The development and coherence of future-oriented behaviors during the preschool years

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ABSTRACT

Although previous research has identified a number of interesting aspects of future thinking in adults, little is known about the developmental trajectory and coherence of future-oriented behaviors during early childhood. The primary goal of this study was to explore these issues by administering a battery of tasks assessing different aspects of future thinking, including mental time travel, delay of gratification, planning, and prospective memory, to 72 preschoolers. Results revealed that performance on all of the tasks increased significantly between 3 and 5 years of age. Although most tasks were correlated, suggesting “behavioral” coherence, many of these significant correlations dropped out once age and receptive vocabulary were controlled. These results are discussed with respect to theories about, and measurement of, future orientation.

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Introduction

Most adults spend a great deal of time thinking about their futures. Indeed, humans are often engaged in behaviors such as planning and delay of gratification, argued by some to be distinctive to our species (e.g., Calvin, 2004). As such, it is not surprising that many areas of psychology, including social psychology (e.g., Buehler & McFarland, 2001; Gilbert, 2006; Loewenstein & Schkade, 1999; Newby-Clark & Ross, 2003), neuropsychology (e.g., Addis, Wong, & Schacter, 2007; Okuda et al., 2003), developmental psychology (e.g., Atance & Meltzoff, 2005; 2006; Busby & Suddendorf, 2005; Haith, Benson, Roberts, & Pennington, 1994; Hudson, 2006), and comparative psychology (e.g., Clayton, Bussey, & Dickinson, 2003; Mulcahy & Call, 2006; Naqshbandi & Roberts, 2006; Suddendorf & Busby, 2005), have...
become increasingly interested in exploring future thinking ability. In this article, we examine future thinking from a developmental perspective. We first consider the possible behavioral manifestations of future thinking ability and then empirically examine their development and the relations between them during the preschool years.

Young children’s transition from being predominantly rooted in the “here and now” to anticipating, planning for, and contemplating the future is of critical importance to healthy development and adaptation. There are many different aspects of young children’s daily lives that call on the capacity to think about and plan for the future. For example, children must learn that engaging in an undesirable behavior now (e.g., putting away one’s toys) may be the only means of bringing about a desirable future outcome (e.g., receiving a treat, watching television). In addition, children’s growing awareness of their own future states helps them to plan for a range of different events. If a child who is told that she will be spending the night at her grandmother’s house can anticipate the emotions associated with being separated from her parents, then she can better plan to address these (e.g., by bringing a favorite blanket or teddy bear). These and other future-oriented behaviors are theoretically important because they mark a transition from children reacting to events as they occur to children adaptively tailoring their behavior in anticipation of what lies ahead.

Despite the importance and adaptivity of future thinking, not much is known about its development or how it is reflected behaviorally. Part of the reason for this gap in our knowledge is that there is no agreed-on definition, or taxonomy, of future thinking (cf. Haith, 1997); hence, there are very few tasks whose aim is to measure this specific construct in young children. This gap has, however, begun to narrow due to recent research and theorizing on humans’ capacity for “mental time travel” (MTT) (e.g., Suddendorf & Corballis, 1997, 2007; Tulving, 2005). With respect to the future, MTT is defined as the ability to project the self forward in time to anticipate and plan for future events, states, and needs (Suddendorf & Corballis, 2007). As such, it comprises an important aspect of future orientation. Several paradigms have now been devised to assess the development of MTT ability.

Atance and Meltzoff (2005) developed a paradigm to assess preschoolers’ capacity to anticipate future states of the self. They asked children to pretend that they would engage in a variety of relatively novel events (e.g., walking up a mountain, walking across a rocky stream) and then asked them to choose an item from a set of three items that they should bring with them to the event in question. For example, when asked to imagine walking across a rocky stream, children were presented with Band-Aids, a pillow, and a fish. The Band-Aids were considered to be the correct choice because they could be used to address the future state of getting hurt. In one experiment, 3-, 4-, and 5-year-olds were tested on their ability to choose items that could be used to address various future states of the self (and hence MTT). Results indicated that these age groups chose the correct items 61, 75, and 92% of the time, respectively. When asked to explain the reasons for their choices, 3-, 4-, and 5-year-olds provided future-oriented justifications (e.g., “I might get hurt”) in 44, 40, and 59% of the trials, respectively.

Busby and Suddendorf (2005) assessed MTT capacity by asking 3-, 4-, and 5-year-olds to anticipate something that they would do tomorrow as well as something that they would not do tomorrow. For children’s responses to be scored as correct on both of these questions, children needed to provide a coherent response that a parent subsequently judged to be correct. Across two experiments, 3-year-olds provided correct responses to these two types of questions 11 to 31% of the time, whereas 4-year-olds responded correctly 60 to 69% of the time—a difference that was significant. Five-year-olds were also tested in a second experiment, and their percentages of correct responses ranged between 63 and 87%. There were no significant differences between children’s answers to the “negative” questions about the future and their answers to the “positive” ones. These two studies suggest that MTT is emerging and showing marked development during the preschool years.

To date, however, there has been no attempt to explore how these instantiations of MTT may be related to other aspects of children’s behavior that have also been described as future oriented, including the capacity to delay gratification, plan, and engage in acts of prospective memory. In the following subsections, we outline the types of tasks used to assess these abilities along with their reported developmental trajectories.
Delay of gratification

Delay of gratification is also described as “future-oriented self-control” (Mischel, Shoda, & Rodriguez, 1989). In the classic delay of gratification paradigm (e.g., Mischel et al., 1989), children are presented with a choice between a highly desirable reward (e.g., 10 mini-marshmallows) and a less desirable one (e.g., 2 mini-marshmallows). Children are told that they can either have the less desirable reward immediately or wait to obtain the larger reward. This wait period typically lasts between 5 and 15 min, during which children are left alone seated in a room with the rewards visible to them. Although there is substantial individual variability, the ability to delay gratification in this context and others like it increases with age (e.g., Mischel et al., 1989; Moore, Barresi, & Thompson, 1998; Thompson, Barresi, & Moore, 1997).

Planning

There are many different definitions of planning, but there is consensus that planning involves the representation of, and preparation for, a future goal. Thus, by definition, planning is a future-oriented behavior. Various tasks have been used to examine young children’s planning skills. A common one is an adapted version of Tower of Hanoi (e.g., Carlson, Moses, & Claxton, 2004; Klahr & Robinson, 1981). In this task, children must plan how they will move a series of disks from peg to peg to create a structure that matches the experimenter’s structure. A challenging feature of this task is that children are required to follow a set of predetermined rules that often results in them needing to execute (correct) moves that appear to distance them from the final goal/structure.

Other tasks to tap the development of planning abilities include “search” tasks, which require children to plan how best to minimize the distance traveled from one point to the next to obtain a series of objects (e.g., Fabricius, 1988; Wellman, Fabricius, & Sophian, 1985), and “route planning” tasks, which require children to navigate as efficiently as possible through a model grocery store to obtain specified items (e.g., Gauvain & Rogoff, 1989) or plan a route from start to finish through a maze (e.g., Gardner & Rogoff, 1990). Children’s planning skills have also been assessed in more “real world” settings. For instance, Hudson, Shapiro, and Sosa (1995) asked children to plan for the familiar events of going to the beach and going grocery shopping. Results from these studies indicate that children’s performance on various planning tasks generally improves with age, with a noticeable increase between 3 and 5 years of age (e.g., Carlson et al., 2004; Hudson et al., 1995).

Prospective memory

Prospective memory is defined as remembering to perform an action at some time in the future (Kerns, 2000); thus, unlike retrospective memory, it is future oriented. Researchers have distinguished between event-based and time-based prospective memory tasks (Einstein & McDaniel, 1990; Kerns, 2000). Event-based tasks require individuals to perform an action that is contingent on the occurrence of an external event or stimulus (e.g., remembering to give John an invitation on seeing him). In contrast, time-based tasks require individuals to remember to perform an action at a certain point in time or within a certain time period. Because time-based prospective memory does not reportedly develop until middle childhood (Kliegel, Ropeter, & Mackinlay, 2006), we restrict our description to those tasks used to assess event-based prospective memory.

Kvavilashvili, Messer, and Ebdon (2001) asked 4-, 5-, and 7-year-olds to name pictures in a stack of cards. The prospective memory aspect of this task was that children were told that when they encountered a picture of an animal, they should put it into a nearby basket. The 7-year-olds were significantly more likely to remember to perform this action than were the younger children. Guajardo and Best (2000) developed a more naturalistic type of prospective memory task. Their task simply entailed asking groups of 3- and 5-year-olds to remember to ask for a sticker and to close the door on completion of a computer task in which they were about to engage. Children were also given a longer delay task that required them to remember to return a picture and to ask for a pencil during a second laboratory visit that occurred between 24 and 72 h later. Results indicated that the 3-year-olds were beginning to demonstrate prospective memory skills on these naturalistic tasks but that by 5 years of age success...
rates were significantly higher. For instance, whereas only 25 and 52% of the 3-year-olds remembered
close the door and ask for the sticker, respectively, the corresponding percentages were 75 and 83%
for the 5-year-olds.

Each of the behaviors described to this point seems to develop substantially between 3 and 5 years
of age and is also argued to rely on frontal lobe functioning (e.g., Goel & Grafman, 1995; Kliegel et al.,
2006). Each also requires children to move beyond the here and now and to adopt a future orientation.
Thus, it is possible that these behaviors are related by virtue of this requirement. For example, the chil-
dren who can begin to envision what will happen tomorrow may be the same children who can begin
to correctly plot their future moves on planning tasks such as Tower of Hanoi. Alternatively, these
behaviors may be relatively distinct. It is possible that future thinking ability is necessary but not suf-
icient for their development. For example, whereas talking about, or planning, what to do tomorrow
may require little, if any, capacity for inhibitory control, delaying gratification may require substan-
tially more. Moreover, different subtypes of future thinking ability may exist, and these might not
be fully overlapping. For example, in Tower of Hanoi, children must engage in some form of future
thinking, but it may differ substantially from the form that is required when thinking explicitly about
what one will be doing tomorrow.

**Current study**

The goal of this investigation was to examine the development and coherence of future-oriented
behaviors. Children between 3 and 5 years of age were given a battery of tasks that measure important
aspects of future orientation, including MTT ability, delay of gratification, planning, and prospective
memory. We also included the Peabody Picture Vocabulary Test–3rd edition (PPVT-3) (Dunn & Dunn,
1997) to measure children’s receptive vocabulary. Doing so allowed us to determine whether any sig-
nificant intertask correlations remained when children’s vocabulary scores (and age) were controlled.
Such a finding would suggest that the behaviors under study draw on a common conceptual core that
is independent of verbal ability and age.

We hypothesized that children’s performance on the various tasks would increase with age and
that tasks designed to measure the same particular capacity (i.e., MTT, planning, and prospective
memory) would be significantly correlated. Our predictions about correlations between the various
tasks were less certain, but we hypothesized that, due to their fundamental requirement of adopting
a future orientation, they should be at least moderately correlated even when controlling for age and
verbal ability.

**Method**

**Participants**

Participants were 72 children: 24 3-year-olds (mean age = 42.08 months, range = 38–47, 12 boys
and 12 girls), 24 4-year-olds (mean age = 53.33 months, range = 48–58, 12 boys and 12 girls), and
24 5-year-olds (mean age = 64.92 months, range = 61–71, 12 boys and 12 girls). One additional child
completed the study but was excluded from the analyses because of equipment failure. All particip-
ants were predominantly White and middle class, which was representative of the university city
from which they were recruited. Participants were fluent in English. Parents received parking reim-
bursement, and children received a toy for their participation.

**Procedure**

One of three female experimenters tested children individually in a small room. Children were
administered eight tasks in one of eight counterbalanced orders, and all sessions were videorecorded.
Each task was conceptualized as assessing one of the following four abilities: (a) MTT, (b) delay of grat-
ification, (c) planning, or (d) prospective memory. Once children had completed the tasks, they re-
ceived the PPVT-3, which was always accompanied by Puppet Retrieval, one of the prospective
memory tasks (see below).
Reliability coding

A trained undergraduate psychology student who was blind to the goals of the study conducted reliability coding on 75% of the data. Only those tasks (or aspects of tasks) for which children's responses were considered to be subjective underwent reliability coding. Disagreements were resolved through discussion.

Mental time travel tasks

Picture Book. This task was identical to the one used by Atance and Meltzoff (2005) with the exception that children were given four trials rather than six trials. In this task, children were shown large color photographs of four locations: (a) a river with large rocks, (b) a desert with a long road, (c) a waterfall, and (d) a mountain. Children were asked to imagine going to the location depicted in the photograph and were then shown three small photographs of objects that they could bring with them. They were asked to select one of the three and to explain their choice. One of the three photographs constituted the correct choice because it could be used to address a future need state, whereas the other two were distracters. Although children were always asked to explain their item choices, we scored only those that followed a correct choice. The items for each trial were as follows: river (Band-Aids, fish, and pillow), desert (water, present, and plant), waterfall (raincoat, rocks, and money), and mountain (lunch, bowl, and grass). Children received a score of 1 for each correct item choice (i.e., Band-Aids, water, raincoat, and lunch, respectively) and a score of 1 for each correct item explanation. Children's explanations were considered to be correct if they contained both a future referent (e.g., gonna, might, will) and a state referent (e.g., hungry, hurt). Children's item choice scores and explanation scores were summed to create one aggregate score (range = 0–8). Reliability for children's item explanations was high, with Cohen's kappa = .91. One child did not provide data due to fussiness.

Tomorrow. This task was similar to the one used by Busby and Suddendorf (2005). Children were first introduced to a stuffed dog named “Scruffles,” who was described as being very curious about children's activities. Scruffles then asked children, “What are you going to do tomorrow?” Following children’s responses, Scruffles asked them to report something else they would do tomorrow. Unlike Busby and Suddendorf's procedure, we asked children to report a second event to allow us to obtain a finer-grained measure, allowing for more individual variability. Children received a score of 1 for each event that they provided and that a parent, when asked at the end of the session, verified as being plausible (range = 0–2). As was the case in Busby and Suddendorf's study, children did not need to provide elaborate event descriptions; a response such as “go to school” was considered to be sufficient.

Delay of gratification task

Treat Delay. The experimenter presented children with a choice between mini-marshmallows and pretzel sticks (Mischel et al., 1989). Once children indicated their preference, the experimenter placed a small pile (2 treats) on one side of a plate and a large pile (10 treats) on the other. Children then indicated which pile they preferred. If children initially chose the smaller pile (this occurred in six cases), the experimenter reminded them that they could choose the larger pile if they preferred (every child except one subsequently changed his or her mind and chose the larger pile). The experimenter then informed the children that she needed to leave the room to do some work and that if they waited until she returned, they could have the large pile of treats; however, if they decided not to wait, they could ring a bell to bring her back, but they would then receive only the small pile. The experimenter checked whether children understood the rules and then left the room. Children received a score from 0 to 8 corresponding to the number of minutes that they waited until ringing the bell or eating the treats. A score of 8 indicated that children were able to wait the full 8 min until the experimenter returned. Four chil-

1 We also administered Thompson, Barresi, and Moore's (1997) modified delay of gratification (or “sticker”) task. Children received three trials in which they chose between receiving one sticker now and receiving two stickers now (“now trials”) and three trials in which they chose between receiving one sticker now and receiving two stickers in the future (“delay trials”). However, the results of this task were difficult to interpret due to the fact that children did not show an overwhelming baseline preference for two stickers versus one in the now trials (this was especially true for the 3-year-olds), making subsequent interpretation of the data difficult.
dren did not provide data for this task: two due to experimenter error, one due to the child refusing to be left alone in the room, and one due to the child not wanting the larger pile of treats.

Planning tasks

Tower of Hanoi. This task followed the procedure outlined by Carlson and colleagues (2004) (adapted from Welsh, 1991). Children were presented with a small wooden structure with three pegs ("trees"). Two wooden disks ("monkeys") were placed on the pegs, with a smaller one (the "boy" monkey) on top and a larger one (the "daddy" monkey) on the bottom. The experimenter explained the three rules of the game, namely that (a) the monkeys need to stay in the trees, (b) only one monkey can jump at a time, and (c) the daddy monkey can never sit on top of the boy monkey (but the reverse is possible). The experimenter had an identical wooden structure, and the children were asked to copy the experimenter's disk pattern using the least number of moves possible. There were six levels in the task, with the last three involving the addition of a third disk (the "baby sister" monkey). The task progressed in difficulty, with the first level (Level 1) involving two disks and requiring the children to make one move to match the experimenter's structure and with the final level (Level 6) involving three disks and requiring four moves. The experimenter confirmed that the children understood the rules of the task by asking them to identify the boy monkey and the daddy monkey (corrections were given as needed). Children were also asked to demonstrate the jumping rule by completing a one-move jump with the larger disk. Finally, children were reminded of the rule they had broken for each trial in which they failed. For each level, children were given two trials to copy the experimenter's structure, with the task ending when the children failed in two consecutive trials on a given level. Thus, children received a score of 0 to 6 based on the highest level they achieved. Reliability for this measure was excellent, with Cohen's kappa = 1.0.

Truck Loading. This task also followed the procedure used by Carlson and colleagues (2004) (adapted from Fagot & Gauvain, 1997). In this task, children played the role of a mail carrier who needed to deliver party invitations. An inverted U-shaped street with arrows running clockwise down the center was drawn on a large piece of cardstock. The colors of the five cardboard houses matched the colors of five small invitations. Children were asked to deliver the invitations to the houses using a small delivery truck while adhering to four rules, namely that (a) the street is one-way and so one can drive in only one direction, (b) one can drive around the block only once because invitations need to be delivered as quickly as possible, (c) the color of the invitation must match the color of the house, and (d) invitations must be taken only off the top of the pile from the back of the truck. These rules were introduced one or two at a time to the children, with corresponding practice trials. For example, the first rule was introduced by asking the children to simply deliver one invitation to one house. Subsequently, another house was added to the setup to introduce the third and fourth rules. Children were also reminded of the rule they had broken when they failed an initial trial of any level. The task began with a warmup in which the experimenter demonstrated how to deliver the invitations—first to one house and then to two houses. The experimenter demonstrated how the last invitation to be delivered needed to be placed in the truck first. There were four possible levels: from two houses to five houses on the street. Children were given two trials at each level, and their score corresponded to the highest level they achieved, for a total score of 0 to 4. Reliability for this measure was excellent, with Cohen's kappa = 1.0. There were missing data for one child due to experimenter error.

Prospective memory tasks

Card in Basket. Following Kvavilashvili and colleagues (2001), the children were shown two piles of 10 flash cards with colored drawings of common objects (e.g., umbrella, apple). "Scruffles," a stuffed dog, was introduced/reintroduced to the children, and the experimenter explained that Scruffles was afraid of all other animals. Consequently, children were told that if they saw a picture card depicting an animal, they should immediately place it in a basket without Scruffles seeing it. The basket was positioned on the floor, out of the children's direct line of sight, so that it did not serve as a memory cue. Children needed to remember to hide the card on two occasions as an animal appeared in each set: once in the second last position and once in the third last position. A score of 1 was given for each card hidden correctly for a possible total score of 0 to 2.
**Table 1**

Mean scores on all tasks as a function of age

<table>
<thead>
<tr>
<th>Task</th>
<th>3-year-olds</th>
<th>4-year-olds</th>
<th>5-year-olds</th>
<th>Age effects (univariate F)</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Receptive vocabulary</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>PPVT-3 raw scores</td>
<td>61.68 (15.09)</td>
<td>76.25 (15.37)</td>
<td>90.38 (17.14)</td>
<td>F(2, 67) = 18.66**</td>
</tr>
<tr>
<td><strong>MTT tasks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Picture Book (range = 0–8)</td>
<td>3.83 (1.70)</td>
<td>5.33 (1.90)</td>
<td>6.04 (1.88)</td>
<td>F(2, 68) = 8.95**</td>
</tr>
<tr>
<td>Tomorrow (range = 0–2)</td>
<td>0.67 (0.82)</td>
<td>1.25 (0.90)</td>
<td>1.29 (0.86)</td>
<td>F(2, 69) = 3.98</td>
</tr>
<tr>
<td><strong>Delay of gratification task</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Treat Delay (range = 0–8)</td>
<td>4.36 (3.77)</td>
<td>7.00 (2.47)</td>
<td>7.09 (2.39)</td>
<td>F(2, 64) = 6.15**</td>
</tr>
<tr>
<td><strong>Planning tasks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Tower of Hanoi (range = 0–6)</td>
<td>1.17 (1.13)</td>
<td>2.42 (1.47)</td>
<td>4.04 (2.27)</td>
<td>F(2, 69) = 17.37**</td>
</tr>
<tr>
<td>Truck Loading (range = 0–4)</td>
<td>1.57 (0.95)</td>
<td>2.38 (1.35)</td>
<td>3.38 (1.10)</td>
<td>F(2, 68) = 14.79**</td>
</tr>
<tr>
<td><strong>Prospective memory tasks</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Card in Basket (range = 0–2)</td>
<td>0.71 (0.91)</td>
<td>1.42 (0.88)</td>
<td>1.79 (0.51)</td>
<td>F(2, 69) = 11.72**</td>
</tr>
<tr>
<td>Puppet Retrieval (range = 0–1)</td>
<td>0.21 (0.42)</td>
<td>0.54 (0.51)</td>
<td>0.57 (0.51)</td>
<td>F(2, 68) = 4.14*</td>
</tr>
</tbody>
</table>

*Note.* Standard deviations are in parentheses. The ns for individual tasks ranged from 68 to 72 due to missing data. Means in the same row that do not share subscripts differ at *p* < .05 using Tukey’s HSD test.

* *p* < .05.

** *p* < .01.

**Puppet Retrieval.** This task was adapted from one used by Guajardo and Best (2000). It was always administered last in conjunction with the PPVT-3. Children were shown a small, colorful finger puppet and were told that after playing one more game (i.e., the PPVT-3), they would receive it as a gift. The puppet was then placed in a red plastic drawer out of the children’s sight. As a check, children were immediately asked to remember where the puppet was hidden. The experimenter then told the children that she had a very bad memory and that they would need to remind her to give them the puppet as soon as the game finished. The PPVT-3 was then administered, with administration time lasting approximately 10 min.² On its completion, children were given a specific prompt (“Now we are done playing the picture game”) to signal the end of the game. If children remembered to ask for the puppet, they received a score of 1; if they did not, a score of 0 was assigned. There were missing data for one child due to experimenter error.

**Language**

Receptive vocabulary was assessed for each child using the PPVT-3. In the PPVT-3, children are shown a series of sets of four pictures. After the experimenter reads a word aloud, children are asked to point to the picture in the set that best represents the word in question. Testing continues until children err on 8 or more words in a set of 12.

**Results**

Our results are divided as follows: (a) descriptive and developmental analyses for each of the individual tasks and (b) relations between the tasks.

**Descriptive and developmental analyses**

One-way analyses of variance (ANOVA)s indicated that children’s performance on the tasks did not vary as a function of sex or order of task administration. All age-related differences on the various tasks, along with raw scores on the PPVT-3 (average age-standardized score was 115.2, SD = 11.8), were tested using one-way ANOVA-s followed up with Tukey’s HSD tests. The results of these analyses are shown in Table 1. As can be seen in this table, performance on all of the tasks showed significant age-related in-

² Although individual administration times for the PPVT-3 varied, an independent samples t test indicated that there was no significant difference between the waiting times of the children who remembered to retrieve the puppet and those of the children who did not (p = .90).
creases. In addition, children’s performance covered the full range of scores on all of the tasks. However, the scores on Treat Delay indicated that most of the 4- and 5-year-olds were able to wait the full 8 min. Although we chose the 8-min period based on the results of previous research (e.g., Carlson, 2005), our findings suggest that a longer delay (e.g., 10–12 min) may be more appropriate for 4- and 5-year-olds.

Relation between the tasks

These analyses explored the extent to which all of the different task scores (raw) were related to one another and to age in months and raw scores on the PPVT-3, hence, to how well the various tasks cohere. Given the large number of correlations conducted, we consider only those with a p value less than .01 as significant in this analysis and all subsequent analyses. As can be seen in the upper portion of Table 2, the majority of the tasks were significantly correlated with age and with scores on the PPVT-3. More important, a number of the tasks were also significantly intercorrelated. Within the different domains tested, the two MTT tasks (Picture Book and Tomorrow) were correlated, as were the two planning tasks (Tower of Hanoi and Truck Loading) and the two prospective memory tasks (Card in Basket and Puppet Retrieval). Across the different domains, Picture Book was significantly correlated with all of the tasks except Truck Loading and Puppet Retrieval; Treat Delay was significantly correlated with Tower of Hanoi and Card in Basket; Tower of Hanoi was significantly correlated with Card in Basket, and Truck Loading was significantly correlated with both of the prospective memory tasks.

However, it is important to determine whether these tasks remain correlated after controlling for age in months and receptive vocabulary (i.e., raw scores on the PPVT-3). If they do, then this suggests that they share a common conceptual core (in this case we argue that it is future thinking) and are not merely related due to these developments just happening to co-occur during the same age range or due to the tasks requiring a certain amount of verbal ability. The results of these second-order corre-

Table 2
Correlations between tasks.

<table>
<thead>
<tr>
<th>Variable</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
<th>8</th>
<th>9</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. Age</td>
<td>.67**</td>
<td>.52**</td>
<td>.27</td>
<td>.38**</td>
<td>.59**</td>
<td>.59**</td>
<td>.56**</td>
<td>.30*</td>
</tr>
<tr>
<td>2. PPVT-3</td>
<td>–</td>
<td>.50**</td>
<td>–.03</td>
<td>.33**</td>
<td>.43**</td>
<td>.54**</td>
<td>.56**</td>
<td>.33*</td>
</tr>
<tr>
<td>3. Picture Book</td>
<td>–</td>
<td>–</td>
<td>.34**</td>
<td>.35**</td>
<td>.38**</td>
<td>.30</td>
<td>.48**</td>
<td>.24*</td>
</tr>
<tr>
<td>4. Tomorrow</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>.22</td>
<td>.16</td>
<td>.08</td>
<td>.08</td>
<td>.26</td>
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<tr>
<td>5. Treat Delay</td>
<td>–</td>
<td>–</td>
<td>.33</td>
<td>.08</td>
<td>.08</td>
<td>.28</td>
<td>.41</td>
<td>.29</td>
</tr>
<tr>
<td>6. Tower of Hanoi</td>
<td>–</td>
<td>–</td>
<td>.44**</td>
<td>.32**</td>
<td>.23</td>
<td>–</td>
<td>.46</td>
<td>.38**</td>
</tr>
<tr>
<td>7. Truck Loading</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>.46**</td>
<td>.38**</td>
<td></td>
</tr>
<tr>
<td>8. Card in Basket</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>.35</td>
<td>.35</td>
<td>–</td>
<td>–</td>
<td></td>
</tr>
<tr>
<td>9. Puppet Retrieval</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>–</td>
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</tr>
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</table>

Note. The ns ranged from 68 to 72.

Table 3
Partial correlations controlling for age and receptive vocabulary.

<table>
<thead>
<tr>
<th>Variable</th>
<th>2</th>
<th>3</th>
<th>4</th>
<th>5</th>
<th>6</th>
<th>7</th>
</tr>
</thead>
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<tr>
<td>1. Picture Book</td>
<td>.38**</td>
<td>.12</td>
<td>.14</td>
<td>–.03</td>
<td>.09</td>
<td>.05</td>
</tr>
<tr>
<td>2. Tomorrow</td>
<td>–</td>
<td>.16</td>
<td>.03</td>
<td>–.01</td>
<td>–.02</td>
<td>.29</td>
</tr>
<tr>
<td>3. Treat delay</td>
<td>–</td>
<td>–</td>
<td>.16</td>
<td>.02</td>
<td>.18</td>
<td>.13</td>
</tr>
<tr>
<td>4. Tower of Hanoi</td>
<td>–</td>
<td>–</td>
<td>.14</td>
<td>–.05</td>
<td>.09</td>
<td>–</td>
</tr>
<tr>
<td>5. Truck Loading</td>
<td>–</td>
<td>–</td>
<td>.12</td>
<td>.14</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>6. Card in Basket</td>
<td>–</td>
<td>–</td>
<td>–</td>
<td>.12</td>
<td>–</td>
<td>–</td>
</tr>
<tr>
<td>7. Puppet Retrieval</td>
<td>–</td>
<td>–</td>
<td>–</td>
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<td>–</td>
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</tr>
</tbody>
</table>

Note. The ns ranged from 68 to 72.

*p < .10.

*p < .05.

*p < .01.
lations are presented in Table 3. The only two tasks that remained significantly correlated were the two MTT tasks: Picture Book and Tomorrow. Neither the two planning tasks nor the two prospective memory tasks remained significantly correlated (although both correlations remained positive).3

**Discussion**

The goal of this study was to examine the developmental trajectory and coherence of various future-oriented behaviors during the preschool years. With respect to developmental trajectory, our findings show that performance on tasks assessing MTT, delay of gratification, planning, and prospective memory increased significantly with age. We would expect similar age-related changes across the tasks if these were drawing on a common conceptual core, yet a deeper exploration was warranted given that the children's performance across a broad range of tasks (e.g., theory of mind, executive function) also improves during the preschool years.

Subsequent analyses indicated that a number of zero-order intertask correlations were significant. Most notably, both tasks designed to assess MTT were correlated, as were both tasks designed to measure planning and prospective memory. There were also a number of tasks from across the different skill sets that were significantly correlated, suggesting that children who begin to display one of the targeted behaviors (e.g., delay of gratification) are also likely to show others (e.g., planning, talking about tomorrow). This is interesting from a behavioral, or "applied," standpoint because it indicates that a variety of future-oriented behaviors are emerging and developing during the 3- to 5-year age window. But these findings do not address the extent to which these behaviors may be a manifestation of a common core concept (i.e., future thinking) as opposed to the product of increasing age and verbal ability.

To address this issue, correlational analyses were rerun partialing out both age in months and receptive vocabulary scores. Only the Picture Book and Tomorrow tasks remained significantly correlated. This finding is notable given that both were independently designed to assess children's MTT ability. Given recent arguments about the importance and adaptive significance of this cognitive capacity, it is encouraging that these two tasks appear to be good means of assessing it developmentally. As such, these tasks may provide an important starting point for studying the relation between this particular aspect of future thinking and other cognitive capacities.

Surprisingly, however, neither the two planning tasks nor the two prospective memory tasks remained correlated. Our findings with respect to the planning tasks, in particular, differ from those of Carlson and colleagues (2004), who found a significant correlation between Tower of Hanoi and Truck Loading in a sample of 3- and 4-year-olds after controlling for age and receptive vocabulary. Nonetheless, a closer analysis of the two planning tasks suggests that Tower of Hanoi was more difficult for children in our sample than was Truck Loading (0, 4, and 50% of 3-, 4-, and 5-year-olds, respectively, scored at the highest level on Tower of Hanoi, whereas the corresponding percentages for Truck Loading were 9, 38, and 71%). A similar pattern was observed for the two prospective memory tasks (for Puppet Retrieval, 26, 54, and 57% of 3-, 4-, and 5-year-olds, respectively, scored 1/1, whereas for Card Sort, 29, 67, and 83% of 3-, 4-, and 5-year-olds, respectively, scored 2/2). Thus, the extent to which tasks designed to measure the same capacity are truly comparable awaits further research.

The fact that the correlations controlling for age and verbal ability were largely nonsignificant is nevertheless an important finding. Although MTT, delay of gratification, planning, and prospective memory all have been described as future-oriented capacities, they do not appear to be held together by this common component—at least not during the age range studied. There are several different ways in which to interpret this result. The first is that these tasks simply do not require children to

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3 We also ran two additional sets of correlations partialing out age in months and receptive vocabulary scores separately. When we partialled out age only, Picture Book remained correlated with Tomorrow \( (r = .30, p = .02) \), but none of the other tasks was significantly correlated \( (p < .05 \) or \( p < .01 \) level). When we partialled out receptive vocabulary only, Picture Book remained significantly correlated with Tomorrow \( (r = .45, p < .001) \). In addition, Picture Book was correlated with Tower of Hanoi \( (r = .26, p = .04) \), Tomorrow was correlated with Puppet Retrieval \( (r = .32, p = .01) \), and Tower of Hanoi was correlated with Truck Loading \( (r = .29, p = .02) \).
think about the future to succeed. This seems unlikely, however, given that it is difficult to conceive of an individual who can anticipate future states and events, delay gratification, plan, and show prospective memory without having some knowledge about, or orientation toward, the future. A second possibility is that the tasks require future thinking but vary in their surface demands and scoring structures, resulting in few significant correlations. Although this may be partly true, it is important to note that tasks that measure theory of mind or executive functioning, for example, also vary along these dimensions, yet many remain correlated after controlling for age and verbal ability (e.g., Carlson & Moses, 2001). A third possibility, and the one we find most plausible, is that these tasks require future orientation but differ in terms of the particular type as well as the additional cognitive components involved.

Most memory researchers agree that memory is a multicomponent process, and we suspect that this is also true of future thinking. However, there have been very few attempts to delineate what these components may be. Based on Tulving’s (1984) distinction with respect to memory, Atance and O’Neill (2001) distinguished between episodic and semantic future thinking. Episodic future thinking is defined as the ability to project the self into the future to preexperience events, whereas semantic future thinking is more akin to script-based knowledge about how routine events unfold. With respect to the self, in particular, the tasks used in the current study varied substantially. Only Picture Book, Tomorrow, and Treat Delay seem to require children to dissociate from their current state to consider a future one, thereby potentially drawing on episodic future thinking. For example, in Treat Delay, children must forgo an immediate reward for the self in favor of an imagined, or represented, future one. Interestingly, Suddendorf and Corballis (2007) argued that the understanding that one’s own future mental states may differ from one’s current mental states may draw on theory of mind capacity. Although the planning and prospective memory tasks involve actions directed toward a future goal, such actions could arguably be accomplished without explicitly representing one’s future self and, thus, need not draw on episodic future thinking or theory of mind. Whether semantic future thinking is a good characterization of these tasks is questionable, however, because it does not seem that success on them is a function of a well-established knowledge base (i.e., semantic knowledge) about how the future will unfold.

It is likely that further theorizing and research will uncover other possible categorizations of future thinking that could account for the task differences that we obtained. However, our current view is that what may be driving these differences are the components, in addition to future thinking, that are required for success on these tasks. By no means an exhaustive list, both working memory and inhibitory control (important aspects of executive functioning) are differentially implicated in the tasks used in this study. For example, to succeed on the planning and prospective memory tasks, children need to remember various pieces of information. For example, for both Tower of Hanoi and Truck Loading, it is important to actively keep in mind the task rules (e.g., a larger disk cannot be placed on a smaller one). Also, to succeed on Card in Basket, it is critical to remember which type of card (i.e., animal) needs to be placed in the box. For each of these tasks, a failure in working memory precludes children from correctly completing a future-oriented action/intention. It is also plausible that a certain amount of working memory is necessary for Treat Delay. That is, children who can better remember the various contingencies (e.g., “If I wait, I get the larger pile”) may be more likely to delay. In contrast, neither Picture Book nor Tomorrow shares this type of requirement. Nonetheless, it is important to point out that other memory demands may be inherent to these tasks. For example, a certain amount of semantic memory is required to succeed on the Picture Book task (e.g., knowing that Band-Aids can be used if one gets hurt), and children may be better able to predict what will happen tomorrow by remembering what they did yesterday or today (i.e., episodic memory). Thus, an important goal for future research will be to determine the particular type of memory that is required to engage in different future-oriented behaviors (see also Suddendorf & Corballis, 2007).

Another important factor that differs across the tasks is inhibitory control. Carlson and Moses (2001) defined inhibitory control as “the ability to inhibit responses to irrelevant stimuli while pursuing a cognitively represented goal” (p. 1033). This factor could explain why there were no significant correlations between Treat Delay and Picture Book or between Treat Delay and Tomorrow, for example, when we controlled for age and verbal ability. Whereas all three tasks may require children to
envision themselves in the future (i.e., episodic future thinking), Treat Delay also requires a substantial amount of inhibitory control (e.g., Carlson, 2005). Inhibitory control is also argued to be an important component of planning tasks such as Tower of Hanoi (Miyake, Friedman, Emerson, Witzki, & Howarter, 2000). For example, in Tower of Hanoi, children must inhibit an (incorrect) action that initially places them closer to the final goal in favor of the (correct) action that distances them from it. Also, in Truck Loading, children need to stack invitations in the reverse order from which they are needed, thereby inhibiting the usual tendency to do it in a forward order. Again, this specific type of demand is not shared by either the prospective memory or MTT tasks.

Our discussion of these different task components (i.e., theory of mind, working memory, and inhibitory control) leads to the important issue of their possible influence on the development of future thinking ability (Suddendorf & Corballis, 2007). In addressing this issue, it may be important to consider a distinction that Carlson and Moses (2001) made between “emergence” and “expression” with respect to the role of executive functioning ability in theory of mind development. An emergence account posits that a certain level of competence in a particular domain is necessary for the skill in question to emerge. For example, Carlson and Moses pointed out that without a certain amount of executive functioning ability, it may be impossible to even conceive of concepts such as mental states (i.e., theory of mind). Similarly, with respect to future thinking, one could argue that without additional cognitive skills such as inhibitory control, it would be difficult to construct a concept of the future (because thinking about the future often entails inhibiting thoughts about what is true in the here and now). In contrast, an expression account argues that children may have the ability in question (e.g., future thinking) but various additional features of the task prevent children from “translating their knowledge into performance” (p. 1048). Consistent with this view is a child who can think about the future but cannot display this knowledge on Tower of Hanoi, for example, because a task rule has been forgotten (i.e., working memory demand).

Consequently, a possible avenue of research is to directly measure the extent to which the various behaviors targeted in this article correlate with abilities such as working memory, inhibitory control, and theory of mind. These abilities also show substantial development, as well as individual variability, during the preschool years (Carlson & Moses, 2001) and, thus, may have an especially important impact on future thinking during this period. If tasks such as Picture Book and Tomorrow, which do not have obvious working memory or inhibitory control demands, still correlate with tasks measuring these components, then an emergence account would receive at least partial support. In turn, this would imply that future thinking is not a unitary construct but rather relies on a number of distinct components, as has been suggested (Suddendorf & Corballis, 2007). A complementary approach is to devise future thinking tasks in which inhibitory control or working memory demands are manipulated. If correlations between the future thinking tasks and working memory and inhibitory control are affected by such manipulations, then an expression account would also be supported (note that emergence and expression accounts are not mutually exclusive). This, in turn, would suggest that additional components may facilitate certain types of future orientation (e.g., planning, delay of gratification) but might not be essential to the core construct itself.

Finally, the role that language may play in the development of future thinking is an important issue that should also be explored in future research. Interestingly, the intertask correlations that resulted from partialing out age only (see note 3) were largely nonsignificant, whereas those resulting from partialing out receptive vocabulary reached only slightly higher levels of significance (with several being significant at both the \( p < .01 \) and \( p < .05 \) levels). Although it is tempting to argue that the zero-order intertask correlations were largely the result of age-related changes rather than language-related ones, this conclusion awaits further research. First, it will be important to hone in on the particular aspect of language that might foster future orientation. For example, Hudson (2001) suggested that it is the acquisition of temporal terms, in particular, that drives the development of temporal knowledge. If this is so, then a measure of receptive vocabulary, such as the PPVT-3, will likely not capture the necessary variation for this particular aspect of children’s language. Second, to obtain a better grip on the possible causal role of language (or aspects of it) in future thinking development, a different type of design would be required. For example, one would need to repeatedly measure children’s future thinking and language abilities over an extended period of time. If language scores at Time 1 predict changes in future thinking scores between Time 1 and Time 2, then this would
be consistent with the claim that language plays a fundamental role in the development of future thinking ability.

In conclusion, this study has shown that various aspects of children's future-oriented behavior, including anticipating future states/events, delaying gratification, planning, and engaging in acts of prospective remembering, develop substantially during the preschool years. Moreover, children's scores on tasks assessing these abilities were correlated, suggesting that there is coherence among them. However, this does not appear to be the result of these tasks drawing on a single common factor given that these correlations are no longer significant after controlling for age and receptive vocabulary. The interpretation that we favor to explain this finding is that, in addition to some form of future orientation, these tasks differentially require abilities such as theory of mind, working memory, and inhibitory control. An important direction for future research will be to determine the extent to which these (and other) various factors influence children's developing capacity to think about the future.

Acknowledgments

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References


