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The emergence of episodic future thinking in humans [☆]

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Abstract

In this paper, we discuss the construct of episodic future thinking. We have previously defined episodic future thinking as the ability to project oneself into the future to pre-experience an event (Atance & O'Neill, 2001). We distinguish this type of thinking about the future from that which is largely based on a script of how an event routinely unfolds (e.g., a restaurant or birthday party script). This distinction is related to the episodic/semantic distinction that has been applied to memory (Tulving, 1972). We discuss tasks, both verbal and nonverbal, that we have developed for young children, and that we believe assess episodic future thinking. Based on our findings from these tasks, we conclude that episodic future thinking emerges between 3 and 4 years of age. Throughout the paper, we attempt to specify the nature of the projection associated with episodic future thinking by elaborating upon how children's behavior in the tasks we discuss, as well as their behaviors in other contexts, are a reflection of this projection.

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In 1972, Tulving drew a distinction between two types of memory systems: semantic and episodic. Since then, he has defined *episodic* memory as the system that allows us to remember personally experienced events and travel backwards in time to re-experience those events. In contrast, he has defined semantic memory as our “knowledge of the world” (Tulving, 1985a, 2001). One of the primary distinctions between the two is that episodic memory is associated with a special type of consciousness—one that is described as being *autonoetic* or “self-knowing” (Tulving, 1985b, 2001). Tulving defines autonoetic consciousness as “the kind of consciousness that mediates an individual’s awareness of his or her existence and identity in subjective time extending from the personal past through the present to the personal future” (Tulving, 1985b, p. 1). Thus, whereas it is our semantic memory that allows us to state the name and location of the high school that we attended, it is our episodic memory that allows us to re-experience the emotions and events during our first day at this school.

Most research that has explored the episodic/semantic distinction has done so in the context of memory. Yet, such a distinction is also important as it applies to thinking about the future (for similar views, see Suddendorf & Corballis, 1997; Suddendorf & Busby, 2003; Wheeler, Stuss, & Tulving, 1997; Suddendorf and Busby, this volume). Indeed, similar to how episodic memory allows us to *re-experience* our past, we have proposed that *episodic future thinking* allows us to *pre-experience* our future (Atance & O’Neill, 2001, 2005). We in fact defined episodic future thinking as the ability to project oneself into the future to pre-experience an event (Atance & O’Neill, 2001). Our interest in the concept of episodic future thinking stemmed from our research exploring future thinking in young children. Similar to Tulving’s distinction between “knowing” about the past versus “remembering” our past (Levine et al., 1998; Tulving, 1985b), we deemed it important to distinguish between “knowing” about the future versus projecting ourselves into the future. Whereas “remembering” and “projecting” rely on an ability to conceive of the self in the past and future, respectively, knowing about the past and the future do not. Neuropsychological case studies of individuals who have suffered brain injury support these distinctions (Klein, Loftus, & Kihlstrom, 2002; Levine et al., 1998; Stuss, 1991; Tulving, 1985b). In these reported cases, individuals have been shown to retain semantic knowledge about both the past and the future (e.g., providing a script for going to a restaurant), but cannot remember any personal episodes from the past, nor project themselves into a future event.

With respect to the future specifically, it is possible that, initially, our conception of how it unfolds is predominantly derived from what could be termed “script-based” knowledge—our knowledge of familiar, routine, events. However, a mature understanding of the future must also include a mechanism by which we can anticipate, or foresee, ourselves in future events that are more novel and uncertain. We were interested in when young children might show evidence of such an ability.

Although we are the first to directly investigate episodic future thinking, the emergence of episodic memory has been studied, and so we will begin by reviewing some of the work in this area. Despite the fact that the temporal orientation of episodic memory and episodic future thinking differs, both involve the notion of “experien-

ing” the self in time. This component, common to both, is what we will focus on in our discussion of episodic memory.

Episodic memory development

Many have argued that episodic memory is not fully in place until at least 4 years of age (e.g., Nelson, 1992, 1993; Perner & Ruffman, 1995; Wheeler et al., 1997). This, however, does not mean that children younger than four have no memory of the past. Indeed, by 1 year of age, children evidence memory of specific “episodes” that they have experienced. For instance, Bauer, Hertsgaard, and Dow (1994) have shown that 1-year-old infants can retain memory of an action sequence 6 months or longer after it has happened. And, already by 2 years of age, children begin to talk about past events (Eisenberg, 1985; Fivush & Hamond, 1990; Nelson, 1989; Sachs, 1983). What is controversial is whether these memories are truly episodic in the manner described by Tulving, or rather, whether they constitute what is best described as “knowledge” of the past or, alternatively, semantic memory. Indeed, Nelson (2001) has argued that very young children may have a repertoire of knowledge about the world that is based on prior experience, and that guides their action in the present. However, what they may lack is the understanding of a self with a specific past and a specific imagined future. In other words, the nonpresent exists for these young children but in a form that is nonexperiential. This claim likely rests upon several specific memory limitations observed in children, suggesting that they lack the fully developed autoeic consciousness that Tulving deems crucial to episodic memory.

One such limitation was observed in a series of studies of delayed self-recognition conducted by Povinelli and his colleagues (Povinelli, Landau, & Perilloux, 1996; Povinelli, Landry, Theall, Clark, & Castille, 1999). In these studies, 2-, 3-, and 4-year-old children were videotaped while playing a game with an experimenter. Unbeknownst to the child, the experimenter covertly placed a sticker on the child’s head. Several minutes later, the child was shown a video playback which included the segment in which the experimenter placed the sticker on the child’s head. These researchers argued that if the child understood that the segment that she was viewing depicted an event which she had just experienced, then she should reach up to remove the sticker. Results indicated that none of the 2-year-olds, and only about 25% of the 3-year-olds did so. Only by 4 years of age did a substantial number of children (75%) do so (Povinelli et al., 1996). Povinelli (2001) has since argued that these findings suggest a limitation in 2- and 3-year-old children’s understanding of the past; namely, that they do not understand how recent past events, that the self has experienced, are causally connected to the self’s current experiences (however, for an alternative interpretation of these findings, in which it is argued that this task may not be a valid measure of the child’s ability to re-experience the past, see Sudendorf, 1999, and Zelazo, Sommerville, & Nichols, 1999).

Another intriguing limitation that young preschoolers experience is in the domain of knowledge acquisition. Within this domain, a well-established finding is that 3-year-olds have a substantial amount of difficulty identifying the source from which they have

acquired a piece of information (O'Neill & Chong, 2001; O'Neill & Gopnik, 1991; O'Neill, Astington, & Flavell, 1992). For example, a 3-year-old who has just smelled a clear liquid to discover that it is in fact strawberry perfume may err by saying that he knows this because he has touched it or looked at it, rather than because he has smelled it (O'Neill & Chong, 2001). Interestingly, Perner and Ruffman (1995) have shown that children's performance on this type of task, and their performance on a free recall task—argued by Tulving (1985b) to tap episodic memory—are significantly related. In their study, the better the children were at identifying how they acquired a specific piece of knowledge, the better they were at recalling a series of pictures that they had been shown. This relation is intriguing because it suggests that the ability to correctly identify how we acquired knowledge—a skill that does not develop until 4 or 5 years of age—seems to be a function of episodic memory. Indeed, Perner (2001) has argued that until children can identify how they acquired knowledge, they cannot be described as having episodic memories in the manner specified by Tulving.

Additional temporal concepts

To this point in our discussion, we have predominantly focused on Tulving's distinction between episodic and semantic memory. However, it is important to note that others have since expanded on this distinction in a manner that more precisely captures the aspect of "self" in time—past, present, and future (e.g., Moore & Lemmon, 2001; Neisser, 1988; Povinelli, 1995; Suddendorf & Corballis, 1997). Despite the fact that the future self has been incorporated into these descriptions, there is, at present, little research that has examined children's developing concepts of the future, and more specifically, what we term episodic future thinking.

Haith (1997) has argued that one of the difficulties in studying the future lies in the fact that there exists no taxonomy for talking about it. This contrasts with the domain of past thinking, or memory, in which various subcategories have been developed (e.g., short-term memory, long-term memory, etc.). But, clearly, some of the same processes relevant to memory are also relevant to future thinking. For example, the concept of "episodic" can apply to both the past and the future. The same can be said of autonoetic consciousness as it is an integral component of the episodic system—past and future. Finally, the temporally extended self (see Moore & Lemmon, 2001) is also a term that applies to our temporal cognition and involves the notion of a self which spans past, present, and future—thus, the recognition that the self has an enduring existence through time. As such, the temporally extended self encompasses both episodic memory as well as episodic future thinking. However, what still remains unanswered is the *nature* of the projection that accompanies episodic future thinking.

Conceptualizing episodic future thinking

Earlier, we mentioned that although children younger than 4 years of age have memories about the past, as evidenced by their talk about past events, this talk is

not necessarily a reflection of episodic memory. Similarly, children's talk about future events is not necessarily a reflection of episodic future thinking. In talking about the future, a child may simply be recognizing the pattern of past events and applying this knowledge to the future. For example, suppose you ask a 3-year-old child what she will be doing for her birthday, and she replies, "I'm gonna eat cake." Is this reply reflective of her ability to place herself in this future event of "eating cake" or is she simply reciting this event as part of an impersonal script that describes what typically happens at birthday parties? We know that from a very young age children possess script-based knowledge (e.g., what happens when you go to a birthday party) (Hudson & Shapiro, 1991; Hudson, Fivush, & Kuebli, 1992), and so it is possible that their earliest conception of the future is fully guided by this knowledge—such that the future is largely conceived as a recurrence of the past. One distinction that can be made, then, involves the novelty of the event. In fact, Nelson (2001) has argued the following: "The most significant talk about the future is usually talk about events that have never before been experienced, in contrast to the everyday routines that young children know and use to support anticipations of things to come" (p. 28).

Although we agree that novelty is important, what we argue is key to episodic future thinking is the projection of the self. Indeed, it is possible to project oneself, in a manner that is episodic, into the routine event of going grocery-shopping. And, similarly, it is possible that one can *know* about a novel future event—for instance, knowing the time and date of our high school graduation—without projecting oneself into this event (i.e., *semantic future thinking*). Why the novelty of the event may be important, however, is that children's talk about such events (and perhaps, more specifically, whether they *can* talk about such events) may provide one of the best means to tap episodic future thinking, as we will discuss later in the paper. In what follows, we attempt to describe the nature of the projection by identifying behaviors that we believe to be evidence of episodic future thinking.

An ability that one might intuitively associate with episodic future thinking is planning. However, there are many requirements of planning that are not necessarily requirements of episodic future thinking. For instance, planning requires multiple processing components such as problem representation, goal selection, strategy choice, strategy execution, strategy monitoring (Scholnick & Friedman, 1993), and executive function skills (Nelson, 2001). One can imagine a young child being able to *think* about a future event, without necessarily having the requisite abilities to plan for that event. Second, most of the existing planning tasks do not make explicit the link between the *self* and the future situation—a component that we deem crucial to episodic future thinking. For example, such behaviors as planning a route through a model grocery store (e.g., Gauvain & Rogoff, 1989; Hudson & Fivush, 1991), through a maze (e.g., Gardner & Rogoff, 1990), and moving the discs on a Tower of Hanoi task (e.g., Carlson, Moses, & Claxton, 2004; Klahr & Robinson, 1981) do not seem to draw heavily on the concept of a future self.

Is there any existing research that has examined what we would consider to be a reflection of episodic future thinking? One paradigm that assesses both the notion of self and future is the delay of gratification task (Mischel & Ebbesen, 1970; Mischel & Mischel, 1983; Mischel, Shoda, & Rodriguez, 1989; Peake, Hebl, & Mischel, 2002).

In this task, children are presented with a small reward option (e.g., 2 marshmallows) and a large reward option (e.g., 10 marshmallows). The experimenter then explains to the children that she has to leave the room, and they are told that if they wait until the experimenter returns, they will be given the large reward. Alternatively, they can ring a bell to bring the experimenter back into the room sooner, but in this case they would receive only the smaller reward. Although individual differences in performance exist on this task, in general, by 4 and 5 years of age, children seem to develop an understanding of the strategies that make delaying easier (Mischel & Mischel, 1983). For example, children learn that delaying will be easier if the rewards are covered rather than exposed. However, in addition to learning strategies that allow for more effective delay, children must also gain a better understanding of the future “interests” of the self. Indeed Moore and colleagues (Moore, Barresi, & Thompson, 1998; Thompson, Barresi, & Moore, 1997) have discussed successful delay on this task in terms of future-oriented prudence, which they define as behavior that is aimed at benefiting the *self* in the future. Specifically, to succeed in delaying, a child must be able to forego an immediate reward in favor of an imagined, or represented, future one (Moore et al., 1998). However, children must also possess fairly sophisticated executive function skills—most importantly, inhibitory control skills. Yet, these types of skills develop substantially between 3 and 4 years of age (e.g., Carlson & Moses, 2001; Frye, Zelazo, & Palfai, 1995), and so it is unclear whether these skills, rather than limitations in future thinking, are what affect children’s performance on delay of gratification tasks.

Tasks designed to measure episodic future thinking

We argue that what is needed to assess episodic future thinking are tasks that incorporate the notion of self and future (as is the case with the delay of gratification tasks described above), but do not require inhibitory control skills. We attempted to do so by designing what we have termed the *trip task* (Atance & O’Neill, 2005). In the trip task, children are asked to talk about the event of going on a trip. A trip is an event for which we can anticipate many possible outcomes. For instance, in thinking about a trip, I am able to anticipate such situations as getting hungry, thirsty, cold, etc. Because the likelihood that these situations will occur is unknown, talk about a trip should entail more uncertainty, and less reliance on a script (hence more speculation) than a routine event such as “bedtime” or “bathtime” where fewer outcomes are possible, and these outcomes are more certain. Thus, we suggest that within the linguistic realm, children’s ability to (1) talk about situations that may occur during a more novel event (i.e., one for which they are not likely to possess a script) and to (2) incorporate uncertainty terms into their talk about these anticipated situations may be markers which reflect the emergence of episodic future thinking.

Thus, in the *trip task*, we asked a sample of 34 3-year-olds (mean age = 43.5 months; range = 39–48 months) to pretend that they were going on a trip and presented them with eight items from which they could choose three to bring with them. The eight items consisted of two items each from four pre-selected “categories of

situations” which reflected a future need of the self. The items and categories were as follows: (1) juice and raisins, to address the possible *physiological* situations of getting hungry or thirsty; (2) sunglasses and Band-Aids, to address the possible *physical* situations of getting sun in one’s eyes or getting hurt; (3) book and teddy bear, to address the possible *emotional* situations of needing something to do, or getting scared; and (4) telephone and money, to address the possible *emergency* situations of needing to telephone someone or needing to buy something. Children were asked to choose three items to bring with them on their trip. After each choice, the child was asked to verbally explain why he or she had chosen that particular item (e.g., “Hey, how come you’re bringing (name of item) on your trip?”).

Children’s explanations were coded with respect to two factors. First, we were interested in children’s propensity to talk about the future in the context of the more novel event of going on a trip. Here, we hypothesized that some children may adopt a “future focus” that would be reflected in their ability to explain their item choice as a function of a future situation in which it might be needed, whereas others may simply focus on a need or desire for the item in the present. Thus, we coded whether children used the terms *will*, *going to/gonna*, *can*, *could*, *would*, *should*, *when (I)* (e.g., “when I get hungry”), *might*, *if*, *in case*, *maybe*, and *probably* which we argued reflect a *future* orientation, versus terms such as *want to* and *need to*, which we argued reflect a *present* orientation.

Second, we were interested in children’s use of uncertainty terms to explain their item choices. The terms that we considered to denote uncertainty were as follows: *might*, *if*, *in case*, *maybe*, and *probably* (note that we considered these terms to reflect both *future* and *uncertainty*). Here, we hypothesized that if children rely exclusively on a well-formed script for going on a trip, then their accounts should be less speculative in nature, and thus should not include uncertainty terms, as evidenced in the following example of a child providing a script for the routine event of going grocery-shopping: “You drive and then you go in and get a cart. You go and buy food. And then you leave.” (Hudson, Shapiro, & Sosa, 1995). In this example, the child is talking about the unfolding of this event as being fixed, rather than uncertain.

Overall, 37% of children’s item explanations clearly referenced future situations that could arise during the course of a trip (e.g., “Because when I’m thirsty I *will* drink it,” and “Because I’m *gonna* be hungry”). Over half of these also denoted the uncertainty inherent in these future situations (e.g., “*In case* somebody has anowie”). Children’s explanations most often contained future terms for the following: (1) the physiological situations of getting thirsty and getting hungry (juice and raisins) (50 and 44%, respectively), (2) the physical situation of getting hurt (Band-Aids) (70%), and (3) the ‘emergency’ situation of needing to contact someone (telephone) (56%). Of these future-oriented explanations, the percentages that also included an uncertainty marker were as follows: 44, 75, 86, and 45% for the juice, raisins, Band-Aids, and telephone, respectively. Although merely speculative, it may be the case that children provided a greater number of future references for the situations listed above because children have had more experience with states such as thirst, hunger, and getting hurt.

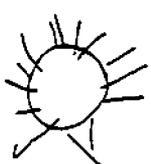
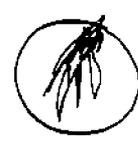
The trip task is clearly a verbal task, and so it is possible that if children were tested on a task that relied less heavily on language, we might obtain more evidence of episodic future thinking. To design such a task, one could assess some aspect of the child's *current* behavior as an indicator of how they are thinking about the future. This is because our behavior in the present is often a reflection of how we anticipate the future unfolding. Consider the following example: I have a journal submission that I want to send off at the end of the day. It is 3 p.m. and a colleague stops by my office to invite me for coffee. I reluctantly say “no” so that I can get the necessary work done on my submission. The decision that I have just made is in anticipation of successfully mailing my submission by the end of the day. Were I not able to anticipate this outcome, then I would have no reason to decline my colleague's invitation. We attempted to mirror this type of example in a task set in the context of children's drawing.

The same group of 34 3-year-old children who were given the trip task described earlier also participated in this next drawing task. In the drawing task, children were asked to state the name of an object that they intended to draw, and then to produce their drawing. However, the task was constrained in the following way: Children had to make their drawing using specified starting points—in one case a circle, and in the other a straight line—each drawn on two separate sheets of paper by the experimenter prior to the child participating in the experiment. In a familiarization trial, that came prior to the test trials, children were shown how a starting point could be turned into a completed drawing. Specifically, children watched as the experimenter transformed a squiggly line into a snake. Prior to doing so, the experimenter stated her intention to an Elmo puppet (e.g., “Elmo, I'm gonna turn this squiggly line into a snake”). For each of the two test trials children were given a starting point—either a circle, or a line—and were then asked to tell Elmo what object they were going to turn it into. After children stated their intention, they were asked to produce their drawing. Children's decision about what they would draw was taken to reflect whether they had anticipated a drawing that would be feasible for them to produce. Our hypothesis was that some children would succeed in this respect and so would decide to draw a relatively simple drawing that they could produce, whereas other children may decide to draw something too complex, in turn reflecting an inability to anticipate what would be a feasible drawing.

All of the children were able to state the name of a drawing that they intended to produce. However, only 38% of the children's drawings matched with their stated intention (see Table 1 for examples of children's drawings). But, importantly, the same children who were able to anticipate future situations in the trip task were also those who were able to anticipate a drawing that they could feasibly produce in the drawing task. A Spearman's rank-order correlation was conducted between children's scores on the trip task (range = 0–3) and their scores on the drawing task (range = 0–2). Partialing out age in months, the correlation between children's scores on the trip task and their scores on the drawing task was significant, $r = .65$, $p < .001$.

At this point, it is important to address what may be perceived as an obvious reason, other than an inability to anticipate a future outcome involving the self, for why

Table 1
Examples of children’s stated intentions and subsequent drawings

Matching drawings	Nonmatching drawings
<p><i>Stated intention</i> Tracks</p> 	<p><i>Stated intention</i> Lady bug</p> 
<p>Long neck</p> 	<p>Tiger</p> 
<p>Sun</p> 	<p>Ghost</p> 
<p>Person</p> 	<p>Whale</p> 

some of the children were unsuccessful on the drawing task: they did not have a good sense of their own drawing ability. Although this may be true, we in fact argue that having such a sense entails the ability to think about, or envision, a process (in this case, drawing) that involves the self. This point is illustrated by the following anecdote: one child in the drawing task stated that he was going to turn the circle into a tiger. However, upon placing his crayon on the page, he asked “How do you make a tiger?” Clearly, this child did not anticipate the difficult process needed to achieve

this outcome. One could characterize this child as not having a good sense of his own drawing abilities, but, what may lie at the heart of this difficulty is a limitation in thinking about the self engaged in this particular drawing process.

To assess the contribution of language to children's performance on these tasks, all of the children in this experiment were administered the Test of Early Language Development-2 (TELD-2) (Hresko, Reid, & Hammill, 1991). We then examined the relation between children's performance on the trip and drawing tasks and their performance on the TELD-2. As might be expected, children's scores on the trip task were significantly correlated with their scores on the TELD-2, $r = .35, p < .05$. However, children's scores on the drawing task were not significantly correlated with their scores on the TELD-2, $r = .23, p = .19$. More importantly, the correlation between children's scores on the trip task, and their scores on the drawing task did not change after age and TELD-2 scores were partialled out, $r = .65, p < .001$. What this correlation demonstrates is that linguistic ability does not seem to be driving children's performance on these two tasks.

In a second experiment, we have now further replicated the existence of a significant relation between children's performance on the trip task and their performance on another nonverbal task designed to assess episodic future thinking. In this second experiment, we administered the trip task to a separate group of 28 3-year-olds (mean age = 43 months; range = 39–48 months). We presented the juice, Band-Aids, teddy bear, and telephone to all of the children, and simply asked them to begin packing for their trip. Otherwise, the procedure was identical to the first trip task described above. Here, children talked about future situations on 50% of the trials, with talk about uncertainty occurring in approximately two-thirds of these instances. Again, the extent to which children's explanations included future, as well as uncertainty, markers differed depending on the situation that the items were designed to elicit talk about. Children's explanations contained future terms 45% of the time when explaining their choice of juice, 62% for the Band-Aids, 36% for the teddy bear, and 53% for the telephone. Of these future-oriented explanations, the percentages that also included an uncertainty marker were as follows: 53, 77, 64, and 57% for the juice, Band-Aids, teddy bear, and telephone, respectively.

Children were also given a new nonverbal block task designed to assess episodic future thinking (as was the case in the drawing task), but that required less fine motor skills than the drawing task. In this task, the experimenter built a tower with four blocks—each a different color—directly across from the child at the far end of the testing table. Two of the blocks were placed side by side to form a bottom row, with the other two, one above the other, *centered* on top of the bottom row. The goal of the task was then explained to the children: "In this game, you have to make your tower look just like mine with the same colors in the same places." The experimenter brought out the second set of four blocks, identical to the first set, and stated that she would begin the "building process" (i.e., "Here, I'll start"). She then proceeded to place one of the two blocks that would make up the *bottom* row on the table in front of the child. Then, off to the child's left-hand side, she presented three blocks and asked "which block do you want next so that your tower will look just like mine?" Each block was placed in one of three clear plastic cups to encourage children to

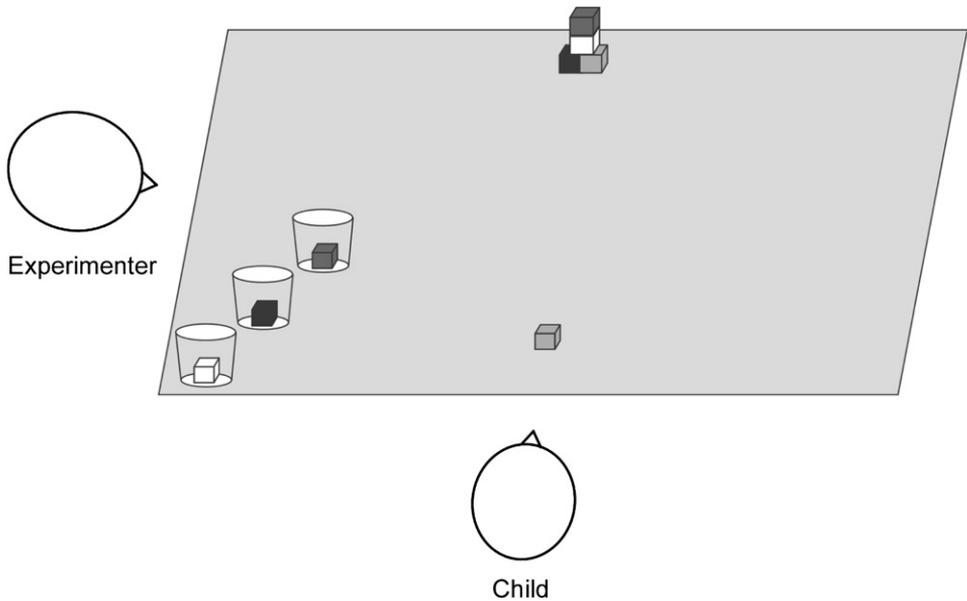


Fig. 1. Experimental set-up for the block task.

reflect on their next choice of block, and to prevent them from quickly and automatically reaching for a block (see Fig. 1). The placement of these blocks was counter-balanced across trials.

To build a tower identical to the experimenter's, it was necessary for children to anticipate that the other bottom block needed to be placed down before either of the two top blocks. This was because the two top blocks were centered *over* the two bottom blocks. We presented the blocks off to the child's left-hand side so that it was necessary for them to make an "anticipatory" look back to the tower to determine which block needed to be placed down next, and to ensure that this anticipatory look could be easily detected and coded. We reasoned that an anticipatory look was necessary, given that children's gaze had been shifted away from the model tower. Indeed, we verified this necessity in a pilot study with a group of 10 adults, and all 10 adults exhibited this anticipatory visual checking behavior.

Thus, our dependent measure for the block task consisted of the combined occurrence of the following two behaviors: (1) a visual check back to the model tower after they had been asked the test question (i.e., "Which block do you want next so that your tower will look just like mine?"), and prior to making their first block choice, and (2) correct choice of block (i.e., choosing the other bottom block). A correct choice without an accompanying visual check back to the model tower was not considered to reflect anticipation given that in our control study all adults produced such a check, suggesting that such a check was necessary to confirm which of the blocks needed to be placed down first. Moreover, it was possible to choose the correct block on the basis of chance alone (i.e., without actually anticipating which block needed to be placed down next). Thus, only if children exhibited both of the behaviors

described above were they given a score of 1; if they exhibited one or neither of these behaviors, they were given a score of 0.

At this point, we want to stress that this task does not only measure children's ability to duplicate the experimenter's tower. What is key is that there exists only one correct choice to accomplish the next step in creating the tower. Recognizing this correct choice, we argue, cannot be accomplished without forethought, as otherwise it is not obvious that the two top blocks cannot be placed down before the remaining bottom block. Again, this is because the two top blocks must be centered over the two bottom blocks. The lack of such foresight would cause a child to choose one of the upper blocks only to discover that it cannot be placed down properly, as was indeed observed to happen.

Children were given two trials of the block task. A different set of four colored blocks was used on the second trial. Although children were given an opportunity to complete the tower on each trial (i.e., put down the second and third blocks), we were only interested in their *first* block choice. Children were not given any feedback at the end of the first trial about whether they had successfully reproduced the model tower; they were simply told "Okay! Let's do another one." It is worth noting that in several important respects the block task retains many of the features of the drawing task, but without any potentially limiting motor components. That is, in the drawing task, children needed to look at a starting point and decide how they could transform it into a completed drawing. Similarly, in the block task, children were given a starting point for the tower (i.e., the experimenter put down the first block) and then needed to complete it. In each task, a failure to anticipate would result in an inability to produce a matching drawing in the drawing task and a tower that was identical to the model in the block task.

Overall, in 40% of the trials, children shifted their gaze from their left-hand side (where the three block choices had been presented) towards the model tower prior to choosing a block, and then proceeded to correctly choose the other bottom block. Once again, we were interested in whether children's performance on our verbal trip task was significantly correlated with their performance on our nonverbal block task. Controlling for both age in months and verbal ability (as measured by the TELD-2), the correlation between children's scores on the trip task (range = 0–4) and their scores on the block task (range = 0–2) was significant, $r(28) = .426, p < .05$.

We believe that the trip, drawing, and block tasks described above are all tasks that tap episodic future thinking. Because children's performance on these tasks was not at ceiling, an important next step would be to establish performance levels for 4- and 5-year-olds. Nevertheless, these data suggest that the particular form of future thinking that we term episodic is emerging in 3-year-olds with approximately 30–40% of this age group demonstrating this ability over our two experiments.

Markers of episodic future thinking

Although in discussing the previous two experiments, we have touched upon various markers that we argue are a reflection of episodic future thinking, in what

follows we outline these, and others, more explicitly. We begin by discussing aspects of a child's behavior, followed by aspects of a child's language.

First, a projection of the self is likely required to a greater extent if the child is anticipating a novel event for which he has little, or no, experience (as opposed to a script-based event). For example: A student is coming to meet with me at 3 p.m. At approximately 2:50 p.m., I look over and realize that there is a pile of papers cluttering the only available chair in my office (where the student will have to sit). In anticipation of this, I clear the papers away. This behavior is not the reflection of any type of event script that I might possess. Thus, even though I know that people sit in chairs (and typically ones that are not cluttered), I must be able to anticipate the fact that someone will soon be arriving. And, perhaps more importantly, I must anticipate this fact in the absence of any physically present cues (i.e., the student walking into my office). In this way, we would distinguish the behavior just described from that of a young infant who raises his arms in the presence of his mother in anticipation of being picked up.

Is there any evidence of these types of "anticipatory" behaviors in children younger than 3 and 4? Here, it is important to also consider children's behavior in naturalistic settings. In a questionnaire study, [Benson \(1994\)](#) asked parents to rate whether such items as "My child does things that show preparation for the future (e.g., My child gets a toy to take to Grandma's)" were applicable to their child. Results indicated that even children as young as 2 years of age were reported to engage in such behaviors. However, what is difficult with these types of naturalistic observations is determining whether they reflect episodic future thinking, as opposed to script-based knowledge of actions which routinely accompany a "trip to Grandma's." Thus, what may be required is careful consideration of the context of the behavior, as well as the extent to which the anticipated event is novel. In addition, the prevalence of such behaviors in naturalistic contexts can be compared to children's success on various experimental tasks run in carefully controlled contexts.

Second, the behavior in question must evidence the child's understanding that one's self in the future may be constrained by one's self in the present. Thus, we argue that taking into account constraints is an inherent feature of episodic future thinking. That is, episodic future thinking is not equivalent to imagining, fantasizing, or daydreaming about the future. For example, if I have a broken leg I can fantasize about skiing but I cannot realistically envision myself on the slopes tomorrow. Similarly, if a child with an upset stomach is asked to think about going to her best friend's birthday party, then her projection into, or account of, this future event should take this constraint into account. Thus, perhaps the child that can really envision herself at the birthday party will recognize that she will not be having cake—despite the fact that eating cake is a well-known action in a birthday party script.

Finally, it is worth noting that the ability to recognize constraints may have played an important role in children's performance on the drawing and block tasks described earlier. To succeed in each of these tasks, children could not simply imagine any outcome that they desired. For instance, despite the fact that drawing a tiger was the desirable or "wished for" outcome of the child described earlier, it is not one that he could have accomplished, precisely because he was constrained by his current

drawing ability. Similarly, in the block task, children were constrained by the fact that the two upper blocks sat centered over the two bottom blocks. Thus, children could not choose any of the three blocks to place down next, but needed to choose the other bottom block.

In terms of language, we argue that the *manner* in which children are talking about a future event may serve as an indicator of whether they are projecting themselves into that event. Although *all* forms of children's talk about the future may not be a reflection of episodic future thinking, we would argue that there are *certain* aspects of children's talk about the future that are likely to be indicative of this ability. First, we believe that the incorporation of uncertainty into children's talk about future events marks a new level of sophistication in their conceptualization of that event. For example, a child who talks about the possibility of getting hurt (e.g., "I might get hurt") may be forming more than one representation of how the future will unfold and, more specifically, what may or may not happen to the self during a future event. Were the child not beginning to form these types of representations, we would expect their talk about the future to be less speculative in nature.

Another linguistic indicator may be the extent to which children talk about future states of the self. Thus, as children begin to project possible states into the future (e.g., I might get hungry, I'm going to feel sad, etc.), they indicate an awareness of the continuity of self through time. Thus, it would be interesting to chart children's talk about these various states of the self—physiological, emotional, and mental, from 3 years of age (which is when episodic future thinking may emerge) until about 5 years of age (when we might assume episodic future thinking to be fully developed).

As evidenced by item explanations in the trip task, 3-year-olds' talk about the future is beginning to contain both references to uncertainty, as well as references to future states (e.g., I might get hurt). In general, we believe that more attention should be paid to children's talk about the future and to how the contexts, as well as the content, of this talk change throughout development. In fact, similar arguments have been made with respect to children's talk about the past, and, more specifically, the extent to which it can be said to reflect episodic memory. For example, Fivush (2001) argues that to create autobiographical memories (a subset of episodic memory that is concerned with events that are integral to our life history) children must begin to evaluate the event in question. In other words, they must convey a personal perspective on what the event *means* (e.g., "I was angry at my brother," "I thought I was going to fall"). Fivush argues that by using these evaluations children are going beyond merely describing what happened and are instead providing a sense of their own subjective perspective.

Finally, an important aspect of episodic future thinking is children's ability to imagine a noncurrent state (e.g., hurt, tired, etc.) and then reason how this state might affect their future experience. Children's ability to consider states that they are not currently experiencing, as well as ones that may even *conflict* with how they are currently feeling is being investigated in ongoing work by the first author (Atance & Meltzoff, 2003, 2005), and may be an especially sophisticated aspect of episodic future thinking.

Developmental factors contributing to episodic future thinking

What factors might contribute to the development of episodic future thinking? The first that we propose is parental talk to children about the future. Although a number of studies have shown that the manner in which parents talk to their children about the past can contribute to autobiographical memory development (e.g., Fivush, 1991; Haden, Haine, & Fivush, 1997), no such studies have been conducted with respect to parental talk about the future. However, one study has examined the frequency with which parents talk to their children about the future. Benson, Talmi, and Haith (1999) found that between 14 and 32 months of age, parental talk about the future increased from 36 to 58%. They also reported that talk about time, both past and future, increased during this period, relative to the other types of talk that they coded.

But, what about the form, or content, of parental talk about the future? Is there any indication that the manner in which parents talk to their children about the future might influence how children conceptualize the future? We know of only one study that has specifically examined this issue. Hudson (2001) has shown that when discussing familiar future events, mothers tend to focus on what usually happens. However, when discussing more novel future events, for which children could not be expected to have any prior experience, mothers are more likely to suggest possible actions and to elicit predictions from their child. Thus, it is possible that this observed difference in maternal talk leads children to form more hypotheses about novel future events than about familiar future events. This may initially take the form of the child answering hypothetical questions posed by the parent and, next, to the child generating these hypotheses on her own. An interesting speculation is that this type of talk on behalf of the parent may be what ultimately leads children to understand that future events can be inherently uncertain. This is then reflected in the child's use of terms such as "might" and "maybe" when talking about future events.

In addition to children gaining a better understanding of the future via conversation with parents and other adults, it is likely that children's developing theory of mind skills contribute to their ability to project themselves into the future (Moore et al., 1998; Suddendorf & Corballis, 1997; Suddendorf & Busby, 2003). Theory of mind refers to the understanding of our own and others' mental states, as well as how these mental states can be used to predict and explain our own and others' behavior (Astington, Harris, & Olson, 1988). One crucial component of having a theory of mind is that we can adopt multiple perspectives on the world. Thus, we can understand that others may share a perspective that differs from our own. Interestingly, both in the visual (Flavell, Everett, Croft, & Flavell, 1981; Flavell, Flavell, Green, & Wilcox, 1981) as well as the conceptual (Taylor, 1988) domains, young preschoolers have difficulty recognizing that others may have a perspective that differs from their own. With respect to thinking about the future, children are not required to adopt the perspective of another, but rather the perspective of a future self. What is challenging in this respect is that the child must envision the self in potentially different situations and states than she currently finds herself. There is initial evidence that this ability improves between the ages of 3 and 5 (Atance & Meltzoff, 2003), thus

placing it on a similar timeline to the improvements that we see in children's theory of mind skills between these same ages.

One final factor to consider is the role of language in episodic future thinking. At the most fundamental level, we can ask whether episodic future thinking (as well as episodic memory) is even possible in the absence of language. Indeed, Nelson (1992) argues that until children can represent their memories linguistically, they cannot form autobiographical memories. Moreover, a topic of ongoing debate across several disciplines is whether animals have the ability to remember their past and to contemplate their future (e.g., Roberts, 2002; Suddendorf & Busby, 2003). Indeed, with respect to thinking about the future, similar to the distinction we have made between projections that are script-like versus episodic, it has been argued that the ability of animals to think ahead is severely constrained and essentially limited to the "here and now." For example, in a recent overview of relevant animal research, Calvin (2004) argues that, although some animals are capable of anticipating routine happenings, multistage planning has not been demonstrated in any animal species. For example, a squirrel's hoarding can be explained as instinctive behavior driven by a physiological mechanism in response to shorter or longer daylight hours. Even among chimpanzees, despite rare displays of insightful problem solving or creativity, Calvin notes (based on the work of authors such as Boesch & Tomasello, 1998; Byrne & Whiten, 1988; Mithen, 1996; Stanford, 1998) that there is no evidence of any ability to think up new functions for tools, plan for novel events, foresee contingencies, or to plan 2 or 3 steps ahead. As he summarizes, "outside of the half-hour scale of intentions, a chimp or bonobo doesn't seem to prepare for tomorrow (2004, p.10)." Such findings might be taken to suggest that language plays a fundamental role, and perhaps even necessary role, in the emergence of episodic future thinking. But we would argue it is too early to come to such a conclusion. Our findings to date actually suggest language is not solely responsible for the relation observed between children's performance on the trip task and our nonverbal tasks designed to tap episodic future thinking. We believe the ability for episodic future thinking will rest, in part, on cognitive component(s) that remain to be elucidated more clearly among children, and that also remain to be demonstrated as being within or outside of the realm of nonhuman species.

In this paper, we have stressed the importance of distinguishing between thought about the future that is based on a script, or knowledge, that we possess about an event, versus thought which involves projecting the self into the future to pre-experience an event. We have termed the latter episodic future thinking. In the behavioral domain, we argue that the ability to anticipate novel events, as well as take into account constraints that may affect our *self* in the future, indicates the emergence of episodic future thinking in human development. In the linguistic domain, we argue that children's incorporation of uncertainty terms into their talk about the future, as well as their references to future states of the self, is also an important indicator of episodic future thinking. Finally, based on animal evidence to date, we believe that episodic future thinking may be a uniquely human ability that begins to emerge sometime during the fourth year of life.

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