

In both naturalistic and experimental studies, developmental differences in PM have been elusive, with some reporting age differences that favor older children and others reporting no age differences even among preschoolers (see Kvavilashvili et al., 2008). However, a number of critical factors that interact with age have varied among these studies and likely contributed (singly and jointly) to the inconsistent findings. These include (a) the nature of the PM task, (b) the requirements of the ongoing primary task that is performed after the intention to remember an action at a future point is set, and (c) the characteristics of the contextual cues that trigger an awareness of the intention to carry out the action.

Concerning the nature of the PM task, PM tasks can be time based or event based. Time-based tasks are performed after a set amount of time (e.g., check the oven in 20 min) or at a certain point in time