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The development of future thinking: Young children's ability to construct event sequences to achieve future goals

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ABSTRACT

Previous studies suggest that the ability to think about and act on the future emerges between 3 and 5 years of age. However, it is unclear what underlying processes change during the development of early future-oriented behavior. We report three experiments that tested the emergence of future thinking ability through children's ability to explicitly maintain future goals and construct future scenarios. Our main objectives were to examine the effects of goal structure and the effects of working memory demands on children's ability to construct future scenarios and make choices to satisfy future goals. The results indicate that 4-year-olds were able to successfully accomplish two temporally ordered goals even with high working memory demands and a complex goal structure, whereas 3-year-olds were able to accomplish two goals only when the working memory demands were low and the goal structure did not involve additional demands from inferential reasoning and contingencies between the temporally ordered goals. Results are discussed in terms of the development of future thinking in conjunction with working memory, inferential reasoning ability, and goal maintenance abilities.

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Introduction

Humans are able to envision their past and think about possible future events. This ability, called *mental time travel*, allows individuals to construct details that occurred in a past event and will occur in a future event (Suddendorf & Corballis, 2007; Tulving, 2002). Furthermore, with mental time travel, individuals can use details from past events to generate possible future actions. Future-directed thought is essential for complex cognitive activities, including planning for the future, accomplishing goals, and remembering to complete intended actions, that is, prospective memory. The study of the roots of future thinking behavior has gained much attention during the last decade primarily through a focus on children's ability to make choices in the present to satisfy future needs (Atance & O'Neill, 2005b; Lemmon & Moore, 2007; McColgan & McCormack, 2008; Metcalf & Atance, 2011; Russell, Alexis, & Clayton, 2010; Suddendorf, Nielson, & von Gehlen, 2011). This recent focus on children's choices for the future has allowed researchers to focus on the emergence of future-directed thought during preschool years as a basis for more complex future-oriented behavior.

Raby and Clayton (2009) distinguished distinct categories that fall under the umbrella of future-oriented behavior. They suggested that prospective thinking reflects a declarative form of future-oriented thought and can be subdivided into prospective, semantic, and episodic future thinking. In their description, semantic future thinking is similar to semantic memory in that it does not necessarily involve projecting oneself into the future. That is, with semantic future thinking, individuals can imagine a future event using script-based or general event knowledge. In contrast, with episodic future thinking, individuals are part of the imagined future event and *where*, *when* and *what* aspects are incorporated into the future event. However, when individuals imagine the future, they likely draw on both semantic and episodic future-oriented thought processes. For example, when imagining a future birthday party, individuals may incorporate elements that are likely to play a role in the party such as a birthday cake, and also plan for novel circumstances of the specific future event such as the best route to reach the party.

In terms of development, past research suggests that although semantic memory and episodic memory processes may emerge together, children are able to use semantic information to plan for future events earlier than episodic information (Hudson, 1986; Hudson & Fivush, 1991; Hudson, Shapiro, & Sosa, 1995; Kreitler & Kreitler, 1987; Nelson & Gruendel, 1981, 1986; Slackman, Hudson, & Fivush, 1986). That is, although young children are able to use general event knowledge to describe future situations, they find it difficult to use specific event details to plan for novel future events (Hudson et al., 1995; Kreitler & Kreitler, 1987). In addition, prior research suggests that episodic future thinking is a precursor for more complex future-oriented behavior, specifically prospective memory (Nigro, Brandimonte, Cicogna, & Cosenza, 2014). Prospective memory requires individuals to employ past- and future-directed thinking. Individuals must remember intended actions and also plan on how to accomplish them (Einstein & McDaniel, 1990; Graf & Uttl, 2001), taxing working memory and cognitive flexibility.

The primary goal of this study was to extend knowledge regarding early future-oriented behavior in preschool-age children in several important ways. First, we sought to determine children's ability to use semantic knowledge to accomplish a set of future goals. Although 3-year-old children are able to use script-based knowledge to describe future events (Hudson & Fivush, 1991; Hudson et al., 1995), there is little information as to whether children at this age are able to use semantic knowledge to accomplish specific future goals. Second, this study would allow us to determine the nature of early future-oriented behavior. Prior research suggests that future-oriented behavior emerges between 3 and 5 years of age (see Hudson, Mayhew, & Prabhakar, 2011, for a review). These studies have largely focused on young children's ability to place events accurately on a temporal scale, provide verbal reports of personal past and future events, and make choices that satisfy personal future goals (Atance & O'Neill, 2005a; Busby & Suddendorf, 2005; Grant & Suddendorf, 2010; Hudson & Mayhew, 2011; McCormack & Hanley, 2011). Many of these studies have found rudimentary past and future thinking ability in 3-year-olds and a developmental progression that culminates in a much more complex ability between 4 and 5 years of age. For example, 3-year-olds are able to converse about the real past and future using temporal terms such as *before* and *after* or *did* and *will* (Blewitt, 1982; Busby & Suddendorf, 2005; Grant & Suddendorf,