Training Preschoolers’ Prospective Abilities Through Conversation About the Extended Self

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The ability to act on behalf of one’s future self is related to uniquely human abilities such as planning, delay of gratification, and goal attainment. Although prospection develops rapidly during early childhood, little is known about the mechanisms that support its development. Here we explored whether encouraging children to talk about their extended selves (self outside the present context) boosts their prospective abilities. Preschoolers (N = 81) participated in a 5-min interaction with an adult in which they were asked to talk about events in the near future, distant future, near past, or present. Compared with children discussing their present and distant future, children asked to discuss events in their near future or near past displayed better planning and prospective memory. Additionally, those 2 conditions were most effective in eliciting self-projection (use of personal pronouns). Results suggest that experiencing communicating about the temporally contiguous, extended self may promote children’s future-oriented thinking.

Keywords: prospection, extended self, preschoolers, conversation, future-oriented thinking

Supplemental materials: http://dx.doi.org/10.1037/dev0000283.supp

The ability to plan for and envision one’s future self is an important cognitive achievement. Prospection is proposed to be a uniquely human ability and critical for a variety of positive outcomes, including goal attainment and self-regulation (Atance & O’Neill, 2001). Recent work on prospection has found that prospective abilities develop rapidly during the preschool years (see Atance, 2008, 2015) and are able to talk about the events of “tomorrow” by age 3 (Hayne, Gross, McNamee, Fitzgibbon, & Tustin, 2011). By late preschool, children show marked improvements in action-based measures of prospection such as delay of gratification (the ability to inhibit a salient response in favor of a future reward; Mischel, Schoda, & Rodriguez, 1989), decreased temporal discounting (valuing future rewards over present rewards; Steinberg et al., 2009), planning (e.g., Atance & Meltzoff, 2005), and prospective memory (remembering to carry out intended plans at future time points; Guajardo & Best, 2000). The research on prospection leaves open several questions regarding the coherence and mechanisms of future-oriented thinking.

One recent line of work has investigated the extent to which different prospective abilities are associated with one another (Atance & Jackson, 2009; Neroni, Gamboz, & Brandimonte, 2014; Iglio, Brandimonte, Cicogna, & Cosenza, 2014). Another important question has been the extent to which prospection is critically dependent on other cognitive competencies, such as language development, memory, or theory of mind (see Hanson, Atance, & Paluck, 2014). Relatedly, recent research has proposed that cognizing about the future may be linked to cognizing about the past (Coughlin, Lyons, & Ghetti, 2014; Cuevas, Rajan, Morasch, & Bell, 2015; Schacter, Addis, & Buckner, 2007). Our work focuses on these interrelated questions through exploring both the coherence and mechanisms of prospection.

One powerful predictor of children’s cognitive and linguistic abilities is their day-to-day social communicative context. For
example, the quality of vocabulary input that parents provide to
children predicts children’s own vocabulary growth (see Hoff,
2006; Rowe, 2012); encouraging children and parents to talk about
mental states predicts children’s theory of mind (Lu, Su, & Wang,
2008; Reese, Sparks, & Leyva, 2010; Taumoepeau & Reese,
2013), and making even small changes in children’s linguistic
input has powerful effects on children’s conceptual understanding
(Rhodes, Leslie, & Tworek, 2012).

Such training studies are powerful in two respects: First, they
are able to provide a basis for creating more formalized interven-
tions targeting children’s conceptual development. Second, they
can uncover the causal mechanisms of conceptual development.
For example, Rhodes and colleagues (2012) found that exposing
children to generic talk in a short storybook task led to an increase
in children’s essentialist thinking, suggesting that generics and
essentialism are causally related.

In the context of future-oriented talk specifically, parents’ use of
temporal markers predicts children’s own use of such markers
(Hudson, 2006). Inspired by this previous work, we were inter-
ested in whether practice with projecting oneself into the future
scaffolds children’s prospective abilities. We designed a short
study in which we asked children to discuss and generate self-
relevant future events. Prior theoretical work has suggested that
practicing simulating and anticipating future events helps motivate
one to better prepare for those events (e.g., Taylor, Pham, Rivkin,
& Armor, 1998). We reasoned that young children, who are still
developing the ability to discuss their futures and may therefore be
unlikely to do so spontaneously, would be particularly likely to
benefit from such an intervention.

Our study also allowed us to test several possibilities for how
and why future-oriented talk might scaffold prospection. One possibility is that simulating oneself in any context outside the
present helps children reason about themselves outside the here
and now and make decisions on behalf of their extended selves
(extended-self talk hypothesis). In support of this possibility, de-
contextualized talk (talk outside the here and now) in many forms
(e.g., explanations, abstractions, narrative of future and past
events) is shown to be a powerful predictor of children’s language
and cognitive development (e.g., Demir, Rowe, Heller, Goldin-
Meadow, & Levine, 2015; Rowe, 2012). Yet another possibility,
however, is that extended-self talk has to be restricted in content in
order to scaffold prospective abilities (future-oriented talk hypoth-
esis). Projecting oneself in the future specifically (rather than the
past) might help anticipate future states, prepare for upcoming
events, or simply bring to mind one’s future self. The concept of
one’s “future self” is taken out of an abstract, hypothetical state
and brought to mind concretely through conversation and episodic
mental simulation. Work with adults has shown that even brief
reminders of one’s future self specifically improves delay of
gratification by helping adults feel closer to their future selves (see
Hershfield, 2011). On this account, one would not expect any and
all forms of extended-self talk to be similarly motivating, because
talk about the past does not provide the benefit of anticipating
future events. Future talk may be more laden with complex lin-
guistic hypotheticals (Hudson, 2002) and thus may serve as a
better scaffold for prospective thinking. Finally, hybrid accounts
are also possible: Because cognizing about the future and past are
thought to rely on the same cognitive competencies (e.g., Schacter
et al., 2007), discussing the extended self (in the future or past)
might improve prospective abilities but only if the extended self is
perceived as being relevant to one’s present self (self-relevant
extended-self talk hypothesis; e.g., see Bryan & Hershfield, 2012;
Hershfield et al., 2011). In the context of our work, this hypothesis
predicts that discussing extended-self events that are nearer in time
to one’s present self are more likely to feel self-relevant, would be
particularly motivating for young children, and thus would serve as
salient reminders to act in service of one’s future self (see Oyser-
man & James, 2009).

To distinguish among these different hypotheses, we designed a
study in which 3- to 5-year-old children were exposed to one of
different types of conversation about themselves. In our focal
group (near future talk group), children were asked to generate
events in their near future (within the next 24 hr). In a control
group (present talk group), children were asked to talk about
events in their present, contextualized context. In addition, we
were interested in whether any future talk scaffolds children’s
abilities or whether future talk has to be temporally contiguous and
closely related with children’s present selves. We thus included a
distant future talk group, in which children were asked to discuss
events that would occur after the next 24 hr (spanning from “tomorrow” to adulthood). Prior work has found that children see
themselves as fundamentally distinct from their “adult” selves
(Carey, 1985). Therefore, if future talk offers specific benefits due
to its linguistic complexity (Hudson, 2002), one should see im-
proved prospective abilities in this group relative to the control
(present talk group). If, however, future talk specifically offers
benefits not due to its linguistic complexity but due to its ability to
invoke notions of the extended self, one should not see improved
prospective abilities, because distant future talk should not feel as
self-relevant as would near future talk.

Finally, because cognizing about the future has been hypothe-
sized to relate to cognizing about the past, we included a near past
talk condition in which children generated events within the last 24
hr. This last condition was matched to our focal near future condition and thus allowed us to test whether talking about tem-
porally proximate selves in the future or past would scaffold pro-
spective abilities. Immediately following training, children were
tested on a broad range of prospective tasks.

Our procedure allowed us to address three interrelated issues.
First, we examined the types of future- (or past)-oriented talk that
children produced during training. Second, we looked for coher-
ence among the diverse prospection tasks used during the assess-
ment phase. Finally, we looked at whether the training groups
differed from one another on prospective measures. In particular, we
tested for the following three mutually exclusive hypotheses:

Hypothesis 1: Extended-self hypothesis: Any conversations
about the extended self, or self in the nonpresent (past or
future), should boost prospective abilities. Children in the
near past, near future, and distant future conditions should
outperform children in the present condition.

Hypothesis 2: Future-oriented hypothesis: Any conversation
specifically about the future should boost prospective abilities.
Children in the near future and distant future conditions
should outperform children in the present or near past
conditions.
Hypothesis 3: Self-relevant, extended-self hypothesis: Conversations about the extended self that are close in time to the present self should boost prospecitive abilities. Children in the near future and near past conditions should outperform children in the present and distant future conditions.

Method

Participants

In keeping with minimum suggested standards in the field (Simmons, Nelson, & Simohnson, 2011), we sought to test 20 children per condition. Thus, we concluded testing and analyzed data once we achieved this minimum. Participants were eighty-one 3- to 5-year-old children (M_age = 4.42; range = 3.15–5.72) recruited from six separate preschool centers in the greater Boston area. The sample included twenty-six 3-year-olds, thirty-seven 4-year-olds, and eighteen 5-year-olds. Forty-five of our participants were female. Demographics on individual participants were not obtained, but two centers self-identified as serving low or lower middle class families (n = 26 children), three served primarily upper middle or middle class families (n = 32 children), and one served mixed (both types of) families (n = 23 children).

Procedure

All children were tested in a separate room or quiet corner at their local preschool. One experimenter conducted the introduction and training phase, and a second experimenter, who remained blind to the training condition the children had just participated in, conducted the assessment phase.

Time line introduction. All children began by being introduced to the concept of linear time (e.g., Busby Grant & Sudden-dorf, 2009). Children were shown a rectangle divided into three colored squares signifying three distinct time periods (“before now,” “now,” and “after now”). The experimenter then placed the word now on the middle square and said, “This is everything that’s happening right now” and then proceeded to list three examples of events in the present context (e.g., “like us playing this game right here or your class playing outside or my friend [referring to the second experimenter] over there working”). Examples were modified slightly to fit the present context. The experimenter then asked the child to identify which square should signify “before now” and which square should signify “after now.” Corrective feedback was provided until each child correctly identified “before now” and “after now,” and the experimenter affixed the words before and after to their respective squares, such that the time line showed “before now,” “now,” and “after now” in successive order.

Training period. At this point, children were randomly assigned to one of four conditions (described in the next four sections), in which they participated in a brief conversation with the experimenter about a specified time period. The structure of the conversations is summarized in Table 1. Near future condition (n = 21). In the near future talk condition, children were told that they would be talking about events that are going to happen “after now.” The experimenter then listed three examples of near future events (in the next 24 hr) in increasing temporal order (“After now are things like right after this game when you will go back to class, later today when you will go home from school, or even a really long time from now when you will go to bed tonight”). To encourage future self-projection, we used a child-friendly version of a procedure that has induced future-oriented projection in adults (Hershfield et al., 2011). In the adult version, adults were shown age-progressed portraits of themselves. In our version, the experimenter asked children to draw a picture of themselves in the last exampled future time period: “Can you draw a picture of yourself going to bed tonight?” After the child completed the drawing, the experimenter placed it on the square labeled after now and reaffirmed that it belonged on that square (“We’re going to put this right here because this is going to happen after now!”).

Children were then cued to generate events in their near future. The experimenter asked children to list some events that would happen in three distinct time periods, all taking place within the next 24 hr: (a) “right after” this game, when children go back to their class (e.g., “What are some things you’ll do right after this game, like when you back to class?”); (b) “later today,” when children go home from school; and (c) “a long time from now,” when children go to bed to that night. A summary of the temporal cues used in each condition is summarized in Table 1. The experimenter asked the question pertaining to each temporal cue and then encouraged children to continually generate events (e.g., “and what are some other things you’ll do later today?”). The experimenter proceeded to the next question or time period once children had either (a) repeatedly stated they could not generate further events or (b) generated five events.

Near past condition (n = 20). The near past talk condition was designed to match the near future talk condition, except that the experimenter referred to events that happened in the preceding (rather than following) 24 hr. The experimenter pointed to the square labeled before now and stated she and the child would be discussing things that happened “before now.” She then listed three examples of near past events (in the past 24 hr) that were matched to the near future events (“Before now are things like right before this game, when you were back in your class; earlier today, when you first woke up; or even a really long time ago, when you went to bed last night”). As in the near future condition, the experimenter then asked children to draw a picture of themselves going to bed last night and placed the drawing on the square titled before now. Children were then asked to generate events during three time periods taking place within the past 24 hr: (a) “right before” this game, when children were in class; (b) “earlier today,” when children first woke up; and (c) “a long time ago,” when children went to bed last night.

Distant future condition (n = 20). The distant future talk condition proceeded in the same form as did the near future talk condition, with the following modifications: First, the experimenter listed examples taking place after the proceeding 24 hr (“After now are things like tomorrow, when you will wake up in the morning; a few weeks from now, when you will [celebrate Thanksgiving]; or even a really long time from now, when you are all grown up”). For the second example (“a few weeks from now”), we used a well-known upcoming holiday (e.g., Thanksgiving).

1 One child was identified as being in the proper age range (3 years old), but her birth date was not provided. Her data are excluded from age calculations but included in the main analyses when possible.
Table 1
Structure of the Training Period Across Conditions

<table>
<thead>
<tr>
<th>Event sequence</th>
<th>Near future</th>
<th>Near past</th>
<th>Distant future</th>
<th>Present</th>
</tr>
</thead>
<tbody>
<tr>
<td>Introduction</td>
<td>&quot;We’re going to be talking about some things that will happen after now.&quot;</td>
<td>&quot;We’re going to be talking about some things that happened before now.&quot;</td>
<td>&quot;We’re going to be talking about some things that will happen after now.&quot;</td>
<td>&quot;We’re going to be talking about some things that are happening right now.&quot;</td>
</tr>
<tr>
<td>Examples</td>
<td>&quot;After now are things that will happen right after, like when you go back to class; things that will happen a little later today, like when you go home from school; or even things that will happen a really long time from now, like when you went to bed tonight.&quot;</td>
<td>&quot;Before now are things that happened right before, like when you were back in class; things that happened a little earlier today, like when you first woke up; or even things that happened a really long time ago, like when you went to bed last night.&quot;</td>
<td>&quot;After now are things that will happen tomorrow, like when you wake up in the morning; things that will happen a few weeks from now, like when you [celebrate Thanksgiving]; or even things that will happen a really long time from now, like when you are all grown up.&quot;</td>
<td>&quot;Right now are things that are happening in this moment, like what you see around you, like this game; or what you hear around you, like [your class playing]; or even what you feel around you, like [this hard floor].&quot;</td>
</tr>
<tr>
<td>Request for a drawing</td>
<td>&quot;Can you draw a picture of yourself going to bed tonight?&quot;</td>
<td>&quot;Can you draw a picture of yourself going to bed last night?&quot;</td>
<td>&quot;Can you draw a picture of yourself when you are all grown up?&quot;</td>
<td>&quot;Can you draw a picture of yourself right now?&quot;</td>
</tr>
<tr>
<td>Temporal Cue 1 (child generates up to 5 events)</td>
<td>&quot;What are some things you’ll do right after this game when you go back to class?&quot;</td>
<td>&quot;What are some things you did right before this game when you were in class?&quot;</td>
<td>&quot;What are some things you’ll do tomorrow when you wake up in the morning?&quot;</td>
<td>&quot;What are some things you see around you right now?&quot;</td>
</tr>
<tr>
<td>Temporal Cue 2 (child generates up to five events)</td>
<td>&quot;What are some things you’ll do later today when you get home from school?&quot;</td>
<td>&quot;What are some things you did earlier today when you woke up?&quot;</td>
<td>&quot;What are some things you’ll do a few weeks from now when you will [celebrate Thanksgiving]?&quot;</td>
<td>&quot;What are some things you hear around you right now?&quot;</td>
</tr>
<tr>
<td>Temporal Cue 3 (child generates up to five events)</td>
<td>&quot;What are some things you’ll do a long time from now when you go to bed tonight?&quot;</td>
<td>&quot;What are some things you did a long time ago when you went to bed last night?&quot;</td>
<td>&quot;What are some things you’ll do a long time from now when you’re all grown up?&quot;</td>
<td>&quot;What are some things you feel around you right now?&quot;</td>
</tr>
</tbody>
</table>

Note. Each column represents the sequence of events within that condition.

ing, the holidays, Valentine’s Day, Fourth of July), which varied depending on the time of year that children were tested. The experimenter then asked children to draw a picture of themselves when they are “all grown up” and placed the picture on the square labeled after now. Finally, the experimenter asked children to generate events in three distinct time periods: (a) “tomorrow,” when children first wake up; (b) “a few weeks from now,” when children celebrate [an upcoming holiday]; and (c) “a really long time from now,” when children are all grown up.

**Present condition (n = 20).** The present talk condition was matched to the other three, except that children were told they would be talking about the square labeled now. The experimenter then listed three examples of things in children’s present context, including something that children could see around them (“things like what you see around you—like this game”), hear around them (“things like what you hear around you—like your class playing outside”), and feel around them (“things like what you feel around you—like this hard floor”). Examples were modified slightly to fit the context (e.g., the experimenter always used a prominent sound, such as children playing outside or teachers talking, that could be easily heard by both herself and the children). Children were then asked to draw a picture of themselves as they are “right now,” and the picture was placed on the “now” square. The experimenter then asked children to talk about the present context and generate things that they (a) see around them right now, (b) hear things around them, and (c) feel around them. As with all the other conditions, the experimenter gave the first prompt (“What are some things you see around you right now?”) and encouraged children to generate examples. The experimenter proceeded to the next prompt once children generated five examples or repeatedly stated they could not generate any further examples.

**Assessment.** Following the training period, a new experimenter (who was blind to the children’s training condition) assessed children on a measure of prospective tasks. Tasks were drawn from prior literature and selected to reflect a broad range of prospective measures appropriate to our targeted age range. Two
measures (prospective memory and mental time travel) had been used extensively in prior work and are known to measure children’s planning abilities. One task (referred to here as the mental time travel task) asked children to reason about a hypothetical planning scenario (e.g., a child pretending to make a plan to walk through a forest scene); a second task (referred to as the prospective memory task) was an action-based planning measure in which children were asked to make a future plan (e.g., remind an experimenter to open a box) and remember to successfully carry out that plan.

We also created three additional measures to look at children’s prospective abilities: two temporal discounting measures (sticker task and temporal discounting task), in which children were asked to choose between smaller rewards in the present or larger rewards in the future, and a task testing children’s conceptual understanding of the linear nature of time (time line task). The tasks and measures are described in the next five sections.

**Prospective memory task.** Following a procedure adapted from Guajardo and Best (2000), children were shown a wooden box and told there was a gift inside (“I have a gift for you in this box when we are all done with this game [referring to the experimental session]”). The experimenter then mentioned that the child had to remind her to open the box at the end of the session. To increase motivation, the experimenter then told the child that she often has trouble remembering things and provided a cue that the child could use (“when I say ‘we’re all done!’ you have to remind me to open the box and give you your gift”). At the end of the session, the experimenter stated the promised cue and waited 10 s. If the child did not make any reminders within the 10 s, she provided a second cue “Did you have to remind me of anything?” and waited 10 more s. If the child still did not remember, she opened the box and retrieved the gift for the child.

To carry out this task successfully, children had to encode an intention to remember at a future time period, hold in mind the intention during the entire assessment period, and then successfully retrieve that intention during the specified future time period (e.g., Mackinlay, Kliegel, & Mäntylä, 2009). Because we wanted to make sure all children had roughly the same time period between encoding (first being introduced to the box) and retrieval (the end of the game), we minimized counterbalancing and always presented this task either first or second (order counterbalanced). The cue to open the box (“We’re all done!”) was always presented at the conclusion of the session. For details on counterbalancing, see Table 2.

Each child received a prospective memory score of either 0 or 1. Children were given a score of 1 if they successfully remembered to tell the experimenter to open the box during the proper cue (after the experimenter said “We’re all done!”) and a score of 0 if they did not remember. We note that 18 children (four in the near future condition, three in the near past condition, five in the distant future condition, and six in the present condition) remembered the gift only after the reminder (“Did you have to remind me of anything?”). Because we do not know whether these children may have been relying solely on retrospective memories (the reminder cued the children to retrospectively recall the intention), we gave these children scores of 0 to be conservative in our analyses.

**Saving for the future task.** Children were shown five brightly colored dinosaur stickers and told they could either play with the stickers and stick them on a plain piece of paper right now or play with the stickers but wait a few minutes while the experimenter finished some work and save some stickers to stick on a cool dinosaur scene (they were shown the dinosaur scene). The experimenter then proceeded to work for 3 min and made minimal contact with the child. At the conclusion of the 3-min period, the experimenter gave the child the dinosaur scene and allowed the child to stick any remaining stickers onto it. This task was designed to test children’s ability to engage in saving behaviors (Metcalfe & Atance, 2011), but it differed from typical temporal discounting tasks in that it did not manipulate anticipated reward size or number (only quality). Children were given a sticker task score (0–5) corresponding to the number of stickers they had successfully saved for the dinosaur scene.

**Time line task.** Children were shown the time line used during the training period (with three squares labeled before now, now, and after now) and told they would be asked about some events that either happened before now or will happen after now (the experimenter pointed to each square as she narrated). The experimenter then told children that if the event happened before now, they should point to the “before now” square, and if the event will happen after now, they should point to the “after now” square. She then asked about six separate time periods: four general time periods (next season[e.g., fall if the child was tested during the summer month], previous season [e.g., spring if the child was tested during the summer month], tomorrow, yesterday) and two autobiographical time periods (when the child will be [next age], when the child was [previous age]). The experimenter stated the time period and then asked whether that period belongs in the “before now” square or the “after now” square. The events were presented in one of two possible orders (referred to as a “forward” order, in which participants were asked about the events in the following sequence: earlier season, next season, tomorrow, yesterday, next age, and previous age; and a “backward” order, in which

### Table 2

<table>
<thead>
<tr>
<th>Order choice</th>
<th>Task 1</th>
<th>Task 2</th>
<th>Task 3</th>
<th>Task 4</th>
<th>Task 5</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>Prospective memory</td>
<td>Saving task</td>
<td>Time line task (forward order)</td>
<td>Mental time travel task</td>
<td>Temporal discounting task</td>
</tr>
<tr>
<td>2</td>
<td>Saving task</td>
<td>Prospective memory</td>
<td>Time line task (forward order)</td>
<td>Mental time travel task</td>
<td>Temporal discounting task</td>
</tr>
<tr>
<td>3</td>
<td>Prospective memory</td>
<td>Saving task</td>
<td>Mental time travel task</td>
<td>Time line task (forward order)</td>
<td>Temporal discounting task</td>
</tr>
<tr>
<td>4</td>
<td>Saving task</td>
<td>Prospective memory</td>
<td>Mental time travel task</td>
<td>Time line task (forward order)</td>
<td>Temporal discounting task</td>
</tr>
<tr>
<td>5</td>
<td>Prospective memory</td>
<td>Saving task</td>
<td>Time line task (backward order)</td>
<td>Mental time travel task</td>
<td>Temporal discounting task</td>
</tr>
<tr>
<td>6</td>
<td>Saving task</td>
<td>Prospective memory</td>
<td>Time line task (backward order)</td>
<td>Mental time travel task</td>
<td>Temporal discounting task</td>
</tr>
<tr>
<td>7</td>
<td>Prospective memory</td>
<td>Saving task</td>
<td>Mental time travel task</td>
<td>Time line task (backward order)</td>
<td>Temporal discounting task</td>
</tr>
<tr>
<td>8</td>
<td>Saving task</td>
<td>Prospective memory</td>
<td>Mental time travel task</td>
<td>Time line task (backward order)</td>
<td>Temporal discounting task</td>
</tr>
</tbody>
</table>
participants were asked about the events in the reverse sequence. Children received a time line task score between 0 and 6 corresponding to the number of events they had successfully placed in the correct square.

**Mental time travel task.** We used two items adapted from Atance and Meltzoff’s (2005) mental time travel task, in which children viewed a scene (either a forest or snow) and told to imagine themselves planning to walk through it (“Let’s pretend that you are going to walk across this road through the forest [snow]. Let’s get ready to go!”). They were then shown three items—an item needed for a possible future state (water for drinking [a jacket]; correct response), an item that was semantically associated with the scene (a plant [ice cubes]), and a distractor item (a present [bathing suit]). The items were labeled, and children were asked to provide an item selection (“Which of these things do you need to bring with you?”) and a justification for their item selection (“And why do you need to bring the [chosen item]?”). The three items were presented in a pseudorandom order (items were presented in one of three possible Latin square design orders).

Children received a mental time travel correct-item-selected score between 0 and 2 corresponding to the number of times children had selected the correct item across the two trials. In addition, children’s explanations were coded according to whether they appropriately referred to a functional future use of that item (e.g., “I might get thirsty so I need to drink”; “the jacket because it’s so cold outside”). Children received a mental time travel planning explanation score of 0–2. Note that coding for these explanations was more lenient than that used in prior work (Atance & Meltzoff, 2005) in order to adjust for the increased variability of children’s use of personal pronouns (e.g., “I, me, mine, my, we, us, our, and ours”) during the training session. Preliminary results revealed no effects of gender, age, or school center. We therefore collapsed across these variables in the following analyses.

Children generated a mean of 23.97 utterances (SD = 18.39) and nine events (SD = 4.43) during the training session. Neither the number of utterances nor the number of events that children generated varied across conditions (both ps > .15), confirming that condition did not systematically affect children’s overall verbal production.

We then looked at the proportion of utterances (out of total utterances) employing the future and past tense (see Figure 1). Note that for all events, children could use either the proper tense to which the time period referred (e.g., “I will sleep”) or could answer without using the proper tense (e.g., “sleeping”). An analysis of variance (ANOVA) on the proportion of children’s utterances containing the future tense revealed significant condition effects, $F(3, 75) = 3.63, p = .02, \eta_p^2 = .13$. In particular, children in the two future conditions (near future and distant future) produced a greater proportion of future tense utterances than did children in the near past and present conditions: linear contrast $t(75) = 3.26, p = .002, d = .75$. Similarly, an ANOVA on the proportion of past tense utterances revealed a significant effect of condition, $F(3, 75) = 15.97, p < .0001, \eta_p^2 = .39$. In particular, the near past condition differed significantly from the other three: linear contrast $t(75) = 6.90, p < .0001, d = 1.59$. Therefore, although overall use of future tense was low (comprising less than 10% of the utterances children produced), children nonetheless used it, and use differed across conditions.

We also looked at the extent of children’s self-projection when generating events. As a proxy for self-projection, we looked at children’s use of personal pronouns (e.g., I, me) during the training session. Note that children could generate events either without self-projecting (“go to sleep”) or by self-projecting (“I [will] go to sleep”). In particular, we were interested in whether the two conditions in which children were asked to discuss their close-in-time extended self might produce greater self-projection. An ANOVA on the proportion of utterances containing personal pronouns revealed significant differences across conditions, $F(3, 75) = 2.79, p = .05, \eta_p^2 = .10$. Children in the near past and near future conditions used a greater proportion of personal pronouns in their utterances than did those in the distant future or present condition, $t(75) = 2.75, p = .008, d = .64$. Therefore, although all conditions elicited some amount of self-projection, talking about the close-in-time, extended self elicited a greater amount of self-projection.

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**Results**

**Talk Produced During Training**

We looked at the talk children generated during the first phase (training session). Preliminary results revealed no effects of gender, age, or school center. We therefore collapsed across these variables in the following analyses.

Children generated a mean of 23.97 utterances (SD = 18.39) and nine events (SD = 4.43) during the training session. Neither the number of utterances nor the number of events that children generated varied across conditions (both ps > .15), confirming that condition did not systematically affect children’s overall verbal production.

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2 Two children’s training sessions could not be recorded (or transcribed) due to a video recording error.

3 Task-irrelevant uses of pronouns that were not specific to generating events (e.g., “I don’t know”; “I wanna play the next game”) were not included in the total calculations.
Coherence of Prospection Tasks

Turning to children's performance on the prospective tasks, we first looked at coherence among the various tasks used in the assessment phase. We conducted a factor analysis using varimax rotation on scores from prospective tasks in the assessment phase (prospective memory score, saving task score, time line task score, mental time travel correct-item-selected score, mental time travel planning explanation score, and temporal discounting score; see the online supplemental materials for raw means of all item scores across age groups). The results revealed two primary factors - a Planning Factor and a Linear Time/Temporal Discounting Factor (see Table 3). Notably, the Prospective memory task cohered with the two mental time travel task scores (i.e., the correct item selected and the planning explanation score), mimicking prior work that has found that prospective memory and planning abilities are related (Mackinlay et al., 2009). Moreover, the two temporal choice tasks (temporal discounting, saving task) were related to one another and related to children's understanding of the linear nature of time (time line task).4

Effects of Training

Finally, we looked at the effect of our training on children's prospective abilities. Analyses revealed no effects of gender or task order, so data were collapsed along these variables. We did, however, find significant effects across ages and between preschool centers. We therefore controlled for age (as a covariate) and preschool center in all of our analyses. Descriptives of performance on prospective tasks across ages are provided in Table 4.

To reduce the overall number of comparisons, we first ran our ANOVAs on each of the two extracted factor scores (Planning Factor and Linear Time/Temporal Discounting Factor). The results revealed significant condition and age-related changes for the Planning Factor: There was a significant effect of condition type, $F(3, 69) = 2.96, p = .04, \eta^2_p = .11$; a significant effect of school center, $F(5, 69) = 5.61, p = .002, \eta^2_p = .29$; and a significant effect of age (with children receiving better scores as they aged), $F(1, 69) = 13.81, p = .0004, \eta^2_p = .17$. There were no significant condition type or age effects for the Linear Time/Temporal Discounting Factor (both $p > .08$), although there was a significant effect of school center, $F(5, 69) = 2.98, p = .02, \eta^2_p = .18$.5 Therefore, children’s planning ability but not temporal discounting ability varied across training conditions. Thus, further analyses examined effects on planning ability.

We next tested for each of our three hypotheses using planned linear contrasts. We ran three separate linear contrasts to test for (a) extended-self talk hypothesis by contrasting the present condition with the other three, (b) future-oriented talk hypothesis by contrasting the near future and distant future conditions with the other two, and (c) self-relevant extended-self hypothesis by contrasting the near future and near past conditions with the other two.

Planned linear contrasts on the Planning Factor supported the self-relevant extended-self-hypothesis: The near future and near past conditions differed significantly from the other two (present and distant future), $F(1, 69) = 7.03, p = .01$. Linear contrasts testing the other two hypotheses were not significant (both $p > .20$). Results were consistent when analyzing the three tasks constituting the Planning Factor separately (see Figure 2). For prospective memory, planned linear contrasts once again supported the self-relevant extended-self-hypothesis, $F(1, 69) = 9.45, p = .003$. Similarly, for the mental time travel planning explanation scores, planned linear contrasts supported the self-relevant, extended-self hypothesis, $F(1, 71) = 7.81, p = .007$. However, there were no significant contrasts for the mental time travel forced choice scores (all $p > .50$).

The overall pattern of results supports the self-relevant, extended-self-hypothesis: Children in the two temporally contiguous conditions (near past and near future) showed better planning abilities (better prospective memories and future-oriented explanations) than did children in the other two conditions (present and distant future).

Discussion

Our results replicate prior work showing age-related changes in children's planning abilities during the preschool years (Atance & Meltzoff, 2005). However, recent work in developmental psychology has called for examining the mechanisms that drive these developmental changes in prospection (Atance, 2015). Here we found that a short conversation about one's "extended self" primed children's prospective memories and planning ability. Our work suggests that experience communicating and thinking about one's extended self promotes the ability to make decisions on behalf of that extended self.

Across several measures, we found support for our self-relevant, extended-self hypothesis. Conversation about the temporally contiguous extended self (near future and near past) showed better planning ability and encouraged higher self-projection. Our results mimic those of prior work showing that adults' ability to engage in delay of gratification tasks was predicted by how closely related they believed their future selves were to their present selves (Bryan

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4 To make sure that our factor analysis was not unduly affected by the fact that we used two scores from the same task, we reran this analysis using a combined mental time travel score (adding scores from children's forced choice and explanation responses). Results remained nearly identical.

5 See the online supplemental materials for analyses of descriptives of the other tasks.
and Hershfield, 2012). Brief visual reminders of one’s extended self (age-progressed portraits of one’s future self) also helped improve delay of gratification (Hershfield et al., 2011). Our work suggests that a similar mechanism may also account for children’s prospective ability—discussion about one’s extended self may help activate concepts about the future self or may make the extended self appear closely related to one’s present self.

Our approach offers an important method for studying individual differences in and consequences of how frequently children conceive of their extended selves. Prior work has found important cultural and individual differences in the specificity of future thinking in adults (Wang, Hou, Tang, & Wiprovnick, 2011). Even a few directives helped children to think about their future selves, but the extent to which children engaged in true future-oriented thinking (used future tense) and self-projection (e.g., “I’ll be sleeping” vs. “sleep”) varied across conditions. In our work, we used a laboratory-based task, although we note that we attempted to create a natural conversation with children through prompting them to focus on script-based everyday events (e.g., going to bed). Prior work has found that parents employ some of the tactics that we used in our conversations (e.g., use of prompts, use of simple future tense; Hudson, 2000); however, there are important individual differences in the extent to which they do so. We believe that one fruitful avenue for future work would be to focus on how individual differences in naturally occurring conversation between parents and children relate to individual differences in prospect.

Talking about near future or past events boosted prospection, but talk about the distant future did not. One possibility would have been that talking about the distant future was more cognitively complex for young children. We found, however, that children were just as adept in discussing their distant selves as their future selves (they did not differ in the number of words, utterance, mean length of utterance, or use of future or past tense) when discussing their near future or distant future selves. In fact, the only difference in children’s verbal production that we found between the distant future relative to the near future or past condition is their use of personal pronouns (self-projection). We thus propose that the distant future may have felt less personal to young children than did the near future or near past. Close-in-time events may have been more readily recognizable to children as closely associated with their present selves, whereas temporally distant events (e.g., “adulthood”) may have felt fundamentally distinct from and incompatible with children’s present selves (see Carey, 1985). Work with adults has also suggested that distant future events are represented more abstractly (Trope & Liberman, 2003), and thus in our study distant future events may have felt less self-relevant to the children. Future work may focus on further refining the relationship between self-projection and prospective ability as well as focus on which types of situations do and do not elicit self-projection (e.g., distant past selves).

We also found coherence among several prospection tasks. The term prospection is often used broadly to refer to a host of subcomponent capacities, each drawing upon distinct cognitive competencies. To this end, many tasks have been developed to assess prospective ability, ranging from action-based tasks (e.g., delay of gratification); fully verbal tasks (e.g., articulating the concept of “tomorrow”); and tasks that draw upon a mix of explicit, conceptual knowledge of the future as well as implicit, action-based knowledge. Our work found that two tasks associated with planning ability (prospective memory and mental time travel) were closely related to one another, even though the two tasks drew upon different cognitive abilities. One task (prospective memory) was action-based and relied on explicit memory, and another task was fully verbal and involved articulating the use of an item for a hypothetical future plan. Despite the fact that these tasks were distinct in form, children’s performance on these remained correlated, even after controlling for age ($r = .32, p = .004$). This suggests that children’s planning ability may be linked together and uniquely distinct from other forms of prospective thinking.

Children’s planning ability was also affected by the type of training that they received; whereas other abilities (e.g., temporal discounting) did not show any differences across training groups. Although similar manipulations with adults have been successful in inducing improvements on temporal discounting tasks (Hershfield & Hershfield, 2012).
field, 2011; Peters & Büchel, 2010), prior developmental work has found that preschoolers have a difficult time engaging in “saving” behaviors (Metcalfe & Atance, 2011) without any prior practice. Notably, our training did not give children practice with either thinking about or practicing saving behaviors. Thus, our finding that training did not change these discounting behaviors is not surprising. We also note that we did not observe condition differences in the time line task. We believe two potential reasons may have contributed to this. First, children in all conditions were introduced to the time line and thus may have had similar experience with it. Second, the events that constituted the time line task tended to focus on the distal future or past (e.g., the child’s next or previous birthday), and thus discussing near future or past events may not have been particularly helpful in reasoning through distal future events. Instead, we found that the training session may have been particularly effective in helping children think about and act on future plans.

Overall, we propose an important approach to studying the development of prospection. More generally, our work suggests that there is a strong role of the communicative social context in activating children’s ability to engage in future-oriented thinking and planning. These results have implications for caregivers’ day-to-day interactions with preschoolers, because even brief conversations with adults can help scaffold, shape, and activate concepts about one’s extended self. Critically, engaging young children in conversations where they are provided with opportunities to cognize, remember, and discuss their extended selves may ultimately help them make future-oriented decisions that benefit those extended selves.

References

Figure 2. Estimated marginal means of planning explanation, mental time travel correct-item-selected items, and prospective memory across conditions. Bars represent standard errors.


Received June 13, 2016
Revision received November 18, 2016
Accepted November 22, 2016