Thinking ahead about where something is needed: New insights about episodic foresight in preschoolers

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ABSTRACT

We explored 3-, 4-, and 5-year-olds' capacity to draw on a past experience that entailed the lack of a particular resource (in this case, toys) in one room, but not in another, to make an adaptive choice (i.e., place toys in the room where there were none) for a subsequent visit to the two rooms. Children's memory for which room had toys and which room did not was explicitly assessed. Children were then queried about where they should place a new set of toys for their next visit to the rooms. In Experiment 1, where children were asked about the "distant" future, 4- and 5-year-olds, but not 3-year-olds, placed the toys in the "no-toy" room at a rate significantly higher than chance. In Experiment 2, where children were asked about the "immediate" future, correct responses of 3-year-olds were still no different from chance, those of 5-year-olds were above chance, and those of 4-year-olds trended in this direction. Our discussion centers on the importance of assessing both "memory" and "foresight" on tasks purported to assess children's episodic foresight, the role of "temporal distance" on children's future-oriented behavior, and implications for future research.

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Introduction

Imagine that you have two close friends: Cathy, who keeps her home on the cool side, and Emily, whose home is the perfect temperature for you. Before too long, you might find yourself bringing a sweater to Cathy's home but not to Emily's home. Indeed, one of the hallmarks of flexible thought is the capacity to draw on our past experiences to make adaptive choices for the future. The example outlined above is one of many instances in day-to-day life where adults demonstrate this capacity. Doing so is argued to reflect the ability to mentally travel through time (e.g., Suddendorf & Busby, 2005)—a topic that has been receiving substantial attention in the areas of adult neuropsychology, social psychology, and cognitive psychology (e.g., Addis, Wong, & Schacter, 2007; D'Argembeau, Renaud, & Van der Linden, 2011; Gilbert, Killingsworth, Eyre, & Wilson, 2009; Suddendorf & Corballis, 2007).

Developmental psychologists have also been interested in children's mental time travel and, with respect to the future in particular, have coined the term "episodic foresight" to refer to the broad capacity to "imagine future scenarios and use such imagination to guide current action" (Suddendorf & Moore, 2011, p. 296). One popular scenario to illustrate this phenomenon was nicely described by Tulving (2005) and is commonly referred to as the "spoon test" as follows. A young girl is at a party where guests are being served a chocolate pudding, but she has no spoon with which to eat the delicious treat. That night, she falls asleep while holding a spoon to avoid making the same mistake again. As such, this young girl was able to draw on her past disappointment (i.e., inability to eat the pudding) to make an adaptive choice for the future (i.e., obtain a spoon). Tulving predicted that children younger than 4 years will fail a task that shares the same structure as the spoon test.

Some of the developmental work on episodic foresight has involved tasks that require children to select items for future use (based on a specific past experience), hereafter referred to as "item choice" tasks, thereby mirroring important aspects of the spoon test. For example, Suddendorf, Nielsen, and von Gehlen (2011); (see also Atance & Sommerville, 2014; Redshaw & Suddendorf, 2013; Scarf, Gross, Colombo, & Hayne, 2013) designed a task that entailed showing children a locked box with a triangular keyhole. The experimenter demonstrated that the box could be opened to retrieve a sticker using a triangular key. Children were then given the opportunity to use the key on two consecutive trials. The box was then removed and replaced by one with a *square* keyhole. Children were simply shown that the triangular key did not fit. At this point, children were told that they would go to a second room but that they would return to the first room later to play with the box. After playing unrelated games for 15 min in this second room, children were presented with three objects and asked to select one to take back to the first room. The target item was a square key, and the distracter items were a circle key and a star key. Whereas 4-year-olds performed above chance, 3-year-olds did not.

Another approach that involves children selecting items for future use was developed by Russell, Alexis, and Clayton (2010). In their study, 3-, 4-, and 5-year-olds were taught to play "blow football"—a game consisting of children and the experimenter standing on either side of a table with a goal at each end and a ball to blow into it. Materials for this game included nonessential thematically related items, such as a cardboard referee and a team badge, as well as one essential item—a straw with which to blow the football. However, to play the game from the experimenter's side of the table (the "blue" side), children also needed a box to stand on. After playing the game with the experimenter from the "red" side, children were told that they would be returning the next day to play the game from the blue side. Children were told that they could save only two items (from an array of six items) and, thus, were instructed to select the items that would be needed for "tomorrow." Only 5-year-olds selected the correct item pair (box and straw) more often than would be expected by chance.

Although these tasks (most notably Suddendorf et al., 2011) fulfill some of the criteria argued by Suddendorf and colleagues and Hudson, Mayhew, and Prabhakar (2011) to be critical for episodic foresight (e.g., use of single trials, novel problems, the need to imagine a specific future episode), there are nonetheless several limitations that are important to address. The first is that children are required to select one correct (i.e., useful in the future) item among a number of distracter items. These distracter items vary in their desirability, and so it is possible that even in the presence of episodic foresight children (especially younger children with weak inhibitory control) may select one of them rather than

the correct item (cf. Hudson et al., 2011). More broadly, item choice tasks may lead to both "false positives" and "false negatives." With respect to false positives, children may succeed by making an association between the correct item (e.g., square key) and the past problem (square keyhole), not by drawing on foresight per se. With respect to false negatives, as noted above, children may fail to select the correct item for reasons other than a lack of foresight (e.g., inhibitory control).

A second concern about item choice tasks is that they require children to remember specific information about the past episode (e.g., that the keyhole is square), and failure to do so necessarily precludes them from making a future-oriented choice. Although children's ability to draw on memory to make an adaptive future-oriented choice is an important ability to assess, the extent to which differences in memory may affect children's performance is important to consider. Indeed, recent data (e.g., Atance & Sommerville, 2014; Scarf et al., 2013) show that children who select the incorrect item in item choice tasks do so mostly because of failures in memory rather than failures in foresight per se. As such, it is unclear to what extent item choice tasks are tapping into a "foresight" component. A similar concern was raised by Hudson and colleagues (2011), who argued for the importance of designing episodic foresight tasks that do not depend on other cognitive abilities such as memory and verbal explanation. Although it may be impossible to design episodic foresight tasks that are independent of memory ability, developing tasks that allow researchers to explicitly assess its contribution—and, by extension, the specific contribution of foresight—is needed.

Our first concern can be addressed by developing a task that does not require children to select a specific item to address a future problem but rather requires them to engage in another type of future-oriented action. Doing so should reduce the possibility that children will succeed based on previous associations between the task and the item needed to solve it or will fail for reasons other than those pertaining to lack of foresight. In addition, because most "behavioral" tasks to assess episodic foresight have relied on children selecting items for future use, it is important to broaden the scope of methods used (and the particular aspect of future-oriented behavior under study) to determine whether similar patterns of performance are obtained.

Our second concern (i.e., memory limitations) can be addressed by explicitly assessing children's memory about the critical information on which the specific future-oriented action is based. That is, more information is needed about whether children's failure on any given task of episodic foresight is primarily due to limitations in memory or to limitations in foresight. For example, if it is discovered that, on a given task, children's memory is high but their capacity to make the correct future-oriented decision is low, then this suggests that capacities *specific* to foresight are the limiting factor. In contrast, if children are not successfully encoding the relevant past experience, then this is equally important to know. With the exception of Atance and Sommerville (2014) and Scarf and colleagues (2013), who used item choice tasks, no studies have systematically assessed the relative contributions of memory and foresight to children's future-oriented decision making.

The current study

To address the concerns outlined above, we drew on a paradigm developed by Raby, Alexis, Dickinson, and Clayton (2007) to assess future planning in western scrub-jays. The authors' methodology entailed the use of two compartments that the birds visited on six alternate mornings. In the morning, when the birds awoke hungry, they were given food (or "breakfast") in one of the compartments, whereas in the other ("no-breakfast") compartment they were not fed. For the rest of the day, food was readily available. On the evening of the sixth day, scrub-jays were unexpectedly given the chance to cache food in one of the compartments. The birds cached more food in the no-breakfast compartment than in the breakfast compartment. This finding suggests that scrub-jays had learned that they would be hungry in the no-breakfast compartment in the morning and, thus, cached food there as a result.

Importantly, this paradigm does not entail subjects selecting a particular item for future use but rather entails them thinking ahead about where an item (in this case, food) is needed. In addition, the paradigm lends itself well to directly asking children about the critical information that is needed to solve the task (in the case of scrub-jays, which location had food and which one did not). If children remember this information but fail to place the item in the correct location, then it is more plausible that their failure is due to processes specific to foresight per se and not solely memory for the problem.

Experiment 1

We adapted Raby and colleagues' (2007) "planning for breakfast" experiment for 3- to 5-year-olds. Rather than deprive young children of food/drink, we instead "deprived" them of the opportunity to play with toys and then determined whether they would place toys in the room where there were none in anticipation of a future visit to the laboratory. Similar to Raby and colleagues' design, children visited two rooms four consecutive times (i.e., two visits to each room) within one experimental session. The rate of attrition resulting from having parents come with their children to the laboratory for four visits on 4 consecutive days was determined to be unmanageably high. In one room (the "toy room"), children were provided with two attractive toys to play with while the experimenter was present but was unavailable to interact with them. In the other room (the "no-toy" room), children had no access to toys and, thus, had nothing to do while the experimenter was also present and again was unavailable for interaction. After these four consecutive experiences, children were brought into a third room and were told that they would be coming back to the laboratory to visit the two rooms when they were a year older (e.g., 3-year-old children were told, "You're going to get to come back here when you're 4 years old to visit Ernie's room and Big Bird's room").

Although previous studies with preschoolers have used the terms "yesterday" and "tomorrow" (e.g., Atance & Meltzoff, 2006; Russell et al., 2010; Suddendorf & Busby, 2005) to assess their understanding of the past and the future, children's understanding of these terms might not be achieved until later during the preschool years (Busby Grant & Suddendorf, 2011; Nelson & Fivush, 2004). In contrast, children as young as 2 years may be able to situate past events at specific points in time such as "my birthday" and "Christmas" (Nelson & Fivush, 2004). We did not ask children about a specific point in time (e.g., their next birthday) but instead asked them about a time in the future when they would no longer be the same age as at the time of testing. It was our observation from conversations with parents and young children that this was a salient future temporal marker. Moreover, in a recent study about the acquisition of temporal terms, Busby Grant and Suddendorf (2011) reported that the concepts "when I was little" and "when I get bigger" are well understood even by 3-year-olds.

After children were told that they would be returning to visit the two rooms, they were shown a box with toys that were slightly different from those they had played with in the toy room and were asked, "Where would you like to put these [toys] for next time?" Of interest was whether children placed the toys in the toy or no-toy room. In addition, prior to children being asked where they should put the toys, they were asked to identify which room had toys and which room did not. This allowed us to explicitly assess whether children remembered the information necessary to make an adaptive future-oriented choice.

Finally, our paradigm assesses an aspect of episodic foresight that has not been tapped in research with children—namely, the ability to discriminate based on a series of past experiences how best to plan for the future. In our opening example, we described how, based on past experience, adults might bring a sweater with them to one location but not to another location. Thus, at issue is not *which* item to select for the future (i.e., sweater) but *where* this item is needed. This type of behavior is also important in the lives of young children. For example, they must learn that indoor shoes are needed at nursery school but not at grandma and grandpa's house. Consequently, if children are told that they are going to nursery school, then placing their shoes in their backpack is the adaptive response. Similarly, if a child's friend, Harry, has a Thomas train at his house, whereas Billy does not, then choosing to bring the train to Billy's house is the adaptive choice. However, to choose adaptively in these situations, children need both to remember the critical past information (e.g., Harry's house = train; Billy's house = no train) and to show the foresight to address it (i.e., if Billy's house, then bring train).

Method

Participants

Participants were 64 children: 24 3-year-olds ($M = 41.88$ months, $SD = 3.39$), 24 4-year-olds ($M = 53.62$ months, $SD = 3.19$), and 16 5-year-olds ($M = 66.81$ months, $SD = 2.83$). Equal numbers of girls and boys were tested in each age group. Participants were recruited from a medium-sized

university city using posters, pamphlets, and advertising at children's fairs. Participants were predominantly White and middle class and were fluent in English.

Procedure

The procedure involved two rooms—one that contained toys and one that did not. Prior to children's visit, toys were placed in the two bottom drawers of a three-drawer plastic storage unit in the toy room, whereas the two bottom drawers of the unit were empty in the no-toy room,. To ensure that children could distinguish between the two rooms, one was labeled as "Ernie's room" and the other as "Big Bird's room" (whether Ernie's or Big Bird's room contained toys was counterbalanced). A photograph of the corresponding character was affixed to the door of each room and to a set of drawers in each room. Both rooms contained a child-sized table and two chairs, a three-drawer storage unit, and a chair and desk for the experimenter that were situated in the corner of the room (see Fig. 1 for a schematic representation of the experimental setup).

Note that 16 children in Experiment 1 and 26 children in Experiment 2 were tested using a slightly different setup due to a laboratory move. However, these children's responses for both the memory and prospection questions did not differ significantly from those of children who were tested in the setup displayed in Fig. 1.

The experimenter introduced the two rooms by saying, "We're going to play in two different rooms today. This is Ernie's room. Look, there's a picture of Ernie on the door. And this is Big Bird's room. Look, there's a picture of Big Bird on the door" (whether Ernie's or Big Bird's room was pointed out first was counterbalanced). The child and the experimenter then entered one of the two rooms (whether this was the toy or no-toy room was counterbalanced), and the child was prompted to look inside the top drawer of the storage unit to check whether the character "was home." The experimenter then removed the corresponding puppet from the top drawer and asked the puppet whether it had any toys for the child to play with (e.g., "Ernie/Big Bird, do you have anything for [child's name] to play with?"). For the toy room, Ernie/Big Bird "whispered" into the experimenter's ear, and the experimenter then said either "Wow, you have a coloring book and crayons and a Slinky" or "Wow, you have blocks and Play-Doh" (order counterbalanced for the two visits to the toy room) for [child's name] to play with." The experimenter then removed the toys from the bottom drawer and encouraged the child to play with them.

For the no-toy room, Ernie/Big Bird "whispered" into the experimenter's ear, and the experimenter said, "Oh no, you don't have anything for [child's name] to play with!" The child then had nothing to
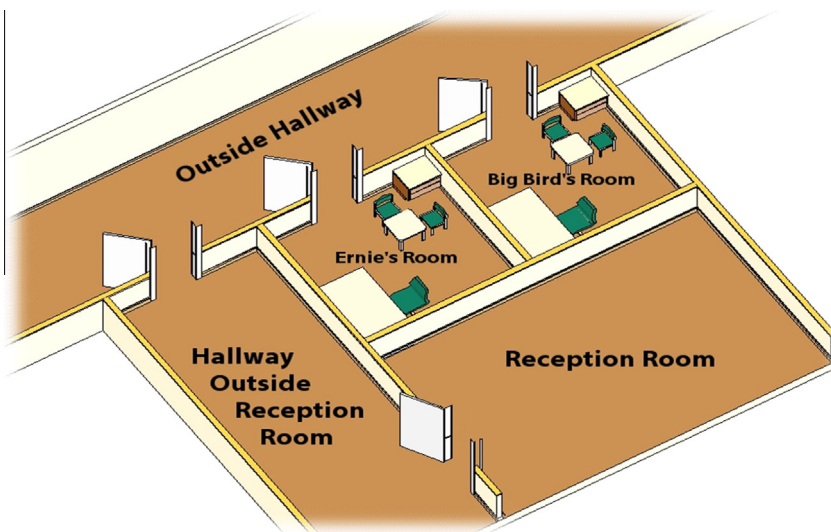

Fig. 1. Schematic representation of the experimental setup.

play with during his or her 3-min stay. Whether in the toy or no-toy room, the experimenter sat down at the desk, put on headphones, and pretended to work to avoid interacting with the child during the 3-min period in the room. If the child attempted to interact with the experimenter, she simply reminded the child that she had work to complete. At the end of the 3 min, the experimenter said, "Now it's time to go to Ernie's/Big Bird's room," at which point the child and the experimenter traveled to the other room, where the same procedure was repeated. The child visited both rooms twice for a total of four visits to the rooms, with each visit lasting 3 min. We decided on this specific number of visits based on pilot work showing that two consecutive visits to each room was the maximum that the youngest children were willing to tolerate without becoming overly frustrated and distractible.

As with the study with the scrub-jays, the goal of the four consecutive visits to the toy and no-toy rooms was for children to learn that one room (i.e., the toy room) was enjoyable to be in, whereas the other room (i.e., the no-toy room) was not (i.e., it was "boring"). In addition, we explicitly queried children about their experience in both rooms. Accordingly, after children visited each room twice, they were brought to the outside hallway (see Fig. 1) and were asked the following two memory check questions in counterbalanced order: "This is Ernie's room—what did you play with in Ernie's room?" and "This is Big Bird's room—what did you play with in Big Bird's room?" If children mentioned at least one toy they had played with (e.g., "Play-Doh") or said "toys" in response to the memory check about the toy room, then they received a score of 1; otherwise, they received a score of 0. If children responded "nothing" or mentioned that they played with their hands, a bracelet they were wearing, or the like to the memory check question about the no-toy room, then they received a score of 1; otherwise, they received a score of 0. Thus, a total score ranging from 0 to 2 was assigned to each child. Regardless of children's responses, they were provided with the correct answers to the memory check questions.

At this point in the procedure, children traveled from the outside hallway to the hallway outside the reception room (see Fig. 1) and were shown a basket with two toys that differed slightly from two toys that they had played with earlier (i.e., a different coloring book and crayons and a different jar of Play-Doh). We reasoned that presenting children with altogether different toys would have been overly salient/attention-capturing for them, thereby reducing the odds that they would preferentially place them in one room versus the other. Children were then told that it was time for them to go home but that they would visit Ernie and Big Bird's rooms again when they were "4/5/6 years old." For example, 3-year-olds were told the following: "Okay, it's time for you to go home now. But, guess what? You're going to get to come back here when you're 4 years old to visit Ernie's room and Big Bird's room. Look what I have—a coloring book and crayons and some Play-Doh. These are for the next time you come to visit Ernie and Big Bird, when you're 4 years old." Children were then asked the "prospection" question: "Where would you like to put these for next time?"

Children received a score of 1 if they correctly responded with the no-toy room option (either Ernie's or Big Bird's room, depending on counterbalancing order) and a score of 0 if they incorrectly responded with the toy room option. Questioning stopped at this point unless children did not provide a response (or said "I don't know") or provided a nonsensical/nonspecific response (e.g., "at home," "in the drawers"). In these cases, they were asked the following "prompted" question: "You tell me whose *room* you would like to put them in." Children received a score of 1 if they responded with the no-toy room option. All other responses were assigned a score of 0. In sum, all children received a score of either 1 or 0 on the prospection question but differed in terms of what level of questioning was required to elicit this response.

A female experimenter tested children individually in one single video-recorded session. Children were tested in one of eight fully counterbalanced orders that varied as a function of whether Ernie's or Big Bird's room contained toys and whether children visited Ernie's or Big Bird's room first in the four-visit sequence. We also counterbalanced which room was pointed out to children first and the order in which children saw the toys in the toy room (coloring book and crayons and Slinky first or blocks and Play-Doh first). Throughout testing, parents observed their children on a television monitor from the reception room. At the end of each session, children were given a small "thank you" gift (e.g., puzzle, Play-Doh) and parents were reimbursed for the cost of parking.

Results

Memory check questions

A series of one-sample *t* tests showed that all three age groups scored significantly higher than would be expected by chance (i.e., >1) on the two memory check questions (see Table 1). Nonetheless, a one-way analysis of variance (ANOVA) showed that age had a significant effect on children's ability to remember which room had toys and which room did not, $F(2, 59) = 3.55$, $p < .05$, $\eta_p^2 = .11$. Tukey post hoc tests showed that the only significant difference in this respect was between the 3- and 5-year-olds ($p < .05$).

Prospection question

Because all three age groups scored above chance on the memory questions, we proceeded to analyze their responses to the prospection question. A series of Pearson chi-square tests revealed that children's responses to this question did not vary significantly as a function of whether Ernie's or Big Bird's room was pointed out first, whether Ernie's or Big Bird's room contained toys, whether children visited the toy or no-toy room first in the four-visit sequence, or the order in which children saw the toys in the toy room (coloring book and crayons and Slinky first or blocks and Play-Doh first) (all *p* values >.14).

Recall that children who did not specify a room in which to place the toys after the first question ("Where would you like to put these for next time?") were then prompted with "You tell me whose room you would like to put them in." We considered responses to the prospection question as being correct if, at either level of questioning, children chose to place the toys in the no-toy room. A series of binomial tests showed that 4- and 5-year-olds ($p < .01$), but not 3-year-olds ($p = .68$), placed the toys in the no-toy room significantly more often than would be expected by chance (see Table 2). A Pearson chi-square test showed that the effect of age trended toward significance on children's responses to the prospection question, $\chi^2(2, 63) = 5.34$, $p = .069$.

Because age had a significant effect on children's performance on the memory questions (5-year-olds were significantly better than 3-year-olds), we also restricted our analysis of the prospection question to those 3-year-olds who responded correctly to *both* memory questions ($n = 11$). Nonetheless, this analysis showed that the performance of this subset of children was still not significantly higher than chance ($p = .55$).

Discussion

The task we used in Experiment 1 required children to draw on a past experience to make an adaptive choice for the future. Unique to our approach is that we assessed both children's memory for the critical past information (i.e., which room had toys and which room did not) and the decision they made about where to place the toys for a future visit. All three age groups performed above chance on the memory questions. We next analyzed whether all three age groups were significantly above chance in deciding to place the toys in the no-toy room. Whereas the performance of 4- and

Table 1
Memory check responses by age for Experiments 1 and 2.

Age (years)	Mean score (range = 0–2)	Standard deviation	One-sample *t*-test value
Experiment 1			
3 (*n* = 22)[a]	1.41	0.73	2.62 (*p* < .05)
4 (*n* = 24)	1.71	0.46	7.48 (*p* < .001)
5 (*n* = 16)	1.88	0.34	10.25 (*p* < .001)
Experiment 2			
3 (*n* = 24)	1.38	0.77	2.39 (*p* < .05)
4 (*n* = 24)	1.79	0.51	7.62 (*p* < .001)
5 (*n* = 10)	1.90	0.32	9.00 (*p* < .001)

[a] Data missing due to experimenter oversight.

Table 2
Prospection question responses by age for Experiments 1 and 2.

Age (years)	Correct	Incorrect	Percentage correct
Experiment 1			
3 (n = 23)[a]	13	10	57
4 (n = 24)	19	5	79
5 (n = 16)	14	2	88
Experiment 2			
3 (n = 24)	14	10	58
4 (n = 24)	17	7	71
5 (n = 10)	10	0	100

[a] One child's response was uncodable.

5-year-olds was significantly above chance, the performance of 3-year-olds was not. This indicates that, for 3-year-olds at least, memory for the past was not sufficient to drive an adaptive future-oriented decision. This suggests that processes other than memory—and quite possibly foresight—are contributing to task performance. If so, then one possibility is that if children are asked about the immediate future, rather than the distant future, the performance of 3-year-olds should be above chance. This finding would be consistent with Russell and colleagues (2010), who found that children were better able to select the correct items to play a game of blow football when they were told that they would play the game "right now" rather than "tomorrow."

Experiment 2

In Experiment 2, a different group of 3-, 4-, and 5-year-olds was presented with the same task used in Experiment 1 except that the "prospection" question entailed telling children that they would have the opportunity to visit Ernie's room and Big Bird's room immediately and that they needed to decide where to put the toys. The 5-year-old data were collected after the 3- and 4-year-old data but are included in this experiment because the methodology was identical to the one reported here.

Method

Participants

Participants were 58 children who had not participated in Experiment 1: 24 3-year-olds (12 boys; M = 41.67 months, SD = 3.02), 24 4-year-olds (12 boys; M = 54.71 months, SD = 3.58), and 10 5-year-olds (6 boys; M = 66.30 months, SD = 2.67). An additional 3 children were tested but were excluded either because of experimenter error (n = 1) or because they were unable to complete the session (n = 2). Participants were primarily White from middle-class backgrounds, and they were drawn from the same city and recruited in the same manner as in Experiment 1.

Procedure

All aspects of the procedure were identical to those in Experiment 1 except that children were asked about the immediate future rather than the remote future. Thus, after the memory check questions, children were asked the following prospection question: "Guess what? We're going to go back and visit Ernie's room and Big Bird's room right now. Look what I have—a coloring book and crayons and some Play-Doh. Where would you like to put these?" As in Experiment 1, children who were unable to answer this question were asked one additional prompted question (i.e., "You tell me whose room you would like to put them in").

Results

Memory check questions

One-sample t tests showed that all three age groups scored significantly higher than would be expected by chance (i.e., >1) on the two memory check questions (see Table 1). As in Experiment 1,

however, a one-way ANOVA showed that age had a significant effect on children's ability to remember which room had toys and which room did not, $F(2,55) = 3.91$, $p < .05$, $\eta_p^2 = .13$. Tukey post hoc tests showed that differences between the 3- and 4-year-olds and between the 3- and 5-year-olds both trended toward significance ($p = .055$ and $p = .066$, respectively).

Prospection question

A series of Pearson chi-square tests revealed that children's responses to this question did not vary significantly as a function of whether Ernie's or Big Bird's room was pointed out first to children, whether Ernie's or Big Bird's room contained toys, whether children visited the toy or no-toy room first in the four-visit sequence, or the order in which children saw the toys in the toy room (all p values >.15).

A series of binomial tests showed that 5-year-olds placed the toys in the no-toy room at a rate significantly higher than chance ($p < .01$), 4-year-olds' choices trended in this direction ($p = .064$), and 3-year-olds' choices did not ($p = .54$) (see Table 2). A Pearson chi-square test showed that the effect of age trended toward significance on children's responses to the prospection question, $\chi^2(2,58) = 5.92$, $p = .052$.

Because age had a significant effect on children's performance on the memory questions, we also restricted our analysis of the prospection question to those 3-year-olds who responded correctly to both memory questions ($n = 13$). Nonetheless, this analysis showed that the performance of this subset of children was still not significantly higher than chance ($p = .58$).

Discussion

All age groups remembered which room contained toys and which room did not at a rate significantly higher than chance. In contrast, only the performance of 5-year-olds was above chance on the prospection question, although the performance of 4-year-olds trended in this direction and was no different [$\chi^2(1,48) = 0.44$, $p = .51$] than the performance of 4-year-olds in Experiment 1, who were above chance. Thus, surprisingly, it appears that asking children about the immediate versus remote future does not lead to a difference in performance. The General Discussion below focuses on the following three points: (a) the extent to which our paradigm taps episodic foresight, (b) the role of temporal distance in children's reasoning about the future, and (c) implications for future research on episodic foresight.

General discussion

We developed a new paradigm modeled after planning work in scrub-jays. As in the paradigm used with the scrub-jays, children experienced a lack of resources (i.e., toys) in one room but not in another room. Rather than selecting an item for future use, as is the norm in behavioral paradigms assessing episodic foresight, children needed to keep track of which location required the item in question and which did not. Our variable of interest was where children decided to place the item for a visit that would occur in either the distant future (Experiment 1) or the immediate future (Experiment 2).

In both experiments, we assessed children's memory for the critical past information (i.e., which room had toys and which room did not) as well as their ability to use this information adaptively (i.e., place the toys in the no-toy room). In Experiment 1, all three age groups remembered which room had toys and which room did not at a rate that was significantly higher than chance, thereby justifying an analysis of their performance on the prospection question. Here, both 4- and 5-year-olds were above chance in stating that they would put the toys in the no-toy room, whereas 3-year-olds were not. Thus, even though 3-year-olds tended to remember the past information, they failed to use it to make an adaptive choice for the future. It is, however, important to note that 3-year-olds remembered this information less well than 5-year-olds. Even so, when we isolated those 3-year-olds who responded correctly to both memory questions, their performance on the prospection question was still not significantly higher than chance. This finding strongly suggests that our task is tapping processes other than memory. This in itself is significant given that recent data with item choice tasks

are consistent with the argument that age-related changes on these tasks are primarily due to processes that are specific to memory (e.g., Atance & Sommerville, 2014; Scarf et al., 2013).

Thus, we reasoned that if our task was indeed drawing on processes specific to foresight, then 3-year-olds may have failed because the future time we asked them about (i.e., when they were 4 years old) was too remote. Thus, in Experiment 2, we kept all aspects of the procedure constant but asked children about the immediate future. Again, all three age groups remembered which room had toys and which room did not at a rate significantly higher than chance. However, despite the fact that the decision they were asked to make (i.e., where to put the toys) had relevance for the immediate future, 3-year-olds' performance was not significantly different from chance, whereas 4-year-olds' performance trended in this direction ($p = .064$). As in Experiment 1, 5-year-olds' performance was significantly above chance. Again, even after isolating those 3-year-olds who responded correctly to both memory questions, performance on the prospection question did not differ from chance.

The fact that children's performance in Experiments 1 and 2 did not markedly differ is notable because research suggests that temporal distance affects the way in which adults think about the future (e.g., D'Argembeau, & Van der Linden, 2004; Trope, & Liberman, 2003) and that older children (i.e., 7- and 8-year-olds) seem better able to judge the future distance of daily activities than of yearly events (e.g., Friedman, 2002). Yet in the context of our task, one possibility is that even though 3-year-olds (and, to a certain extent, 4-year-olds) remembered the critical past information, they were unable to recombine elements of their past experience (i.e., which room had toys and which room did not) in a way that allowed them to make the correct choice (e.g., "if no toys in Ernie's room, then toys should go there"). This possibility is quite consistent with at least one theory about the role of memory in future thinking. Specifically, Schacter and his colleagues (e.g., Schacter, Addis, & Buckner, 2008; see also Suddendorf & Corballis, 1997, 2007) argued that people simulate future episodes by flexibly recombining event details from the past or what the authors termed the "constructive episodic simulation hypothesis." Indeed, recent research with children has shown that relational memory (taken as an index of the ability to recombine past event details) is correlated with episodic future thinking (Richmond & Pan, 2013). It may be that this demand applies whether the event in question will occur immediately (Experiment 2) or more remotely (Experiment 1). Thus, this argument is relevant to the issue of temporal distance—the topic we turn to next.

One explanation for why our "temporal manipulation" did not improve children's performance is that even though children were asked a question that was ostensibly about the present, its temporal reference may still be considered "future." This is especially plausible given that the choice that children made would take effect only at a location removed in time (although very briefly) and space. This highlights the need to better specify the *temporal distance into the future* that is needed for a task to qualify as reflecting episodic foresight and, more important, whether manipulating this distance even affects children's performance. It is quite possible that as soon as children's action is directed toward a problem that is not immediate *and* concrete (visible), future-directed capacities and episodic foresight are called on.

Both our data and interpretation with respect to temporal distance are consistent with a recent study by Redshaw and Suddendorf (2013). These authors used an item choice task that was very similar to Suddendorf and colleagues' (2011) task, but rather than have children choose an item to be used immediately to solve the problem presented earlier in another room, a 5-min delay (via the use of a sand timer) between the time when children selected the item and the time when they would visit the neighboring room was imposed. The authors argued that their paradigm tests children's ability to link past and *deferred* future episodes. Consistent with our results, Redshaw and Suddendorf reported that their 4-year-olds performed no differently from Suddendorf and colleagues' 4-year-olds who did not experience the 5-min delay. Similar to the argument we have been making, these authors proposed that people may use the same cognitive mechanisms to prepare for an event that will occur immediately versus in the next few minutes. Intriguingly, they also raised the possibility that similar mechanisms are used to prepare for more distant future episodes (e.g., "next summer's holiday"). Our findings support this exact prediction. That is, children in our study performed no differently when told that their choice would take effect immediately (Experiment 2) versus (in most cases) months from the present (Experiment 1).

On the surface, these findings (both ours and those of Redshaw & Suddendorf, 2013) are at odds with those of Suddendorf and colleagues (2011) and Russell and colleagues (2010), both of whom found that children's performance was affected by a temporal manipulation. However, Suddendorf and colleagues (2011) did not manipulate temporal distance into the future; rather, they manipulated the amount of delay that elapsed between when children were confronted with the problem and when they were given the opportunity to address it. As such, it is likely that the difference in performance between their "instant" and "delayed" conditions was due to memory for the problem or, at the very least, to processes other than temporal distance into the future because this aspect specifically was not manipulated. In contrast, Russell and colleagues' (2010) present and future task versions did differ in terms of temporal distance into the future and, importantly, delay was held constant. Russell and colleagues found that more children chose the correct items in the present version than in the future version. However, the absolute difference in performance was not great; whereas 33% of 3-, 4-, and 5-year-olds succeeded in the present version, 11% did so in the future version. Moreover, in the present version of their task, children may have been motivated to choose the correct items because they were given the opportunity to play the game *immediately.* In contrast, in their future version, children's motivation may have shifted to wanting the items that were most desirable (and, in this case, incorrect) because the game itself would be played only in the future. Nonetheless, the issue of temporal distance is an intriguing one, and it is possible that dependent variables (e.g., reaction times, level of detail in verbal descriptions) other than children's specific choice for the future (e.g., which item to choose, where to place a particular item) may reveal differences in how children represent/encode the immediate versus distant future.

In closing, it is important to address some limitations of our task. The first limitation—and one that plagues a great deal of research on future thinking ability—pertains to the wording used to ask children about the future. For example, in a recent study examining children's production (and, perhaps most important, comprehension) of temporal terms, Busby Grant and Suddendorf (2011) reported that whereas most 3- and 4-year-olds use the term "tomorrow," only roughly half of parents report that they understand its meaning. As we noted in the Introduction, however, one term that shows a high level of comprehension, even among 3-year-olds, is "when I get bigger/grow up." The wording we used in Experiment 1 to denote "futurity" was quite similar to this term (i.e., "when you're 4/5/6"); thus, children arguably interpreted our prospection question as referring to a future point in time.

Even so, asking children about an event that is relatively distant can be problematic. With respect to our task in particular, children may have doubted that the choice they made would remain relevant in the future (e.g., someone could move the toys). Nonetheless, the fact that children's correct responses improved with age is evidence that this interpretation cannot fully account for our data. Moreover, in the absence of explicit information about intervening events, the best strategy is to operate with one's current knowledge. As such, an interesting manipulation would be to present children with information about an intervening event (e.g., someone moving the toys) that would affect the choice they should make.

Finally, several criticisms about Raby and colleagues' (2007) paradigm may also apply to ours. For example, Premack (2007) and Suddendorf and Corballis (2008) argued that the scrub-jays may have used a general heuristic (e.g., balance food sources) rather than episodic foresight per se. We have no way of ruling out the possibility that children in our study were simply placing toys where there were none, similar to using some kind of associative strategy. Yet by this argument, an equally plausible strategy is to put the toys where there currently are some (i.e., "where they belong"). Moreover, there is no reason to believe that children have a "balance toys" heuristic—at least not in the same way as scrub-jays may operate with a heuristic to balance food sources (a strategy that Raby & Clayton, 2009, nonetheless argued does not rule out some form of foresight).

In addition to addressing the limitations we have just raised, it will also be important to conduct more research aimed at disentangling the relative roles of memory and episodic foresight per se in children's performance on this and other "choice-for-future" tasks (cf. Atance & Sommerville, 2014). Although, it is arguable that, in most contexts, future-oriented decision making or planning is necessarily influenced by our memory of the past, it is arguable that processes *specific* to foresight also play a role. Identifying such processes is a critical step in learning more about the development of children's episodic foresight and future-oriented cognition more broadly. Finally, the role that temporal

distance may play in young children's reasoning about the future is an intriguing topic that warrants additional inquiry.

Acknowledgments

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