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## “What Should You Bring with You to This Place?”: Examining Children’s Episodic Foresight Using Open-Ended Questions

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### ABSTRACT

Children’s episodic foresight, the ability to mentally project oneself into the future to pre-experience an event (e.g., Atance & O’Neill, 2005), begins to emerge early in the preschool years. Results from the Picture-book task (Atance & Meltzoff, 2005) have shown that children are generally capable of selecting an item needed in the future (from provided options), but young preschoolers have difficulty justifying their choice with future-oriented explanations. Because episodic foresight has typically been measured using forced-choice questions (such as the Picture-book task) less is known about children’s more naturalistic and “open-ended” future thinking (i.e., more spontaneous forms of episodic foresight). Forty-eight 3-to 5-year-olds completed a new, open-ended version of the Picture-book task. Using a descriptive approach, we found that children were able to generate an appropriate item to bring with them to a future location, and that this ability improved with age. Temporal focus as well as internal (episodic) and external (semantic) details were explored in the context of children’s explanations. Children’s explanations were mostly present-oriented and included episodic and semantic details equally. Our findings extend our knowledge of children’s episodic foresight by highlighting children’s ability to solve future-oriented problems in an open-ended manner.

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Imagine standing on the top deck of an Alaskan cruise in shorts and a t-shirt; this chilly and unpleasant experience could have been avoided had you realistically imagined what visiting Alaska would be like while packing your suitcase for the cruise. Indeed, imagining distant and near futures can help one make better decisions (e.g., reduce impulsive decision making; Bromberg, Wiehler, & Peters, 2015) as well as avoid future problems (e.g., obesity; Dassen, Jansen, Nederkoorn, & Houben, 2016). The capacity to mentally project oneself into the future to pre-experience an event, known as *episodic foresight*, has adaptive advantages in the form of being better prepared for the future, securing future needs, avoiding mistakes, and fulfilling goals (Suddendorf & Busby, 2005). For example, a child who fails to imagine themselves becoming thirsty after a long hike may not bring a water bottle with them and, thus, be unprepared for the future situation of thirst. Indeed, episodic foresight becomes increasingly necessary as children enter school and gain autonomy from their parents (e.g., Prabhakar, Coughlin, & Ghetti, 2016).

Research has examined the development of episodic foresight in children as young as 3 years old (e.g., Atance, Louw, & Clayton, 2015; Atance & Meltzoff, 2005; Scarf, Gross, Colombo, & Hayne,

2013). Studies show that future thought seems to emerge around 3 years old with children beginning to imagine and discuss hypothetical future events as well as use future-oriented terms (e.g., maybe, will, etc.; Atance & O'Neill, 2005; Hudson, 2006; Nelson, 2001). Generally, age-related improvements continue into the preschool years with substantial gains between 3 and 5 years of age across a wide range of different episodic foresight tasks (e.g., Atance & Meltzoff, 2005; Bélanger, Atance, Varghese, Nguyen, & Vendetti, 2014; Hayne, Gross, McNamee, Fitzgibbon, & Tustin, 2011; Suddendorf, Nielsen, & Von Gehlen, 2011; Suddendorf & Busby, 2005).

There are at least three types of tasks typically used to measure children's episodic foresight that show a similar developmental trajectory across early childhood: verbal tasks, location tasks, and item choice tasks (Hudson, Mayhew, & Prabhakar, 2011). First, verbal tasks require children to report information about the future (e.g., Busby & Suddendorf, 2005; Quon & Atance, 2010) through the use of broad open-ended questions such as, "What will you do tomorrow?" (Tomorrow task; Busby & Suddendorf, 2005) or more specific future event questions, such as "What are you going to eat for supper tomorrow?" (Quon & Atance, 2010). Second, location tasks require children to select an appropriate location that would allow them to achieve a future goal (e.g., McColgan & McCormack, 2008; Prabhakar & Hudson, 2014). For example, Prabhakar and Hudson (2014) asked children to select the order of locations they should visit (correct response: toy store first, then a friend's house) in order to accomplish the hypothetical future goal of bringing a present to the friend's birthday. Finally, item choice tasks involve children selecting an item that could help solve a future problem, such as choosing between three provided items (e.g., soap, sunglasses, and seashell) to bring to an imagined future location (e.g., desert; Atance & Meltzoff, 2005) or choosing an item needed to solve a problem in another room (e.g., bringing a tool to open a box; Suddendorf et al., 2011).

Interestingly, although item choice tasks are widely used in the literature to measure children's episodic foresight, the extent to which these tasks require future projection may be limited. Specifically, it is unclear whether children need to project themselves into the future in order to select the appropriate item for future use (e.g., Atance & Sommerville, 2014; Martin-Ordas, Atance, & Louw, 2012; Russell, Alexis, & Clayton, 2010), or whether children succeed on these item choice tasks by relying on general script-based knowledge (i.e., thinking about birthday parties more generally rather than a specific birthday party in the future; Hudson et al., 2011). For example, the correct item could be selected through the use of semantic associations (e.g., sunglasses for sun; Hudson et al., 2011), general knowledge about the world, or memory for the past problem (Atance & Sommerville, 2014). In fact, Atance and Sommerville (2014) showed that age-related differences in children's memory for a problem they encountered in the past (e.g., smiley face missing a "googly eye") predicted their performance on item choice tasks, whereas age-related differences in children's episodic foresight did not (see also Scarf et al., 2013).

Equally important, providing children with possible solutions to future problems differs from the future-oriented reasoning children engage in on a daily basis (e.g., Moffett, Moll, & FitzGibbon, 2018). For example, a parent may ask a child to get ready to go to their grandma's house, without listing all the possible items that they should bring with them. To this end, the ecological validity of forced choice-tasks may be limited. One way to increase ecological validity and the chances of children engaging in a future simulation process is to ask them open-ended questions, rather than providing a limited set of possible response options. Therefore, one interesting direction to explore is whether children can independently generate ideas or solutions to solve a future problem on tasks that have traditionally provided forced-choice response options (i.e., item choice tasks).

To this end, several researchers have begun to examine children's more spontaneous episodic foresight and planning for the future. These few studies suggest that young children may be capable of spontaneously generating a solution to a future problem (Atance, Celebi, Mitchinson, & Mahy, 2019; Caza & Atance, 2019; Moffett et al., 2018). Evidence of spontaneous future thinking

in a two-rooms task has been indexed by children's verbal utterances throughout the task (e.g., the child independently suggests an item to solve the problem; Caza & Atance, 2019), as well as in response to direct questioning (e.g., What should we bring to the other room?; Atance et al., 2019; Moffett et al., 2018). The latter approach is of particular interest given how little is known about children's ability to respond to open-ended questions on episodic foresight tasks.

First, Caza and Atance (2019) examined children's spontaneous episodic foresight in a more naturalistic manner. In this study, children also visited two rooms, one that lacked a resource (e.g., candies) and another that contained the resource. Throughout the task, children's spontaneous future utterances were coded for indications of solving the task (e.g., wishing to bring the resource to the empty room). Children were then asked to allocate a resource to one of the two rooms for the next day. Caza and Atance (2019) found that children who successfully allocated the resource to the correct room in the future also made more future utterances during the task than those who failed the task. Interestingly, age did not predict children's likelihood of making future utterances, nor their ability to spontaneously solve the task.

Moffett et al. (2018) investigated children's spontaneous planning by asking them to generate the means to complete a game in the future. In this task, children named four possible items to pack for preschool (e.g., snack, book) and drew items on cards if they were not already present in the experimenter's stack of object cards. Next, children proceeded to a second room with the item cards and were assigned to one of two conditions: a condition where a specific picture (e.g., banana) was needed to complete a game, or a condition where all pictures needed to complete a game were present. After playing the game, children went back to the first room where they were asked to draw what they wanted to take back to the previous room. This drawing period provided children in the "missing picture" condition an opportunity to draw the picture (e.g., banana) that was needed to complete the game in the second room. Across three trials, the researchers found that 5-year-olds drew the appropriate item to complete the game more often than 4-year-olds. However, 4-year-olds nevertheless generated the appropriate item more often when the picture was needed to complete the game compared to when there was no future need.

Similarly, Atance et al. (2019) used a two-rooms task to compare 3- to 5-year-olds' episodic foresight when they were asked to choose from a provided set of options versus verbally generate their own responses from a provided cue. In the first experiment, children encountered a problem in the first room (e.g., a toy animal that did not have its favorite fruit to eat) and then proceeded to a second room where, after a short break, they had the opportunity to return to the first room with an item. Children were assigned to one of three conditions where they were given either a forced choice of three items to choose from (an apple, lemon, or orange), a category cue (e.g., "What would be a good *fruit* to bring back with you?"), or a general object cue (e.g., "What would be a good *thing* to bring back with you?"). Children performed better with a category cue than a general object cue, although performance in the forced-choice condition was superior to both cued conditions. Further, children's performance did not improve with age. In a second experiment, Atance et al. (2019) assigned children to only the forced-choice and category cue conditions and similarly found children had more difficulty generating their own object to bring with them to the second room, than they did choosing from a list of provided options. Age-related differences in overall performance were found between the 3- and 5-year-olds in this second experiment.

Together, studies on children's more spontaneous or open-ended forms of future thinking suggest that children can generate their own responses to future-oriented questions. However, children's performance tends to be worse than when response options are provided. Notably, the research examining children's more spontaneous future thinking has mainly used the two-rooms task procedure, but has not explored children's ability to generate solutions to future problems using another commonly-used measure of episodic foresight—the Picture-Book task (e.g., Atance & Jackson, 2009; Atance & Meltzoff, 2005; Hanson, Atance, & Paluck, 2014; Mahy, Grass, Wagner, & Kliegel, 2014).

The Picture-Book task (Atance & Meltzoff, 2005) is a measure of episodic foresight that asks children to imagine visiting novel locations (e.g., desert, forest, waterfall) at a future point in time (i.e., tomorrow) and make predictions about which item would be appropriate to bring with them to the location in question. Children are also asked to provide an explanation for their choice. Atance and Meltzoff's (2005) standard administration of the task asked children to imagine visiting six novel locations: desert, stream, dirt road, snowy forest, mountains, and waterfall, but has also been adapted and produced similar results using fewer trials (e.g., four locations; Atance & Jackson, 2009; Mazachowsky & Mahy, 2020). These locations were originally chosen by Atance and Meltzoff (2005) so that they were familiar to children, but not so familiar that children could rely on script-based knowledge rather than imagination and future projection to complete the task. Atance and Meltzoff (2005) intended that imagining the location would evoke feelings and thoughts about the physiological states (e.g., sun in eyes, thirst, cold) likely to be encountered, which should in turn inform children's decision about the appropriate item to bring with them. Importantly, on this task, children are provided with a set of possible items to accompany them to each location (e.g., a snowy mountain): a correct item (e.g., winter coat), a distractor item (e.g., bathing suit), and a semantic associate (e.g., ice cubes). Results from the Picture-book task show that by 3 years old, children are able to select an appropriate item to take with them to a future location. However, when one of the possible item choices was a semantic associate, 3- and 4-year-olds tended to select the item that was semantically associated with the location (e.g., seashell for desert location) as often as they chose the correct item that addressed a future physiological state. Moreover, when explaining their item choices, older children referred to future states (e.g., "I *will* get *hungry*", or "I *might* be *cold*") and used more future talk (e.g., "It *will* be cold") in their explanations than younger children (Atance & Meltzoff, 2005).

This pattern of findings suggests that young children are proficient at selecting an item needed in the future, but are less successful when a semantic associate is introduced, and do not often justify their choice with a future-oriented explanation. Thus, these findings suggest that younger children might simply not be thinking about the future when completing the Picture-Book task. What we do not know, however, is whether children can successfully generate their own items to bring to a future location and whether their explanations for their item choice would elicit a similar level of future talk as in the forced-choice paradigm. An open-ended response therefore might give us more insight into how children generate their own items for future use and might better reveal the extent to which children are anticipating the future. Using this approach is important because it captures the kind of future thinking children must do in their daily lives outside of the laboratory (e.g., a parent asking their child to pack a backpack), and may also require a greater degree of self-projection compared to the passive selection of an item.

In addition to projecting oneself into a future place, episodic foresight tasks also require children to temporally locate events at a future time (i.e., tomorrow versus next month). Thus, it is important to consider children's understanding of time and their ability locate events in time. Hoerl and McCormack (2019) describe temporal cognition as a dual system comprised of temporal updating (a primitive system that tracks and updates information according to changes in an environment and incorporates previously learned information) and temporal reasoning (a sophisticated system that can represent specific times, temporal order, and location of events in time). According to this framework, children start to shift from reliance on the temporal updating system to the temporal reasoning system in the preschool years. One study showed that 3- to 5-year-old children's level of accuracy in placing events (e.g., birthday, drive a car, sleep in a cot) on past and future timelines improved with age. However, overall, children were more accurate at placing past events compared to future events on the correct location on the timeline (Busby Grant & Suddendorf, 2009). Future events may be particularly challenging for young children because they have yet to occur, so children must apply their knowledge of general temporal understanding to locate events in the future. Further, research suggests that thinking about

temporally distant future events (e.g., several years into the future) may be more difficult, particularly for young children, than more temporally close future events (e.g., several days into the future; Hudson & Mayhew, 2011). It has also been suggested that children who have difficulty temporally locating future events may rely on more semantic (versus episodic) knowledge of events (Hudson & Mayhew, 2011). Thus, exploring the episodic versus semantic nature and temporal focus (e.g., present versus future) of children's explanations on a more spontaneous version of the Picture-book task could provide insight into the role of children's temporal understanding in episodic foresight tasks. Specifically, children who are better at locating themselves at different points in time might refer to more episodic details of a future event and should be more likely to use future terms when describing the event.

The goal of the current study was to explore 3- to 5-year-olds' responses on a new version of the Picture-book task in which we asked them to verbally generate their own item for use at a future point in time. In this version of the Picture-book task, children were presented with four novel locations and for each location they answered an open-ended question (i.e., "What should you bring to this place?"). After generating a response, children were asked to explain why they would bring the item in question. Our research questions were as follows: (1) Are children able to identify an item needed to solve a problem in the future using an open-ended version of the Picture-book task?, (2) Does children's ability to generate an appropriate item improve with age?, (3) Are children's explanations for their generated item temporally focused on the future (versus present) and internal and episodic in nature (versus external and semantic)?, and (4) Does the temporal focus and episodicity of children's explanations differ as a function of age? In addition to examining the temporal focus of children's explanations, we were also interested in exploring children's reference to semantic or episodic details in their explanations as both types of details may be important in the development of children's self-projection abilities (Martin-Ordas et al., 2012). In general, the investigation of children's ability to verbally generate their own responses is important given that open-ended questioning may require greater future-orientation (see Atance & Sommerville, 2014, for discussion of foresight involvement in forced-choice tasks) and might produce a more ecologically valid test of children's episodic foresight (Atance & Caza, 2019).

## Method

### Participants

Fifty-three children between ages 3 and 5 years participated in the study. Five children were excluded due to uncooperativeness ( $n=3$ ) or atypical development ( $n=2$ ). The final sample consisted of 48 children: 16 3-year-olds (6 males;  $M=41.69$  months,  $SD=3.24$ ), 16 4-year-olds (8 males;  $M=53.56$  months,  $SD=4.29$ ), and 16 5-year-olds (9 males;  $M=66.38$  months,  $SD=3.26$ ). The majority of children were Caucasian (77%) and from middle-class backgrounds (79% of parents reporting a household income of \$40,000 or above).

### Picture-book task (adapted from Atance & Meltzoff, 2005)

In this task, children were asked to imagine visiting four different locations (i.e., desert, snowy forest, dirt road, and waterfall) in the future. Locations were selected and considered appropriate for 3-to 5-year-olds based on the standard use of these locations in previous administrations of the Picture-Book task with this age group (e.g., Atance & Meltzoff, 2005). Children first answered an open-ended question about what item they would bring with them to each location. For example, when imagining visiting the desert, children were told "I want you to imagine going here tomorrow. Okay, let's pretend that you are going to go walk across the sand. It's time to get

ready to go!” and asked, “What should you bring to this place [desert]?” Children were then asked to explain why they would bring the chosen item to that location.

### *Children’s item choices*

Children’s item choices were first coded into categories that determined whether the item could address a future need in the location. Item choices were coded independently from children’s explanations to parallel the coding procedure of the Picture-book task as it has previously been scored (e.g., Atance & Meltzoff, 2005). The first category pertained to physiological needs and included food and drinks (e.g., water for desert). The second category included items that addressed physical situations in the location. Items that fell under this category included protective items or clothing (e.g., boots that addressed the physical situation of keeping one’s feet warm when visiting the snowy mountain). The third category included items that addressed the emotional situations of becoming bored or getting scared when visiting the location. Items that fell under this category included items that provided comfort (e.g., teddy bear) or items that could be used at the location to mitigate boredom (e.g., surfboard for the waterfall; skis for the snowy forest). The fourth category included items that could address possible emergency situations experienced at the location. Items that fell under this category included emergency supplies (e.g., medicine for the desert). For each location, children’s item choice was considered correct (addressing a future need) and given a score of 1, if it was assigned to one of the four item categories.

Item choices were considered incorrect and unable to address a future need in that location if they were a semantic associate (e.g., bringing snow to the snowy forest) or a nonsensical item (e.g., a polar bear to the snowy forest). With respect to the latter, all animal item choices were classified as nonsensical (versus semantic) given that: (1) it was not always clear whether children were selecting the item based directly on its semantic association with the location and (2) bringing any wild animal to a location was unrealistic and thus nonsensical. For example, one child chose to bring a camel to the desert, but their explanation for their choice was episodic (i.e., “so we don’t need to walk so long”) rather than semantic (e.g., appealing to the fact that camels live in the desert). Thus, for consistency all animals were coded as non-sensical. Importantly, for the purpose of our analysis, semantic associates and non-sensical items were not analyzed separately and were both scored as incorrect. Failure to provide a response or stating “don’t know” were also coded as incorrect. Thus, children were assigned an item choice score of 0 or 1 for each of the four locations and these scores were collapsed across locations, where scores could range from 0 to 4. **Table 1** provides examples of children’s item choice responses for each location with the corresponding category assigned. Agreement between two independent coders for item choice categories was almost perfect,  $\kappa = .95$ ,  $p < .001$ .

### *Temporal focus of children’s explanations*

All of children’s explanations were coded based on several criteria relating to temporal focus. First, we were interested in examining whether children’s explanations were future-oriented or

**Table 1.** Examples of Children’s Responses and Corresponding Item Category and Explanation Orientation.

Location	Example response (item choice ... explanation)	Item choice category	Explanation Temporal Focus
Desert	“Teddy bear ... I will play with him”	Emotional	Future
	“Medicine ... because when you get sick there”	Emergency	Future
Snowy forest	“Penguins ... Penguins there, ice”	Non-sensical	Generalized present
	“Jacket ... Because you might get cold”	Physical	Future + uncertain
Dirt road	“Apple ... It’s eating time”	Physiological	Generalized present
	“A seashell ... I don’t know”	Non-sensical	No response
Waterfall	“Some water boots ... Because I want to”	Physical	Present
	“Surfboards ... Because you would go down the hill”	Emotional	Future

present-oriented. Following a coding scheme used by Atance and O'Neill (2005), we coded the temporal focus of children's explanations as (1) future-oriented (e.g., *will, going/gonna, could*), (2) future-uncertain (e.g., *might, if, in case*), (3) present-oriented (e.g., *want to, need to*), (4) generalized present-oriented, which included explanations referencing a general current state or convention (e.g., *it's snowy, or because there's water*), or (5) no response, which included no explanation, or a response such as *because* or *don't know*. Longer explanations that included multiple clauses could be assigned to multiple categories. For example, "It's hot and we *might* get sunburnt" was assigned generalized present and future-uncertain category designations.

For each location, children's explanations were assigned a score of 1 if their explanation was future-oriented or future-uncertain. Otherwise, explanations were assigned a score of 0. Scores were collapsed across the four locations, where scores could range from 0 to 4. In addition, those explanations that were either future-oriented or future-uncertain were further coded for the presence of a state term referring to internal feelings (e.g., thirst, hunger, cold, hurt, etc.; see Atance & Meltzoff, 2005). Table 1 provides examples of children's explanations for each location with the assigned temporal focus category. Agreement between two independent coders for temporal focus and state terms in explanations was almost perfect,  $\kappa = .96, p < .001$ .

### Episodicity of children's explanations

All of children's explanations were also coded for episodicity. Adapted from Levine, Svoboda, Hay, Winocur, and Moscovitch (2002), children's explanations were coded as referencing: (1) internal details that were episodic and related to the specific event, (2) external details that were semantic (i.e., describing general knowledge or factual information), or not related to the specific event (i.e., details not central to the main event), or (3) referencing both external (semantic) and internal (episodic) details. Because children's explanations in the Picture-book task were generally much shorter than those from autobiographical interviews with adults, those explanations that were too vague or did not provide enough detail to determine if they were referring to internal or external details (e.g., "hot") were coded as "too vague". Additionally, children who provided no response (including children who said, "don't know" or "because") were coded as "no response". For each location, children were assigned an episodicity score of 1 if their explanation referenced internal (episodic) details (including explanations that referenced both internal and external details), otherwise a score of 0 was assigned. These scores were collapsed across locations, where scores could range from 0 to 4. Table 2 provides examples of explanations that were coded as internal versus external. Agreement between two independent coders for episodicity indicated substantial agreement,  $\kappa = .77, p < .001$ . All disagreements were resolved through discussion.

After children's explanations were coded for episodicity, all explanations were further coded under a number of additional categories (adapted from Levine et al., 2002) for the type of internal and external details. Explanations that were previously coded as internal were then

**Table 2.** Examples of Episodicity and Type of Internal and External Details in Children's Item Choice Explanations.

Example response (item choice ... explanation)	Episodicity	Type of internal or external details
"A life jacket ... because you might fall in the water"	Internal	Event
"Earmuffs ... Because you might get cold"	Internal	Thoughts/Emotions/Physiological
"Rain jacket ... cause there's tons of water"	External	General knowledge/Factual information
"Lemon ... because I like lemon juice"	External	Details not central to main event
"Water ... so when you get thirsty because deserts have no water"	Internal and External	Thoughts/Emotions/Physiological and General knowledge and factual information
"Sweats/Snowboots ... cuz you don't want to get snow"	Too vague	Not applicable
"I don't know ... no"	No response	Not applicable

categorized as relating to (a) *an event* taking place at the location, such as occurrences, weather conditions, or other people at the location, (b) *perceptual* experiences at the location, such as auditory, olfactory, or visual details, (c) *thoughts, emotions, or physiological states* experienced while at the location, (d) *time* details about the year, season, month, or day while at the location, or (e) *place* details localizing the future event (e.g., room, building, city). Explanations that were previously coded as external were then categorized as relating to (a) *general knowledge* or *factual information* about the location, or (b) details *not central to the main event* (see Table 2 for examples of explanations that were coded under these additional internal and external detail categories). Children's explanations were coded by two independent coders for external or internal detail category. Agreement between two independent coders for internal and external detail categories was high,  $\kappa = .89, p < .001$ .

### Procedure

Children were tested individually in a small laboratory room or at a local museum after receiving parental consent and child assent. The entire session took approximately 30 minutes to complete. In addition to the open-ended version of the Picture-Book task, children completed several other episodic foresight tasks not related to the main research question and thus not reported here. At the end of the testing session, children received a small prize and were thanked for their participation. Research ethics boards at the University of Ottawa and at Brock University approved all procedures.

### Analytic strategy

Three main sets of analyses were conducted. For each set of analyses, we first describe the pattern of results and then age-related findings. First, we examined children's item choices, describing the general categories these items corresponded to, followed by the relation between item choice performance (the number of correct items that addressed a future need) and age. Next, we examined the temporal focus of children's explanations, describing the frequency of future-oriented language, followed by the relation between use of future-oriented language in children's explanations and age. Last, we examined all explanations for episodicity, describing the frequency of internal (episodic) versus external (semantic) details, the relation between use of internal (episodic) details and age, and the specific types of internal and external details provided. Age in months was used in all analyses pertaining to age.

## Results

### Children's item choices

Table 3 shows the percentage of children's item choices by category across locations. Overall, 77% of children's item choices addressed a future need in the given locations, whereas 23% of

**Table 3.** Percentage of Children's Item Choices on the Picture-book task per Item Category by Imagined Future Location.

Item category	Desert	Snowy forest	Dirt road	Waterfall	Item category total
Physiological	29.2%	10.4%	10.4%	12.5%	15.6%
Physical	14.6%	47.9%	18.8%	58.3%	34.9%
Emotional	18.8%	18.8%	45.8%	14.6%	24.5%
Emergency	4.2%	2.1%	2.1%	0.0%	2.1%
Non-sensical	29.2%	20.8%	16.7%	10.4%	19.3%
No response	4.2%	0.0%	6.3%	4.2%	3.6%

Note.  $N = 48$ .

children's item choices did not. Typically, children chose items that addressed physical (35%) or emotional (24%) needs.

Location was not a significant predictor of children's item choice performance ( $Wald \chi^2(3) = 5.61, p = .13$ ), so performance on this variable was collapsed across the four locations. Descriptively, two children received a score of 0 (i.e., did not generate any correct items), two children received a score of 1, seven children received a score of 2, 16 children received a score of 3, and 21 children received a score of 4 ( $M = 3.08, SD = 1.07$ ). Children's item choice performance was significantly related to age in months,  $r(46) = .39, p = .01$ .

### **Temporal focus of children's explanations**

Across locations, 18% of children's explanations referenced the future, 16% referenced future-uncertainty, 17% referenced the present, 35% referenced the generalized present, and for 14% of the explanations no response was provided. Thus, 34% of children's explanations were future-oriented (either referenced the future or future-uncertainty). Of the future-oriented explanations, 36% included both a future term (e.g., might, will, gonna) combined with a state term (e.g., cold, thirst) referencing internal feelings (e.g., "Because you might get cold").

Location was not a significant predictor of future orientation in children's explanations ( $Wald \chi^2(3) = 5.47, p = .14$ ), so children's use of future orientation in their explanations was collapsed across the four locations. At a descriptive level, 20 children received a score of 0 (i.e., none of their explanations were future-oriented), nine children received a score of 1, eight children received a score of 2, seven children received a score of 3, and four children received a score of 4 ( $M = 1.29, SD = 1.37$ ). Across locations, children's age in months was related to greater use of future-orientation in their explanations,  $r(46) = .51, p < .001$ .

### **Episodicity of children's explanations**

Collapsing across locations, children's explanations for their chosen item referenced internal (episodic) details 35% of the time and referenced external (semantic) details 31% of the time, while only 3% of the explanations referenced both internal and external details. The remaining explanations were either too vague to code (16%) or no response was provided by the child (15%).

Given that the episodicity frequencies did not differ across locations,  $\chi^2(12) = 7.32, p = .84$ , children's episodicity score was collapsed across locations. At a descriptive level, 16 children received a score of 0 (i.e., none of their explanations contained internal details), 11 children received a score of 1, eight children received a score of 2, seven children received a score of 3, and six children received a score of 4 ( $M = 1.50, SD = 1.41$ ). Across locations, children used more episodic details in their explanations with age,  $r(46) = .41, p < .001$ .

Of the explanations that referenced internal details, 71% pertained to an event that would occur at the location, whereas 29% included thoughts, emotions, or physiological states. No children whose explanations were coded as internal mentioned time, place, or perceptual details about the location. When children provided external details in their explanations, they tended to report general knowledge or factual information about the location (87%). A smaller percentage of children referenced irrelevant details (e.g., "It's fun to eat") that were unrelated to the location (13%). Finally, when children provided both internal and external details in their explanations (five children did so): 60% of children referenced information about the event and general knowledge or factual information about the location, 20% referenced thoughts, emotions, or physiological information and general knowledge about the location, and 20% referenced event details and details not central to the main event.

## Discussion

The current study is the first to explore children's ability to generate a useful item for a future situation using a new, open-ended version of the Picture-book task. First, we found that the majority of 3- to 5-year-olds were able to generate an appropriate item to bring with them to a future location and were equally capable of doing so across a variety of novel locations. Children's ability to generate appropriate items also improved with age. Second, children's explanations were predominantly present-oriented, while less than half of the explanations referenced the future. Further, older children referred to the future in their explanations more frequently than younger children. Interestingly, children referred to internal and external details in their explanations approximately equally, but older children tended to use more internal (episodic) details in their explanations than younger children.

Our finding that, irrespective of age, children were quite proficient at generating their own items for use at a future point in time adds to the small body of work that has begun to examine more generative forms of future thinking in young children. Specifically, 77% of children's item choices were coded as able to address a future need at the locations. Notably, children seemed particularly capable of generating items that addressed a physical (e.g., clothing to protect against environmental factors) or emotional need (e.g., toys to reduce boredom). Research that has adapted "forced-choice" episodic foresight tasks to promote more spontaneous or generative responses generally report that children perform quite well (Atance et al., 2019; Caza & Atance, 2019; Moffett et al., 2018). For example, Atance et al. (2019) found that children were able to verbally generate an item to solve a future problem, although this was more difficult than choosing between items already provided to them (i.e., forced-choice measure). Yet, despite children's reported difficulty on open-ended compared to forced-choice measures of episodic foresight, we found that the majority of children generated appropriate item choices using this open-ended version of the Picture-book task (33% of children generated three correct items out of four, and 44% of children generated all four correct items). Nonetheless, on forced-choice versions of the Picture-book task performance seems to be even higher with the majority of children, particularly older children (4- to 7-year-olds), performing at ceiling (Atance & Meltzoff, 2005; Mazachowsky & Mahy, 2020). For example, 79% of 3- to 7-year-olds performed perfectly across 3 trials of a forced-choice version of the Picture-book task (Mazachowsky & Mahy, 2020). Despite the added difficulty of open-ended questions, these may better capture children's independent thinking and more accurately reflect the type of questioning or demands children encounter in everyday life. Future research should continue to investigate which forms of questioning most accurately assess children's episodic foresight.

As expected, children's ability to generate appropriate items for future use on the open-ended version of the Picture-book task differed as a function of age. In this respect, our findings align with the larger episodic foresight literature (e.g., Mahy et al., 2014; Suddendorf & Busby, 2005) and with studies using the forced-choice version of the Picture-book task (e.g., Atance & Jackson, 2009; Atance & Meltzoff, 2005) that show developmental improvements in episodic foresight across the preschool years. Research using more spontaneous tasks has also reported age-related development in episodic foresight (Atance et al., 2019; Moffett et al., 2018), although the differences between age groups are inconsistent. For example, Moffett et al. (2018) found that 5-year-olds spontaneously generated a solution to solve a problem in the future more often than 4-year-olds, while Atance et al. (2019) only found a significant difference in generative episodic foresight among their oldest and youngest age groups (i.e., 5-year-olds and 3-year-olds). Overall, it is encouraging that open-ended and forced-choice questions similarly show improvements in children's episodic foresight from ages 3 to 5. Importantly, while previous work using verbal episodic foresight tasks has suggested that verbal demands may affect children's performance (see Hudson et al., 2011 for discussion), even the youngest children in our study seemed capable of spontaneously reporting their thinking and producing items that would be useful in the future.

Surprisingly, having children generate an item to bring to a future location may not promote greater future orientation as evidenced by our finding that only 34% of children's explanations were coded as such, whereas 52% were present-oriented. However, our frequencies are in line with Atance and O'Neill (2005) who found that when 3-year-old children were asked to explain why they would bring an item on a trip (e.g., raisins, juice, money, sunglasses) their explanations referenced the future (future and future uncertainty) 37% of the time, and the present (present and generalized present) 46% of the time. Despite Atance and O'Neill's (2005) study only testing 3-year-olds, we found comparable temporal focus frequencies (34% future-oriented and 52% present-oriented) in 3-to 5-year-olds' explanations in the current study. Interestingly, we found age-related differences in the frequency with which children used future-orientation in their explanations suggesting that with age children tended to justify their item choice using more future-oriented (e.g., will, gonna, might), than present-oriented language. Similar results have been found using the forced-choice version of the Picture-book task. For example, Atance and Meltzoff (2005) found that 3-year-olds used less future talk in their explanations than 4- and 5-year-olds. Our finding that use of future-oriented language improves with age coincides with the substantial growth of children's future-oriented abilities that occurs across the preschool years (e.g., Atance & Jackson, 2009).

Children's explanations were also examined for their reference to internal, episodic details compared to external, semantic details. Descriptively, we found that children referenced both internal (episodic) and external (semantic) details approximately equally in their explanations for their item choices. Researchers have suggested that children may perform better on forced-choice behavioral measures of episodic foresight by relying on general knowledge (e.g., deserts are hot) and semantic associates (e.g., waterfall and raincoat) rather than processes associated with future simulation (e.g., Atance & Meltzoff, 2005; Hudson et al., 2011). Children seemed to similarly rely on external (semantic) details on this open-ended measure. We also found that children tended to use more internal, episodic details in their explanations with age. Increased use of episodicity, particularly in the context of personal narratives about a future event, have similarly been reported to increase across the childhood years (e.g., Coughlin, Lyons, & Ghetti, 2014). Nevertheless, many children provided semantic details in their explanations, particularly general information or factual knowledge about the location, and it may be the case that even the open-ended questions posed to children in our study did not demand more self-projection than the forced-choice version of the task.

A limitation of the current study is that the Picture Book methodology does not exclusively draw on children's ability to generate a novel solution to future problems (as in the two-rooms task, for example; Suddendorf & Busby, 2005), given that children likely had prior experience with many of the items they generated in the open-ended condition (e.g., suitcase, sunscreen, etc.) and there were multiple solutions to the future problem. Since children struggle with innovation (e.g., innovation of a tool to solve a problem; Beck, Apperly, Chappell, Guthrie, & Cutting, 2011) in early childhood, future research should continue to investigate children's ability to verbally generate solutions in the face of novel future problems.

Second, the current study (nor any other study to our knowledge) did not account for children's baseline knowledge of the locations used in the Picture-book task. A basic understanding of the key properties of each location (i.e., a desert being hot and sunny) is an important prerequisite in order to generate a relevant item to address a future state. Importantly, this task has been successfully used in multiple studies (e.g., Atance & Jackson, 2009; Mahy et al., 2014; Mazachowsky & Mahy, 2020) and our own data show that 77% of children were able to generate at least three correct items. Atance and Meltzoff (2005) also reported that for each location, children chose the correct item significantly above chance suggesting that children were not guessing. They also found similar performance across locations which suggests that children had a solid understanding of the properties of all locations.

A third limitation is that the open-ended questioning used in the current study still does not capture children's truly spontaneous episodic foresight. That is, children do not, of their own volition, seek out an item for future use but, rather, are directly asked about an item they should bring. Thus, further investigation of children's episodic foresight could consider adapting episodic foresight tasks, like the Picture-book task, to place more demands on children's future projection and to align more closely with purely spontaneous episodic foresight.

Fourth, although the Picture-book task asks children to imagine visiting several future locations tomorrow, it is possible that children could succeed on this task by imagining the place in the future, without temporally situating themselves in a specific future point in time. This distinction aligns with Hoerl and McCormack's (2019) dual process theory of temporal cognition. Specifically, the more primitive, temporal updating system, which includes previously learned information about location, environment, and the world, may be all children need to draw on in the Picture-book task. In contrast, the more sophisticated temporal reasoning system (involves reasoning about time and temporal order) may not be required for success on the task.

Finally, the current study did not include a measure of verbal ability, which could limit children's ability to explain their item choice in a future-oriented manner. However, Atance and O'Neill (2005) did not find a relation between general language ability and future talk when children were asked to explain why they would bring a chosen item (from a provided set of options) on a future trip.

Given the importance of episodic foresight in the development of autonomy and optimal functioning in children's daily lives, understanding its development under various task demands is an important endeavor. Future research should continue to examine the contexts in which examining children's open-ended responses are best suited to evaluate performance. Open-ended questioning may be useful in extending our knowledge of the development of children's episodic foresight and temporal cognition more broadly and should be considered when designing future measures to capture this important ability.

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