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The cognitive cost of event-based prospective memory in children



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ABSTRACT

Prospective memory is the act of remembering to perform an action in the future, often after the presentation of a cue. However, processes involved in remembering the future intention might hinder performance on activities leading up to and surrounding the event in which an intention must be carried out. The current study was designed to assess whether young children who were asked to engage in prospective memory do so at a cost to current cognitive processing. Participants (4-, 5-, and 6-year-olds) either performed a simple ongoing selection task only (control condition) or performed the selection task with an embedded prospective memory task (experimental condition). Results revealed that children in the experimental condition were slower in the execution of the ongoing task relative to children in the control condition, lending support to the theory that children as young as 4 years selectively allocate resources in an effort to succeed in multiple tasks.

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Introduction

Prospective memory refers to the process of remembering to perform an action in the future (Kvavilashvili, 1992). This is a common challenge in our everyday lives because we are constantly planning events and need to act on them at the appropriate times. Although there has been some focus on time-based prospective memory that requires an action to occur after a specified amount of time has elapsed (e.g., Hicks, Marsh, & Cook, 2005; Park, Hertzog, Kidder, Morrell, & Mayhorn, 1997), the

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current investigation focused on event-based prospective memory that requires an intention to be carried out when a stimulus or cue is presented in the environment (McDaniel & Einstein, 2000). To mimic the real-life situation of needing to remember to perform an action in the future in the midst of performing other activities, most laboratory tasks require performance of an “ongoing task” that is interrupted to perform the prospective act (e.g., Kliegel, Mackinlay, & Jäger, 2008).

According to a number of event-based prospective memory frameworks, representations of both the cuing event and the intended action are made when forming a delayed intention (Einstein & McDaniel, 1996; Guynn, McDaniel, & Einstein, 1998). Based on their multiprocess framework, McDaniel and Einstein (2000) proposed that prospective memory retrieval can be automatic or effortful. The automatic processes can be driven either by an exogenous attentional system or by automatic memory processes. In contrast, the effortful processes rely on strategy selection and executive attention. Furthermore, McDaniel and Einstein argued that when retrieval is automatic, event-based prospective memory requires attentional processes when the cue is presented but not throughout the ongoing task (see also Gollwitzer, 1999).

One method that has been used to determine whether there is effortful (as opposed to automatic) processing associated with executing a prospective memory intention is to measure the costs to the ongoing task. Assessing ongoing task performance is important because it speaks directly to the debate of whether prospective memory can ever truly be automatic in the sense that it does not place a burden on other cognitive resources. There is evidence in adult populations that ongoing task performance suffers when a secondary prospective memory task is incorporated (e.g., Anderson, Craik, & Naveh-Benjamin, 1998; Craik, Govoni, Naveh-Benjamin, & Anderson, 1996; Park et al., 1997; Smith, 2003; Smith, Hunt, McVay, & McConnell, 2007). For example, Park and colleagues (1997) looked at performance on the ongoing task in a study where younger and older adults performed both time-based and event-based prospective memory tasks. In the ongoing task of Experiment 1, participants were shown words against a patterned background and were told to monitor continuously so that they could remember the last three words. Throughout the task, when participants saw the word “RECALL,” they were to say aloud the last three words they saw. The event-based prospective memory task was that participants would press the “0” key when a specific pattern appeared as the background (e.g., plaid). In Experiment 2, participants were given the same ongoing working memory task but were instead given a time-based prospective memory task to perform (e.g., to pull a lever every 1–2 min). The findings suggested that both event-based and time-based prospective memory required allocation of cognitive resources, which posed a cost to the ongoing task, although the cost seemed to be more pronounced for event-based prospective memory. The authors speculated that event-based prospective memory may require continuous attention, whereas time-based prospective memory requires a central executive component to disengage from the ongoing task in a timely manner.

Smith (2003) also challenged the assumption that event-based prospective memory does not require cognitive resources during the ongoing task. Adult participants were given two blocks of a lexical decision task in which they were shown a string of letters and asked to determine whether the string was a word. Participants in the experimental condition performed the second block with the additional requirement of an event-based prospective memory task. Specifically, these participants were given a list of six words to memorize and were instructed to press the space bar when any of these words appeared. Participants in the control group were given the prospective memory instructions but were told that they would not need to follow those instructions for the current task. Smith found that participants in the control condition had shorter response latencies when completing the lexical decision task in the second block, which was attributed to practice effects. In contrast, participants in the experimental condition had longer response latencies in the second block, suggesting that prospective memory requires an allocation of resources that hinders performance on the ongoing task. Smith suggested that the allocation of resources when performing an event-based prospective memory task occurs because one is engaging in *preparatory attentional processes* that serve to maintain the goal over time.

The preparatory attentional and memory processes (PAM) theory contends that these attentional processes are not automatic (Smith, 2003; Smith & Bayen, 2005; Smith et al., 2007) but may be outside conscious awareness. In other words, an individual must maintain a state of readiness during the ongoing task, and individuals must monitor the ongoing task for the cues related to the prospective

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