8 Episodic Future Thought: Remembering the Past to Imagine the Future

Karl K. Szpunar and Kathleen B. McDermott

INTRODUCTION

Imagine for a moment attending a party for next New Years' Eve. Take 10 s or so to generate a specific mental scene for this upcoming party. Chances are that you can "see" some pretty specific details: You can identify some of the guests, you envision clothes, and you can imagine a configuration of people intermingling in a specific setting—potentially one you know very well. How is it that we are able to envision the future in such a specific way? That question forms the topic of this chapter. Specifically, we examine the capacity for episodic future thought (Atance & O'Neill, 2001) and consider the possibility that recollection of the past is a fundamental component of envisioning the future.

We begin by reviewing the development of the concept of episodic memory and the hypothesis forwarded by Tulving and colleagues that episodic future thought and recollection of the past are tightly intertwined. We consider evidence for this claim from neuropsychological patients with amnesia, from the child development literature, from other special populations, and from neuroimaging. We conclude by considering some of the differences between remembering and episodic future thought (for a related discussion, see Van Boven, Kane, & McGraw, Chapter 9, this volume).

THE CONCEPT OF EPISODIC MEMORY: FROM EVENT MEMORY TO AUTONOETIC CONSCIOUSNESS

Episodic memory, or the ability to remember events from one's personal past (Tulving, 1983, 2002), has a relatively short empirical history. In fact, before 1972 the distinction between episodic memory and semantic memory (declarative knowledge devoid of a sense of reexperiencing the past) had not been acknowledged in the psychological literature (Tulving, 1972). The episodic/semantic distinction has since been embraced by the field, and there now exists a great deal of evidence to suggest that episodic memory represents a dissociable system of the human brain, characterized by its unique function and properties (Schacter & Tulving, 1994; Sherry & Schacter, 1987; Tulving, 1984, 1985a).

At the time of its original conception (Tulving, 1972), episodic memory was framed in terms of the then-prevailing information-processing approach to the study of human memory; that is, the assumption was that processing of event-specific information proceeds through successive stages (i.e., input, storage, output). There was only a vague acknowledgment of the importance of conscious awareness during retrieval. Since then, the concept of episodic memory has been considerably refined, specifically with regard to the conscious awareness associated with reexperiencing the past (Gardiner, 1988; Rajaram, 1993; Tulving, 1985b). In fact, Tulving and his colleagues now consider episodic memory to be one aspect of a more general system that is used for mental time travel (for a recent review, see Szpunar & McDermott, 2008b).

This most recent conceptualization is best captured by the concept of autonoetic consciousness, which is the ability to "both mentally represent and become aware of subjective experiences in the past, present, and future" and is thought to enable "mental time travel in the personal, subjective way that is the hallmark of retrieval from episodic memory" (Wheeler, Stuss, & Tulving, 1997, p. 331). The idea, initially delineated by Tulving (1985b), is roughly that humans possess the ability to mentally represent their personal past and future (see also Suddendorf & Corballis, 1997; Tulving, 2005). That is, just as we can vividly recollect our personal past, we can also, with a seemingly equal level of vividness and efficacy, travel forward in time to preexperience our personal future (Atance & O'Neill, 2001; Buckner & Carroll, 2007; Dudai & Carruthers, 2005; Schacter & Addis, 2007; Szpunar & McDermott, 2007; but see also Van Boven et al., Chapter 9, this volume, for a somewhat different perspective).

Recently, psychologists have directed more empirical attention to understanding the relation between remembering the past and simulating the future. The emerging consensus appears to be that the ability to simulate personal future events relies on the ability to remember the past. Corballis (2003; Suddendorf & Corballis, 1997) posited that in simulating the future we recursively sample elements of remembered events (e.g., people, places, objects, etc.) to help generate a virtually unlimited number of potential future scenarios. According to this view, episodic memory represents an inherently constructive system that enables people to simulate both their personal past and future (Schacter & Addis, 2007).

An implication of this suggestion is that there should be considerable overlap in the psychological and neural processes involved in remembering the past and simulating the future. Next, we discuss an emerging set of empirical findings in support of this hypothesis. Specifically, it has been shown that personal past and future thought can be selectively impaired in patient populations typically associated with deficits of episodic memory (e.g., Addis, Wong, & Schacter, in press; D'Argembeau, Raffard, & Van der Linden, in press; Klein, Loftus, & Kihlstrom, 2002; Tulving, 1985b; Williams et al., 1996), that personal past and future thought emerge together in ontogenetic development (e.g., Busby & Suddendorf, 2005; Suddendorf & Busby, 2005), and that both share common neural correlates (Addis, Wong, & Schacter, 2007; Okuda et al., 2003; Szpunar, Watson, & McDermott, 2007) traditionally associated solely with remembering the past (Maguire, 2001).

Method of Assessment

Before considering the data, we introduce some background with regard to the method by which episodic future thought is typically assessed. Generally, participants are required to mentally generate hypothetical future scenarios (e.g., I am with my close friends, and we are enjoying a night out at our favorite restaurant …) in response to word cues (e.g., restaurant) or event cues (e.g., New Year's Eve). To ensure that participants are able to produce detailed mental images, researchers explain to participants that their simulations need not necessarily be related to the cues themselves. That is, participants are encouraged to elaborate on the first event that comes to mind.

Following event generation, participants are asked to rate their mental images on a variety of phenomenological characteristics (e.g., vividness). These ratings are typically completed on a trial-by-trial basis, but participants may also be asked to provide such ratings only after all events have been imagined (see Szpunar et al., 2007). Finally, to compare the likeness of episodic future thought to episodic memory, researchers ensure that participants remember (and rate) an equal number of specific events as they imagine.

Amnesia

The suggestion that remembering the past and simulating the future may share many component processes was first proposed to the field of psychology by Tulving (1985b), who observed in amne-

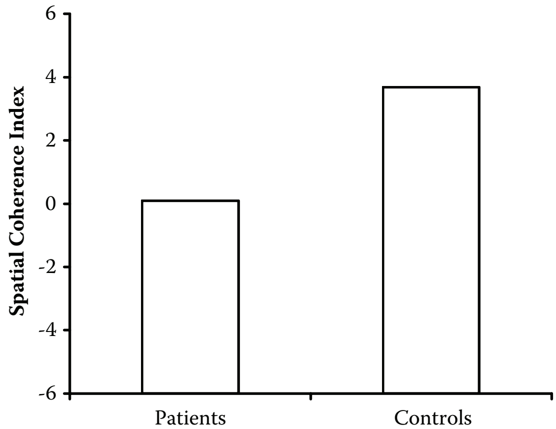

FIGURE 8.1 Average patient and control participant ratings of spatial coherence for mental images of novel future events. Spatial coherence index score ranged between −6 (totally fragmented) to +6 (completely integrated). (Adapted from "Patients With Hippocampal Amnesia Cannot Imagine New Experiences," by D. Hassabis, D. Kumaran, D. S. Vann, and E. A. Maguire, 2007, *Proceedings of the National Academy of Sciences of the United States of America, 104*, 1726–1731.)

sic patient K. C. a complementary inability to perform either task. Patient K. C. became amnesic following brain trauma to his frontal and medial temporal lobes. When asked to report on his personal past or future (e.g., What did you do yesterday? What will you do tomorrow?), patient KC would say that his mind was blank. Furthermore, when asked to compare the phenomenological experience of remembering his past and simulating his future, K. C. would report that both were associated with "the same kind of blankness" (Tulving, 1985b, p. 4).

A more in-depth analysis relating personal past and future thought in amnesia was subsequently reported by Klein, Loftus, and Kihlstrom (2002). Klein et al. studied patient D. B., who had become amnesic following an anoxic episode. As had Tulving (1985b), Klein et al. examined the extent to which patient D. B. was able to remember the personal past and simulate personal future events. Importantly, Klein et al. also asked patient D. B. to think about the past and future from an impersonal perspective (e.g., discuss a general concern for the world in the past/next few decades). As with patient K. C., patient D. B. possessed a profound inability to think about the personal past and future. However, D. B. performed at normal levels (relative to control participants) when thinking about the past and future in a nonpersonal manner. This particular pattern of data highlights the specific (episodic) nature of deficit observed in such patients.

Hassabis, Kumaran, Vann, and Maguire (2007) examined the ability of 5 amnesic patients, with brain damage limited to the hippocampal region, and 10 age-matched control participants to mentally construct novel future scenarios. Relative to control participants, the mental images generated by amnesic patients were particularly deficient in terms of spatial coherence. For instance, when cued to generate a novel future event occurring in the context of an exotic beach, one patient was only able to imagine the sky, whereas control participants conjured highly detailed and integrated scenarios (see Figure 8.1). Hassabis et al. suggested that both remembering the past and simulating the future rely on an intact medial temporal lobe system (particularly the hippocampus), which is believed to be integral to binding together basic elements from memory into a coherent mental image (Cohen et al., 1999; Eichenbaum, 2001; Miller, 2007).

It is important to note that the above-mentioned case reports represent but a few of hundreds of reported cases on amnesia. Thus, a great deal of caution must be exercised in considering such data, at least until they are further corroborated by future investigations. Nonetheless, these studies present an intriguing case for the hypothesis that mentally simulating the future relies on remembering the past, and confidence is gained when considering converging lines of evidence. Next, we turn our attention to studies relating past and future thought in aging and development.

Aging and Development

Research involving young children and older adults has recently noted a close coupling of the ability to mentally simulate the personal past and future. With regard to younger children, an extensive body of literature indicates that the ability to mentally reexperience a past event does not emerge until approximately the age of 4 years (Szpunar & McDermott, 2008b; Wheeler, 2000a, 2000b; Wheeler et al., 1997). Although children under the age of 4 are able to report on past events (Bauer & Werenka, 1995; Howe & Courage, 1993), their ability to do so is based largely on knowing about the semantic contents of those events and not on reexperiencing the spatial and temporal details associated with those contents (Gopnik & Graf, 1988; O'Neill & Gopnik, 1991; Wimmer, Hogrefe, & Perner, 1988).

Developmental psychologists have begun to consider that the emergence of the ability to simulate personal future events may coincide with the emergence of the ability to vividly recollect the past. In one study, Hudson, Shapiro, and Sosa (1995) reported that the ability to plan for specific future events gradually improves between the ages of 3 and 5 years. Although we believe it important to differentiate between episodic future thought and planning, this development of planning strategies may emerge as a result of the development of episodic future thought. More recently, Busby and Suddendorf (2005) examined the ability of children aged between 3 and 5 years to report on both personal past (e.g., What did you do yesterday?) and future events (e.g., What will you do tomorrow?). The authors found that although 3-year-olds had difficulty with remembering the past and simulating the future, 4- and 5-year-olds were proficient at both tasks (see Figure 8.2).

One common criticism of studies relating past and future thought in children emerges from the reliance of experimental procedures on verbal protocols. Although research suggests that time-related terms appear within children's speech by the age of 3 (e.g., Veneziano & Sinclair, 1995), such terms are often implemented inaccurately (Clark, 1973). Hence, based on studies employing the use of verbal protocols, it remains uncertain whether children under the age of 4 lack the ability for mental time travel, or rather the ability to describe the experience. Confidence is gained, however, through the use of nonverbal tasks.

Suddendorf and Busby (2005) recently conducted an experiment in which they presented children (ages 3 to 5) with what they call the "rooms task." The experiment required that children initially visit one room, which either contained an empty puzzle board (experimental group) or not

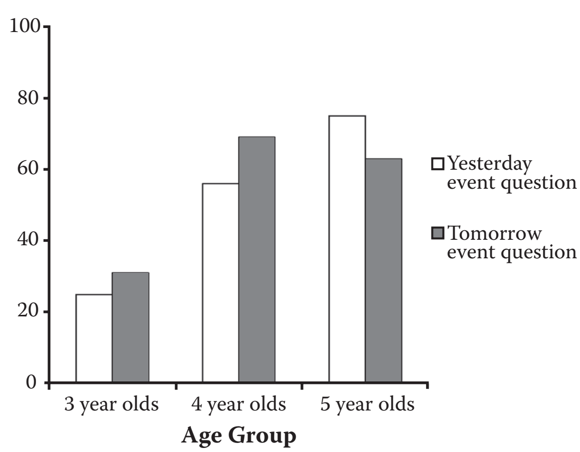

FIGURE 8.2 Percentage of 3-, 4-, and 5-year-old children producing correct answers in response to remembering the past and simulating the future. (Adapted from "Recalling Yesterday and Predicting Tomorrow," by J. Busby and T. Suddendorf, 2005, *Cognitive Development, 20*, 362–372.)

(control group). The children were then momentarily taken to a second room, where they played with other unrelated toys. Finally, the children were told that they would return to the first room, and that they could take one of four toys back with them (one of which was a puzzle set). The critical observation was whether the children in the experimental group would be more likely to take the puzzle set back to the first room. The authors found that this was the case for both 4- and 5-year-old children but not for 3-year-olds. A similar set of findings, using various nonverbal tasks, has been reported (Atance & Meltzoff, 2005; Atance & O'Neill, 2005). In general, it appears that the ability for children to mentally consider a state that they are not currently experiencing does not emerge until approximately 4 years of age (see also Saxe, Chapter 17, this volume).

As with young children, it has been well documented that aging is accompanied by declines in episodic memory function (Craik & Salthouse, 2000). For instance, Levine, Svoboda, Hay, Winocur and Moscovitch (2002) have shown that, relative to younger participants, older adults recall fewer episodic details when remembering events from their past. Addis et al. (in press) have reported that this episodic deficit extends to mental simulations of the future. In their experiment, participants (both young and old) were asked to generate personal past and future events in response to a series of word cues (e.g., dress). Addis et al. found that the verbal protocols of older adults were characterized by a lack of episodic detail for remembered events and simulated future scenarios. The authors argued that this complementary deficit supports the hypothesis that the contents of memory are regularly sampled in constructing novel future scenarios (D'Argembeau & Van der Linden, 2004, 2006; Schacter & Addis, 2007; Szpunar & McDermott, in press-a). As discussed next, a similar pattern of deficit has been reported using various clinical populations.

Clinical Populations

As with most empirical analyses of episodic memory, research on patients with depression (Evans, Williams, O'Loughlin, & Howells, 1992; Williams, 1996; Williams & Broadbent, 1986; Williams & Dritschel, 1988) and schizophrenia (Danion et al., 2005; Feinstein, Goldberg, Nowlin, & Weinberger, 1998; Riutort, Cuervo, Danion, Peretti, & Salame, 2003; Wood, Brewin, & McLeod, 2006) has focused on the recollection of past events. In general, both patient groups typically produce impoverished and unspecified accounts of their personal past. Williams et al. (1996) extended such findings for patients with depression to include a decreased level of specificity associated with simulating personal future events. Specifically, patients with depression and nondepressed control participants were required to generate personal past and future scenarios in response to a variety of sentence cues (e.g., imagine an event that would make you feel proud). Patients with depression generated memories and mental images of the future that were less specific than those of control participants. Furthermore, the specificity associated with past and future thought was highly correlated within participants ($r = 0.57$). That is, participants (depressed or control) who remembered vivid memories were more likely to generate vivid mental images of the future. This pattern of data (also reported by Addis et al., 2008) further corroborates the hypothesis that common component processes mediate mental simulations of the personal past and future.

A study by D'Argembeau et al. (2008) has reported a similar pattern of data using patients with schizophrenia. In general, it appears that subject populations known to be limited in their ability to remember specific events from their past also possess a complementary inability to mentally simulate personal future events. Next, we consider evidence from brain imaging. If the ability to simulate the future does rely on the ability to remember the past, then simulating the future should engage neural correlates normally associated with remembering the past. Indeed, this appears to be the case.

Evidence From Brain Imaging

Functional neuroimaging techniques, such as positron emission tomography (PET) and functional magnetic resonance imaging (fMRI), allow neuroscientists to examine brain activity associated

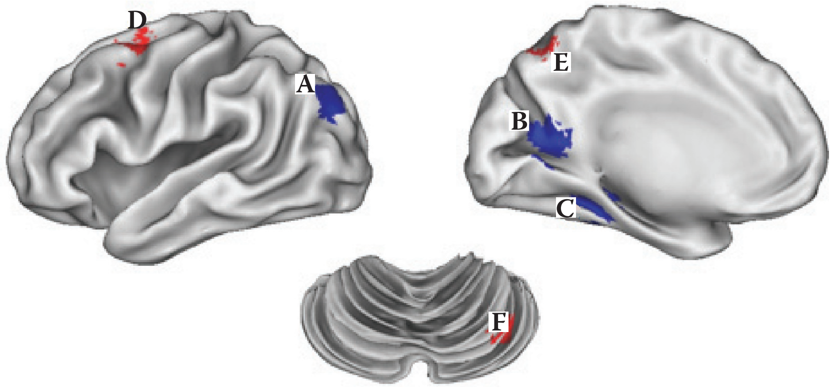

FIGURE 8.3 Brain regions exhibiting similarities (A–C) and differences (D–F) during remembering the past and simulating the future. Regions showing similarities appear within A, superior occipital cortex; B, posterior cingulate cortex; and C, medial temporal lobes. Regions showing differences appear within D, lateral premotor cortex; E, medial posterior parietal cortex; and F, right posterior cerebellum.

with mental activity. When participants in a research study engage in a given cognitive task, PET or fMRI can provide information about the level of cerebral blood flow (PET) or blood oxygenation level (fMRI) in the particular parts of the brain involved in performing the task.

In the typical design of a neuroimaging study, brain activity associated with two tasks is contrasted with the hope of isolating the brain regions that are important for the cognitive process of interest. In most cases, researchers attempt to contrast a pair of tasks that are similar to one another but vary in one key way. For instance, to identify the brain regions that are important for episodic memory, the tasks contrasted might both require the retrieval of a personal memory, but only one requires the recollection of a specific time and place. For example, requiring a person to remember a specific feature of her first day of high school (a task that would place clear demands on episodic memory) might be compared with requiring the person to retrieve the name of the high school she attended. Both tasks require the retrieval of a personal memory, but naming the high school does not involve recollecting experiences at a specific time and place in the past.

In an fMRI study, Szpunar et al. (2007) set out to identify brain regions that might be important for representing oneself in time and then to examine those regions to see whether they are similarly engaged by past and future thought. To accomplish this goal, Szpunar et al. asked study participants to perform a set of three tasks while lying in a scanner. In two of these tasks, participants viewed a series of event cues (e.g., birthday party) and were asked to envision either a personal memory of that kind of event or one that might take place in the future. Brain activity common to both tasks (past and future) was contrasted with that observed during a third task. This task involved similar processes, such as mental construction of lifelike scenarios, but did not involve representing oneself in time. The specific control task required participants to imagine former U.S. president Bill Clinton.

As can be seen in Figure 8.3, several regions in the brain's posterior cortex (A–C) were similarly engaged during personal past and future thought but not during the control task. These regions were located in the occipital cortex, the posterior cingulate cortex, and the medial temporal lobes. Previous research had shown that these regions are consistently engaged during autobiographical memory retrieval (Maguire, 2001; Svoboda, McKinnon, & Levine, 2006). Szpunar et al. (2007) hypothesized that asking participants to envision a personal future scenario likely required similar processes. That is, to effectively generate a plausible image of the future, participants reactivate contextual associations from memory (cf. Bar, 2004, 2007; Bar & Aminoff, 2003). Postexperiment questionnaires indicated that participants did tend to imagine future scenarios in the context of familiar settings and people.

Hypotheses based on exploratory research, such as identifying the neural relation of past and future thought, are significantly strengthened if the results can be replicated. Indeed, Addis et al. (2007) have presented a similar set of data. In their study, participants were given cue words (e.g., car) and asked to remember a past event or to envision themselves in the future. Once the event was "in mind," they were to press a button and then to keep thinking about the event. Relative to baseline tasks that involved sentence generation and imagery, thinking about past and future episodes led to equivalent activity in a set of posterior cortical regions consistently implicated in episodic memory (e.g., medial temporal lobes, posterior parietal cortex) and similar to those reported by Szpunar et al. (2007; see also Okuda et al., 2003, for a relevant study conducted using PET). In sum, brain regions known to be important for remembering the past appear to play an important role in simulating future events.

Differentiating Past and Future

Thus far, we have considered evidence from clinical, aging, and healthy human populations corroborating the hypothesis that personal past and future thought are closely related and involve similar processes. One issue that has yet to receive much attention is how the human mind/brain is able to distinguish between the experience of remembering the past and that of simulating the future.

Indeed, a similar issue—the differentiation of memory from imagination—has long been a topic of philosophical and psychological debate. In general, memories are characterized by greater sensory detail than are images of imagination (e.g., Hume, 1739/1978; Johnson & Raye, 1981), including those based on mentally projecting oneself into the future (D'Argembeau & Van der Linden, 2004, 2006; Szpunar & McDermott, 2008a; Van Boven et al., Chapter 9, this volume). Some images based on imagination can be more vivid than some memories, however, and yet we are consistently able to distinguish memory from imagination (see Brewer, 1995, for a more in depth discussion).

An alternative possibility, proposed by Hume and others (e.g., Earle, 1956; Johnson, Foley, Suengas, & Raye, 1988), is that images of imagination (including those projected into the future) are consciously experienced as requiring more construction than remembering (see also Sanna, Schwarz, & Kennedy, Chapter 13, this volume). In relation to the present topic of discussion, remembering the personal past requires reconstructing an event that has already taken place (with constructive processes contributing, too), but imagining a future event requires actively and continuously constructing a new scenario. The future event has not yet taken place, so it is up to the individual to decide where the event is taking place, who is there, and what they are doing.

Consider again the neural relation between personal past and future thought. Neither Addis et al. (2007) nor Szpunar et al. (2007) found a single region of the brain that was preferentially engaged as participants remembered past events relative to future events. However, Addis et al. did report greater hippocampal activity associated with simulating the future. The authors argued that although remembering the past and simulating the future both involve sampling the contents of memory, those contents must be bound in novel ways when simulating the future (see also Corballis, 2003).

Furthermore, Szpunar et al. (2007) also reported various brain regions that consistently showed activity differences in favor of simulating the future relative to remembering the past. These regions appeared within lateral premotor cortex, medial posterior parietal cortex, and posterior cerebellum (see Figure 8.3; D–F). Szpunar et al. noted that similar regions have been identified in studies that require participants to mentally simulate motor movements (e.g., Beilock & Lyons, Chapter 2, this volume; Decety & Grezes, 2006; Decety & Stevens, Chapter 1, this volume; Grezes & Decety, 2001). The authors suggested that these regions are preferentially engaged in simulating the future because stored action representations must be combined in novel ways based on the nature of the scenario participants conjure (e.g., What am I doing today after I eat breakfast?).

Based on these preliminary reports, it appears as though it may be the degree of generative and consciously constructive processing that serves to distinguish remembering the past and simulating the future. Of course, future research will need to test these claims.

SUMMARY

In this chapter, we have examined the hypothesis that the ability to simulate one's future is related to one's ability to remember the past. Based on our review of the preliminary data, we believe that the following statements generally support this hypothesis: (a) Those who lack the ability to remember their past appear also to be unable to think about themselves in the future; and (b) brain regions known to play an important role in remembering one's past become similarly engaged as people simulate personal future events.

Episodic memory has been the subject of experimental interest for over 35 years. Until recently, the focus of this research has been unequivocally directed toward understanding how humans represent their personal past. At the same time, there has been surprisingly little inquiry into our ability to mentally represent the future (for an exception, see Amit, Algom, Trope, & Liberman, Chapter 4, this volume). We believe that the coming years will see an increase in the number of studies of how the brain enables us to mentally represent future thought and how future thought may be related to and distinguished from memory.

Importantly, there will also be a need for future research to consider the nature in which episodic future thought is conceptualized and how the concept is assessed. Until now, there has been little consideration of how episodic future thought is differentiated from related concepts such as imagination and daydreaming (for a review, see Klinger, Chapter 15, this volume). For instance, does mentally projecting an imaginary event into the future make it any different from imagining it in the present? We suspect it might, but the nature of this supposed difference remains an empirical question.

As discussed in this chapter, a general method for examining episodic future thought now exists by which participants generate mental images and rate their phenomenological characteristics. Whether the study of episodic future thought might expand beyond a reliance on subjective introspection is yet to be seen. Experimenter analyses of verbal protocols (e.g., D'Argembeau & Van der Linden, 2004) and neuroimaging data represent steps toward a more objective understanding of the concept.

REFERENCES

Addis, D. R., Wong, A. T., & Schacter, D. L. (2007). Remembering the past and imagining the future: Common and distinct neural substrates during event construction and elaboration. *Neuropsychologia, 45*, 1363–1377.

Addis, D. R., Wong, A. T., & Schacter, D. L. (2008). Age-related changes in the episodic simulation of future events. *Psychological Science, 19,* 33–41.

Atance, C. M., & Meltzoff, A. N. (2005). My future self: Young children's ability to anticipate and explain future states. *Cognitive Development, 20*, 341–361.

Atance, C. M., & O'Neill, D. K. (2001). Episodic future thinking. *Trends in Cognitive Sciences, 5*, 533–539.

Atance, C. M., & O'Neill, D. K. (2005). The emergence of episodic future thinking in humans. *Learning and Motivation, 36*, 126–144.

Bar, M. (2004). Visual objects in context. *Nature Reviews Neuroscience, 5*, 617–629.

Bar, M. (2007). The proactive brain: Using analogies and associations to generate predictions. *Trends in Cognitive Sciences, 11*, 280–289.

Bar, M., & Aminoff, E. (2003). Cortical analysis of context. *Neuron, 38*, 347–358.

Bauer, P. J., & Werenka, S. S. (1995). One- to two-year olds' recall of events: The more expressed, the more impressed. *Journal of Experimental Child Psychology, 59*, 475–496.

Brewer, W. F. (1995). What is recollective memory? In D. Rubin (Ed.), *Remembering our past: Studies in autobiographical memory* (pp. 19–66). Cambridge, England: Cambridge University Press.

Buckner, R. L., & Carroll, D. C. (2007). Self-projection and the brain. *Trends in Cognitive Sciences, 11*, 49–57.

Busby, J., & Suddendorf, T. (2005). Recalling yesterday and predicting tomorrow. *Cognitive Development, 20*, 362–372.

Clark, E. V. (1973). On the acquisition of "before" and "after." *Journal of Verbal Learning and Verbal Behavior, 10*, 266–275.

Cohen, N. J., Ryan, J., Hunt, C., Romine, L., Wszalek, T., & Nash, C. (1999). Hippocampal system and declarative (relational) memory: Summarizing the data from functional neuroimaging studies. *Hippocampus, 9*, 83–98.

Corballis, M. C. (2003). Recursion as the key to the human mind. In K. Sterelny & J. Fitness (Eds.), *From mating to mentality: Evaluating evolutionary psychology* (pp. 155–171). New York: Psychology Press.

Craik, F. I. M., & Salthouse, T. A. (Eds.). (2000). *Handbook of aging and cognition* (2nd ed.). Hillsdale, NJ: Erlbaum.

D'Argembeau, A., Raffard, S., & Van der Linden, M. (2008). Remembering the past and imagining the future in schizophrenia. *Journal of Abnormal Psychology, 117,* 247–251.

D'Argembeau, A., & Van der Linden, M. (2004). Phenomenal characteristics associated with projecting oneself back into the past and forward into the future: Influence of valence and temporal distance. *Consciousness and Cognition, 13*, 844–858.

D'Argembeau, A., & Van der Linden, M. (2006). Individual differences in the phenomenology of mental time travel: The effect of vivid imagery and emotion regulation. *Consciousness and Cognition, 15*, 342–350.

Danion, J. M., Cuervo, C., Piolino, P., Huron, C., Riutort, M., Peretti, C. S., et al. (2005). Conscious recollection in autobiographical memory: An investigation in schizophrenia. *Consciousness and Cognition, 14*, 535–547.

Decety, J., & Grezes, J. (2006). The power of simulation: Imagining one's own and other's behavior. *Brain Research, 1079*, 4–14.

Dudai, Y., & Carruthers, M. (2005). The Janus face of mnemosyne. *Nature, 434*, 823–824.

Earle, W. (1956). Memory. *Review of Metaphysics, 10*, 3–27.

Eichenbaum, H. (2001). The hippocampus and declarative memory: Cognitive mechanisms and neural codes. *Behavioral Brain Research, 127*, 199–207.

Evans, J., Williams, J. M. G., O'Loughlin, S., & Howells, K. (1992). Autobiographical memory and problem-solving strategies of parasuicide patients. *Psychological Medicine, 22*, 399–405.

Feinstein, A., Goldberg, T. E., Nowlin, B., & Weinberger, D. R. (1998). Types and characteristics of remote memory impairment in schizophrenia. *Schizophrenia Research, 30*, 155–163.

Gardiner, J. M. (1988). Functional aspects of recollective experience. *Memory & Cognition, 16*, 309–313.

Gopnik, A., & Graf, P. (1988). Knowing how you know: Young children's ability to identify and remember the sources of their beliefs. *Child Development, 59*, 1366–1371.

Grezes, J., & Decety, J. (2001). Functional anatomy of execution, mental simulation, observation, and verb generation of actions: A meta-analysis. *Human Brain Mapping, 12*, 1–19.

Hassabis, D., Kumaran, D., Vann, D. S., & Maguire, E. A. (2007). Patients with hippocampal amnesia cannot imagine new experiences. *Proceedings of the National Academy of Sciences of the United States of America, 104*, 1726–1731.

Howe, M. L., & Courage, M. L. (1993). On resolving the enigma of infantile amnesia. *Psychological Bulletin, 113*, 305–326.

Hudson, J. A., Shapiro, L. R., & Sosa, B. B. (1995). Planning in the real world: Preschool children's scripts and plans for familiar events. *Child Development, 66*, 984–998.

Hume, D. (1739/1978). *A treatise of human nature* (2nd ed.). Oxford, England: Clarendon Press.

Johnson, M. K., Foley, M. A., Suengas, A. G., & Raye, C. L. (1988). Phenomenal characteristics of memories for perceived and imagined autobiographical events. *Journal of Experimental Psychology: General, 117*, 371–376.

Johnson, M. K., & Raye, C. L. (1981). Reality monitoring. *Psychological Review, 88*, 67–85.

Klein, S. B., Loftus, J., & Kihlstrom, J. F. (2002). Memory and temporal experience: The effects of episodic memory loss on an amnesic patient's ability to remember the past and imagine the future. *Social Cognition, 20*, 353–379.

Levine, B., Svoboda, E., Hay, J. F., Winocur, G., & Moscovitch, M. (2002). Aging and autobiographical memory: Dissociating episodic from semantic retrieval. *Psychology and Aging, 17*, 677–689.

Maguire, E. A. (2001). Neuroimaging studies of autobiographical memory. *Philosophical Transactions of the Royal Society of London: B, 356*, 1441–1451.

Miller, G. (2007). A surprising connection between memory and imagination. *Science, 315*, 312.

Okuda, J., Fujii, T., Ohtake, H., Tsukiura, T., Tanji, K., Suzuki, K., et al. (2003). Thinking of the future and past: The roles of the frontal pole and the medial temporal lobes. *NeuroImage, 19*, 1369–1380.

O'Neill, D. K., & Gopnik, A. (1991). Young children's ability to identify the sources of their beliefs. *Developmental Psychology, 27*, 134–147.

Rajaram, S. (1993). Remembering and knowing: Two means of access to the personal past. *Memory & Cognition, 21*, 89–102.

Riutort, M., Cuervo, C., Danion, J. M., Peretti, C. S., & Salame, P. (2003). Reduced levels of specific autobiographical memories in schizophrenia. *Psychiatry Research, 117*, 35–45.

Roediger, H. L., & McDermott, K. B. (1995). Creating false memories: Remembering words not presented in lists. Journal of Experimental Psychology: Learning, Memory, and Cognition, 21, 803–814.

Schacter, D. L., & Addis, D. R. (2007). The cognitive neuroscience of constructive memory: Remembering the past and imagining the future. *Philosophical Transactions of the Royal Society of London: B, 362*, 773–786.

Schacter, D. L., & Tulving, E. (1994). What are the memory systems of 1994? In D. L. Schacter & E. Tulving (Eds.), *Memory systems 1994*. Cambridge, MA: MIT Press.

Sherry, D. L., & Schacter, D. L. (1987). The evolution of multiple memory systems. *Psychological Review, 94*, 439–454.

Suddendorf, T., & Busby, J. (2005). Making decisions with the future in mind: Developmental and comparative identification of mental time travel. *Learning and Motivation, 36*, 110–125.

Suddendorf, T., & Corballis, M. C. (1997). Mental time travel and the evolution of the human mind. *Genetic, Social, and General Psychology Monographs, 123*, 133–167.

Svoboda, E., McKinnon, M. C., & Levine, B. (2006). The functional neuroanatomy of autobiographical memory: A meta-analysis. *Neuropsychologia, 44*, 2189–2208.

Szpunar, K. K., & McDermott, K. B. (2007). Remembering the past to imagine the future. *Cerebrum, February.*

Szpunar, K. K., & McDermott, K. B. (2008a). Episodic future thought and its relation to remembering: Evidence from ratings of subjective experience. *Consciousness and Cognition, 17,* 330–334.

Szpunar, K. K., & McDermott, K. B. (2008b). Episodic memory: An evolving concept. In D. Sweat, R. Menzel, H. Eichenbaum, & H. L. Roediger III (Eds.), *Learning and memory: A comprehensive reference*: Elsevier.

Szpunar, K. K., Watson, J. M., & McDermott, K. B. (2007). Neural substrates of envisioning the future. *Proceedings of the National Academy of Sciences of the United States of America, 104*, 642–647.

Tulving, E. (1972). Episodic and semantic memory. In E. Tulving & W. Donaldson (Eds.), *Organization of memory* (pp. 381–403). New York: Academic Press.

Tulving, E. (1983). *Elements of episodic memory*. New York: Oxford University Press.

Tulving, E. (1984). Relations among components and processes of memory. *Behavioral Brain Science, 7*, 257–268.

Tulving, E. (1985a). How many memory systems are there? *American Psychologist, 40*, 385–398.

Tulving, E. (1985b). Memory and consciousness. *Canadian Psychology, 26*, 1–12.

Tulving, E. (2002). Episodic memory: From mind to brain. *Annual Review of Psychology, 53*, 1–25.

Tulving, E. (2005). Episodic memory and autonoesis: Uniquely human? In H. S. Terrace & J. Metcalfe (Eds.), *The missing link in cognition: Origins of self-reflective consciousness* (pp. 3–56). New York: Oxford University Press.

Veneziano, E., & Sinclair, H. (1995). Functional changes in early child language: The appearance of references to the past and of explanations. *Journal of Child Language, 22*, 557–581.

Wheeler, M. A. (2000a). Episodic memory and autonoetic consciousness. In E. Tulving & F. I. M. Craik (Eds.), *Oxford handbook of memory* (pp. 597–608). New York: Oxford University Press.

Wheeler, M. A. (2000b). Varieties of consciousness and memory. In E. Tulving (Ed.), *Memory, consciousness, and the brain: The Tallinn Conference* (pp. 188–199). Philadelphia: Psychology Press.

Wheeler, M. A., Stuss, D. T., & Tulving, E. (1997). Toward a theory of episodic memory: The frontal lobes and autonoetic consciousness. *Psychological Bulletin, 121*, 331–354.

Williams, J. M. G. (1996). The specificity of autobiographical memory in depression. In D. Rubin (Ed.), *Remembering our past: Studies in autobiographical memory* (pp. 271–296). Cambridge, England: Cambridge University Press.

Williams, J. M. G., & Broadbent, K. (1986). Autobiographical memory in suicide attempters. *Journal of Abnormal Psychology, 94*, 144–149.

Williams, J. M. G., & Dritschel, B. (1988). Emotional disturbance and the specificity of autobiographical memory. *Cognition and Emotion, 2*, 221–234.

Williams, J. M. G., Ellis, N. C., Tyers, C., Healy, H., Rose, G., & MacLeod, A. K. (1996). The specificity of autobiographical memory and imaginability of the future. *Memory and Cognition, 24*, 116–125.

Wimmer, H., Hogrefe, G.-J., & Perner, J. (1988). Children's understanding of information access as a source of knowledge. *Child Development, 59*, 386–396.

Wood, N., Brewin, C. R., & McLeod, H. J. (2006). Autobiographical memory deficits in schizophrenia. *Cognition and Emotion, 20*, 336–347.