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Making decisions with the future in mind: Developmental and comparative identification of mental time travel

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Abstract

Mechanisms that produce behavior which increase future survival chances provide an adaptive advantage. The flexibility of human behavior is at least partly the result of one such mechanism, our ability to travel mentally in time and entertain potential future scenarios. We can study mental time travel in children using language. Current results suggest that key developments occur between the ages of three to five. However, linguistic performance can be misleading as language itself is developing. We therefore advocate the use of methodologies that focus on future-oriented action. Mental time travel required profound changes in humans' motivational system, so that current behavior could be directed to secure not just present, but individually anticipated future needs. Such behavior should be distinguishable from behavior based on current drives, or on other mechanisms. We propose an experimental paradigm that provides subjects with an opportunity to act now to satisfy a need not currently experienced. This approach may be used to assess mental time travel in nonhuman animals. We conclude by describing a preliminary study employing an adaptation of this paradigm for children.

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Long-term planning—and hence the very possibility of stewardship—is something utterly new on the planet, even alien. It exists only in human brains. The future is a new invention in evolution. It is precious. And fragile. We must use all our scientific artifice to protect it.

Richard Dawkins (Open letter to Prince Charles, May 21, 2000)

Humans regularly plan future events, be it this weekend's dinner party, next year's graduation, or retirement in a couple of decades. We agree with Dawkins that there is something special and distinctly human about this ability (Suddendorf & Busby, 2003a). Furthermore, we have argued that the ability to reconstruct past events, episodic memory (Tulving, 1983, 2002), is an adaptive design feature of this future planning system. Together the ability to revisit the past and to imagine potential futures comprise what is called mental time travel. The evolution of this capacity may go a long way in explaining how humans managed to change the face of the Earth and why we appear so different from other animals (Suddendorf & Corballis, 1997).

Curiously, most research on mental time travel has focussed on the ability to entertain the past rather than the future. Tulving (e.g., 2002) proposed that we use episodic memory when we explicitly remember personal events (e.g., recall what happened at your graduation ceremony). We can re-experience episodes in our minds as we project ourselves back in time. Extensive research over the last decades has established that episodic memory can be dissociated from semantic memory (i.e., from explicitly knowing something), and from various types of implicit memories such as skills and habits, priming, conditioning, habituation (Levine, 2004; Squire, 1992; Tulving, 2002; Vargha-Khadem, Gadian, & Mishkin, 2001). Here, however, we would like to draw more attention to, what we believe to be, the ultimately more important aspect of mental time travel, mental travel into the future. After all, in and by itself, there can be no selective advantage to mentally reconstructing the past, unless it matters for the present or future.

Mental time travel into the future may employ very similar mechanisms as travels into the past (Suddendorf & Corballis, 1997; Tulving, 2005, Chap. 1). Atance and O'Neill (2001) refer to episodic future thinking, the ability to project the self into possible future scenarios. As with mental constructions of past events, mental pre-constructions are explicit representations. We can extrapolate from a remembered past event to generate likely future events and, together with our general semantic knowledge, we can foresee novel situations. Such forethought involves recursive rules (Corballis, 2003) to combine and recombine basic elements (e.g., actors, objects, and actions) to generate virtually unlimited potential scenarios (Suddendorf & Busby, 2003a). We can mentally simulate behavior that we may perform (or have performed) and perceptions we may experience (or have experienced) (cf., Hesslow, 2002).

Looking ahead to the next few pages, in this paper we will first discuss the distinction between mental time travel and other mechanisms that can produce what we may call future-oriented or anticipatory behavior. Next we consider the development of this capacity in human children and how it may be investigated using language, before suggesting a novel research design to test mental time travel in children and animals. We end by describing a preliminary implementation of such a test with preschoolers.

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