Novel ways to measure future-oriented cognition: Using parent-report measures and open-ended responses to explore young children's future thinking development

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Abstract

Future-oriented cognition encompasses a set of key abilities that children must develop for successful functioning in daily life including, saving, prospective memory, episodic foresight, planning, and delay of gratification. These future thinking abilities are supported by memory systems (e.g., semantic, episodic), as well as constructive processes, self-projection, and executive functions. Research primarily measures young children's future-oriented abilities through behavioural tasks, which have various limitations and may not engage future thinking. The current studies introduce new methods to overcome some of these limitations: developing a parent-report questionnaire and examining children's open-ended responses. In Study 1 (N = 101; Mazachowsky & Mahy, 2020), 3-to 7-year-old's future thinking was examined to establish the psychometric properties of a new parent-report measure, The Children's Future Thinking Questionnaire (CFTQ). The CFTQ detected development of children's future thinking and is a reliable and valid measure. Study 2 (N = 48; Mazachowsky et al., 2020) examined 3-to 5-year-old children's episodic foresight using a novel, open-ended version of the Picture-book task. Results showed that children were able to generate items for future use and were more successful with age. Children's explanations for their generated items were typically present-focused and included both episodic and semantic details. Expanding on Study 2, Study 3 (N = 158; Mazachowsky et al., revisions requested) explored 3-to 5-year-old's explanations for their item choices on two episodic foresight tasks to determine the degree to which these tasks engaged children's episodic and future-oriented processes. Children provided more future-oriented explanations on the Picture-book task compared to the Spoon task, but episodicity did not differ between tasks. Further, children's Picture-book task explanations included more first-person personal pronouns compared to the Spoon task, but explanations did not differ in other pronoun

use. Together, these studies show that use of a parent-report measure and examination of children's open-ended responses offer unique insight into the development of young children's future thinking and engagement in future-oriented processes.

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CHAPTER 1

General Introduction

Novelist John Galsworthy (1928) wrote “if you do not think about the future, you cannot have one”. Indeed, thinking about the future is an important cognitive capacity that allows humans to anticipate, imagine, plan, and consider a time beyond the present. This ability is referred to as future-oriented cognition and is a frequent mental activity, which is engaged in daily by children and adults. Some researchers suggest that future thinking occurs almost twice as much as thinking about the past (38% versus 21%; Jason et al., 1989) and as frequently as 59 times per day, on average (e.g., D'Argembeau et al., 2011). In daily life, future thinking makes possible a wide variety of tasks, such as when children need to remember to hand a permission slip to their teacher the following day, imagine what their upcoming beach vacation might be like to pack their suitcase, or save their pocket money to buy a gift for their sibling’s birthday. Future thinking more specifically encompasses a variety of abilities such as saving behaviour, prospective memory, episodic foresight, planning, and delay of gratification. Importantly, being able to accurately anticipate the future, remembering to carry out future actions, and acting to benefit the future-self are important for avoiding a variety of negative consequences in social, academic, and health domains (e.g., Daniel et al., 2015; Moller et al., 2021; Shoda et al., 1990). For example, children’s ability to perform prospective social tasks in the future (e.g., remembering to bring a present to a friend’s birthday) impacts adults’ judgements of children’s character traits (e.g., intelligent, capable, trustworthy; Moller et al., 2021). Other researchers have reported that for children with obesity, mental projection (i.e., imagining positive autobiographical future events) reduced their calorie consumption (Daniel et al., 2015). Thus, understanding the emergence and development of future thinking in childhood is critical to children's independent everyday functioning. Further, exploring novel ways of measuring children's future thinking may lead to important discoveries or insight about their development to foster more future-focused adults.

Theoretical Accounts of Future-Oriented Cognition

Future-oriented cognition (also referred to as future projection or future thinking) is multidimensional and various theories and models have been proposed to identify the component abilities encompassing or underlying future-oriented cognition. Tulving (1972) and others (e.g., Suddendorf and Corballis, 2007) have suggested that future thinking is supported by two core memory systems: semantic memory (general knowledge) and episodic memory (personal past experiences). The constructive episodic simulation hypothesis (Schacter & Addis, 2007) emphasizes the role of episodic memory in allowing one to recall past events to build novel representations of the future. In support of this theory, research with amnesic patients with damage to the bilateral hippocampus showed impairment in constructing new future experiences as well as recalling past experiences (Hassabis et al., 2007). However, Irish and Piguet (2013) suggested that semantic memory is also important for forming future representations (i.e., the semantic scaffolding hypothesis) showing that individuals with semantic memory impairment also had difficulty imagining the future. Szpunar et al. (2014) later proposed an organizational framework, the "taxonomy of prospection", which included four interacting modes of future thinking: simulation, prediction, intention, and planning that range from episodic to semantic in nature on a continuum. According to this framework, an individual may construct a personal future event demonstrating episodic simulation but could also construct a general future event demonstrating semantic simulation, and between these points on the continuum may lie the construction of a non-specific personal event.

In addition to memory mechanisms, constructive processes (the process of generating a complex mental scene based on the retrieval and recombination of past events; e.g., Hassabis & Maguire, 2007; Schacter & Addis, 2007), self-projection (moving attention beyond the present-self and mentally projecting the self into the future; Buckner & Carroll, 2007), and executive processes (used to retrieve information from long-term memory and to manipulate and hold information from the past while forming a future representation) have also been proposed as critical processes supporting future thinking. In support of the involvement of various components in future thinking, D'Argembeau et al. (2010) found relations between future thinking and executive processes, future-time perspective, and visual-spatial processing. Thus, these theories have aided in understanding the mechanisms supporting future-oriented cognition and its various domains, but these theories are mainly based on adult neuroimaging studies with little support for the component processes of future thinking arising from developmental work (but see Quon & Atance, 2010).

Development of Future-oriented Cognition

Similar to other cognitive abilities (e.g., executive function; Zelazo et al., 2014), future-oriented cognition follows an inverted U-shaped trajectory across the lifespan marked by dramatic improvements in future thinking during early childhood continuing into adulthood and then declining into older adulthood (e.g., Abram et al., 2014; Kliegel et al., 2008; Zimmermann & Meier, 2006). The substantial increase in future-oriented thinking that occurs during the preschool years, mapping onto the ages of 2 to 6 years, makes it a particularly important developmental period to examine (e.g., Atance & Jackson, 2009; Ślusarczyk et al., 2018; Suddendorf et al., 2010). For example, during this time, preschool children gradually produce and begin to accurately use future temporal terms (e.g., "next week", "tomorrow") such that by 4 years old temporal terms are an established part of children's vocabulary (Grant & Suddendorf, 2011). Indeed, most of the future thinking domains (e.g., saving, prospective memory, episodic foresight, planning, and delay of gratification) show similar developmental trajectories using a variety of different methods (e.g., parent report, behavioral measures, etc.). In the following sections, developmental findings in young childhood will be discussed in five key domains of future-oriented cognition: saving, prospective memory, episodic foresight, planning, and delay of gratification

Saving Behaviour

Reserving limited resources for future use or consumption represents the first key domain of future-oriented cognition, saving behaviour (Metcalf & Atance, 2011; Kamawar et al., 2018). Theoretical perspectives like the *future-self continuity* hypothesis (Ersner-Hershfield et al., 2009) have been proposed to explain why some individuals save for the future while others do not. Ersner-Hershfield and colleagues (2009) found that adults who felt more connected to their future-self also placed more value on future rewards and accrued greater financial assets in real-life (e.g., higher proportion of home owned, more money in the bank). Past research with children has also examined their saving development in the context of economic behaviours, suggesting that children's understanding of banks and the functional role of money improves across childhood (e.g., Sonuga-Barke & Webley, 1993; Otto et al., 2006). Using a board game and structured questioning, Sonuga-Barke and Webley (1993) examined 4-, 6-, 9- and 12-year-old children's purchases and deposits/withdrawals from a bank, as well as their saving strategies during the game. Between 6 and 12 years, the most development in children's economic behaviours occurred, such that children showed increasing awareness of the usefulness of banks as a strategy to protect their money from being spent and better understanding that spending money in the present had consequences for future spending opportunities. In contrast, 4-year-olds showed little understanding of the functional use of banks and the reasons why one should save, explaining their choice to use the bank with statements such as “because I do” (p. 26).

More recent research has focused on preschool children’s saving, which may be displayed by their saving of more age-appropriate resources, such as specific items. Metcalf and Atance (2011) designed a marble game where children were provided with a limited number of marbles to use on a small less exciting marble game in the first room and a larger more exciting marble game in a second room (Figure 1.1). Thus, children needed to anticipate future boredom and disappointment if they used all their marbles on the small marble game in the first room. Results showed that children generally struggled to spontaneously save for the future with no improvements across 3-to 5-year-old’s saving. However, other research using the Marble Game has reported age-related improvements in children’s saving when strategies were implemented, such as reminding children that they can save marbles if they want to (Atance et al., 2017) or having children budget the number of marbles they will use on the small and large marble runs prior to playing the game (Kamawar et al., 2019).

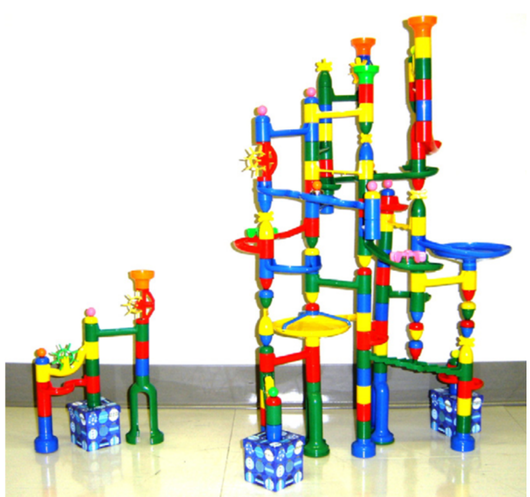

Figure 1. 1. The Marble Game. Small less exciting marble run (left) and large more exciting marble run (right). Taken from Metcalf, J. L., & Atance, C. M. (2011). Do preschoolers save to benefit their future selves?. Cognitive Development, 26, 371-3821

Other psychological and social factors influence young children's saving behaviour. For example, children's feelings about saving, such as the degree to which an individual finds spending money painful, may play a role in their desire to save financial resources (e.g., Smith et al., 2018). A "tightwad" describes an individual who finds spending money distressing and tends to spend less, while a "spendthrift" describes an individual who is not distressed by spending and tends to spend more (Rick et al., 2008). Smith et al. (2018) found that children's spendthrift versus tightwad tendencies predicted their spending behaviour such that children with spendthrift tendencies were more likely to spend their money on a bag of candy compared to children with tightwad tendencies. Further, children developed more tightwad tendencies with increasing age. In addition to individual differences in spending, social factors (e.g., parent's attitudes about saving and parent's financial practices) have also been shown to impact the development of children's saving versus spending behaviour (e.g., Tang, 2017). Overall, across the preschool years, children struggle to save money or resources for the future spontaneously, but a desire to save, parent saving practices, or saving strategies may help support the development of children's saving for the future.

Prospective Memory

Prospective memory (PM), the second key domain of future thinking, involves remembering to carry out intentions in the future (Einstein & McDaniel, 1990). Prospective memory tasks may be event-based, such that the prospective intention is carried out in response to a certain event cue (e.g., remembering to return a book when you see your friend), or time-based, such that the prospective intention is carried out at a specific time or after a certain amount of time (e.g., returning a book to the library at 8 a.m. or in 15 minutes; Einstein & McDaniel, 1990). One common paradigm used to measure children's event-based PM in the laboratory are card-sort tasks. On these tasks, children are provided with an intention to carry out (intention formation; e.g., place animal cards in a box behind them), then after a delay period, children begin the on-going task (e.g., naming pictures of everyday objects on cards) that has the PM cues imbedded within it (Figure 1.2; Kvavilashvili et al., 2001; Mahy et al., 2014).

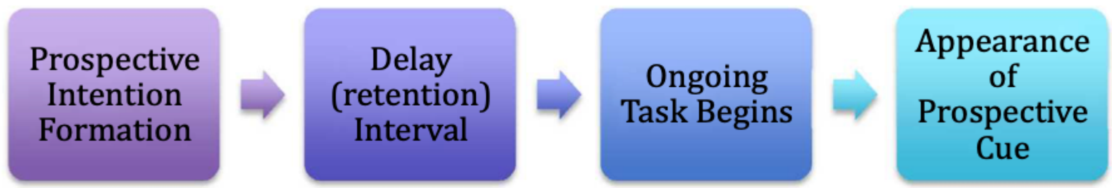

Figure 1.2. Components of a prospective memory task. The typical PM task paradigm begins with the presentation of the prospective intention, and after a delay interval to allow the PM intention to be retained, the on-going task begins. Within the on-going task, the prospective cues are embedded. Taken from Mahy, C. E., Moses, L. J., & Kliegel, M. (2014). The development of prospective memory in children: An executive framework. *Developmental Review*, *34*, 305-326.

Generally, children's event-based PM performance on card sort tasks improves across 3 to 7 years old (e.g., Atance & Jackson, 2009; Kvavilashvili et al., 2001; Mahy et al., 2014; Mahy et al., 2018; Sheppard et al., 2015). A few studies have examined PM in 2-year-olds, but this research generally suggests that at 2 years old PM is quite limited by their inability to recall the task instructions (Kliegel & Jäger, 2007; Ślusarczyk et al., 2018). Time-based tasks (e.g., remembering to stop catching fish after 1-minute had elapsed) are more difficult than event-based (e.g., remembering to stop catching fish when a striped fish appeared on the screen) but have been successfully used in in children as young as 5-year-olds (Kretschmer et al., 2014; Yang et al., 2011). The Cyber cruiser (Kerns, 2000) is one such time-based PM task where children navigate traffic hazards in a driving simulation game (ongoing task) and are required to monitor the fuel levels and refuel the car (PM intention) once every minute. On time-based PM tasks, developmental improvement in PM is also found (Kerns, 2000; Kretschmer et al., 2014; Voigt et al., 2011).

When intentions are carried out regularly (e.g., remembering to brush your teeth before bed each night), researchers have further distinguished these types of PM tasks as “habitual” versus the more irregularly performed “episodic” PM tasks (e.g., remembering to give parents a note from the teacher when you arrive home; Graf & Uttl, 2001). The cognitive processes supporting episodic and habitual PM tasks have been described by two PM theories. Under McDaniel and Einstein’s (2000) Multiprocess framework, retrieval of prospective intentions can rely on strategic attentional resources (e.g., strategic monitoring), or automatic processes. In contrast, according to Smith’s (2003) Preparatory Attentional and Memory Processes theory, effortful attentional processes are always required for retrieval of the PM intention, which opposes the designation of spontaneous retrieval experiences as PM (e.g., Anderson et al., 2017) that may occur during habitual PM tasks. Studies that have compared children’s performance on habitual and episodic PM tasks using a Virtual Week game find that 8-to 12-year-olds perform regular PM tasks more frequently than irregular PM tasks (Henry et al., 2014). A new parent report-measure, the Children’s Everyday Memory Questionnaire, also distinguishes between habitual and episodic PM tasks finding that children’s episodic and habitual PM are significantly related and improve across childhood (Mazachowsky et al., 2021). Nevertheless, both the Multiprocess framework and PAM theory support the role of executive processes in prospective memory. Indeed, the Executive Framework of PM development (Mahy et al., 2014) suggests that in young childhood retrospective memory initially drives PM development by helping children remember what they are supposed to do (i.e., remember the PM intention). However, by about 4 years old, executive functions (e.g., working memory, inhibition) become more critical for children's PM development by helping them to carry out the intention at the appropriate time once they have sufficient memory ability to encode, store, and retrieve the prospective intention. In sum, PM research supports developmental improvements of this future-oriented ability across childhood. Initially, young children can carry out event-based PM tasks and later, more difficult or complex PM tasks, such as time-based tasks, as component abilities (e.g., executive functions, monitoring; Mahy et al., 2014) improve.

Episodic Foresight

The third key domain of future thinking, episodic foresight (also referred to as episodic future thinking or mental time travel) involves mentally projecting oneself into the future and acting with that imagined future in mind (Atance & O'Neill, 2001; Hudson et al., 2011; Suddendorf & Corballis, 1997). Theoretically, episodic foresight is thought to draw on both episodic and semantic memory (Tulving, 1984). Semantic memory stores knowledge about the world acquired from previous experience or past events, but it is not tied to a specific experience (Tulving, 1984; 2005), such as knowing that apples are fruit and could be red or green in colour. Episodic memory is thought to develop later than semantic memory (e.g., Hudson & Nelson, 1986) and stores information about personal experiences including temporal markers (e.g., when the event occurred; Tulving, 1984; 2005), such as remembering apple picking at a local orchard last year. According to Schacter and Addis' (2007; Addis & Schacter, 2008) *constructive episodic simulation hypothesis*, episodic memory provides the details that allow one to simulate future events and is also constructive, allowing these past details to be flexibly recombined into a novel future event. Supporting this conceptual framework is neuroimaging research showing a shared network of regions (i.e., mapping on to the default network) support past and future thinking (Schacter et al., 2007), such that similarities in neural activation of the hippocampus were found when adults elaborate on details from past and future events (Addis & Schacter, 2008).

There are a variety of tasks used to measure the development of episodic foresight that generally show that children's episodic foresight improves during the preschool years (e.g., Atance & Meltzoff, 2005; Bélanger et al., 2014; Caza et al., 2021; Quon & Atance, 2010; Suddendorf & Busby, 2005). For example, using a choice task, Russell et al. (2010) had 3- to 5-year-olds select two items needed to play a novel game in the future. Five-year-olds chose the two correct items (i.e., a straw and a box) above chance levels, while none of the 3-or 4-year-olds selected the two correct items. However, when children were asked to select the items for present use, all age groups performed above chance levels. Other studies, like Suddendorf et al. (2010) have used verbal measures to examine 3-and 4- year-olds emerging episodic foresight abilities by having them report what they did yesterday or what they will do tomorrow. Results showed that 4-year-olds produced significantly more correct responses to the future question (81%) compared to 3-year-olds (37%). Further, supporting the link between past and future thinking, children's ability to produce correct responses on the past and future questions were related after controlling for age. A few studies have also examined naturalistic parent-child conversations and suggest that children as young as 2 years old engage in conversations about upcoming future events (e.g., Hudson, 2006; Hudson, 2002; Shin et al., 2020). Generally, these parent-child conversations about the future were temporally more complex (e.g., used hypothetical talk, referenced future events, and general event knowledge) compared to conversations about past events (e.g., used past tense and referenced familiar events; Hudson, 2002). Also capturing age-related changes in episodic foresight and the most frequently used measures are the Picture-book task and the Spoon task, which involve a forced-choice component and often a verbal component.

The Picture-book task has been used across a number of studies to examine young children's ability to project themselves into a novel scenario and anticipate their future needs (e.g., Atance & Jackson, 2009; Hanson et al., 2014; Mahy et al., 2014). In the general paradigm, children imagine visiting unfamiliar locations in the future such as a desert, rocky stream, dirt road, snowy forest, mountain, and waterfall (Atance & Meltzoff, 2005). For each location, children first make a choice between three items to take to the location (e.g., dirt road: water, present, plant), which should serve a purpose in the future or address a physiological state likely to be experienced in the location (e.g., water would address thirst when walking along the long dirt road). Then, children explain why they chose the selected item. Capturing the development of children's episodic foresight, Atance and Meltzoff (2005) found that that 3- and 4-year-olds selected the correct item less frequently compared to 5-year-olds. Further, children referred to the future (e.g., used future terms such as "would", "might", "going to") and future states (a future term paired with an internal, state term, e.g., "I *might* get *cold*") in their explanations. Generally, studies using the Picture-book task consistently show that children are better able to select the correct item for the future and provide a future-oriented explanation as they get older (e.g., Atance & Jackson, 2009; Hanson et al., 2014; Mahy et al., 2014). In these previous studies using the Picture-book task, children's response options are limited (i.e., children must choose an item for the future location from the provided items), and their explanations have not been extensively examined (but see Atance & Meltzoff, 2005) under varying conditions (e.g., presentation of different response options).

The Spoon test (Tulving 2005; Suddendorf & Busby, 2005) is also frequently used to measure children's ability to solve a novel problem in the future, such as selecting the appropriate tool to open a box in the future. The task is based on an Estonian story of a girl who dreams she cannot eat pudding at a party because she did not bring a spoon, so the following evening she brings a spoon to bed should she return to the party again in her dreams (Tulving, 2005). In this paradigm, children are brought to Room 1 where they encounter a problem, such as a locked box containing stickers (Figure 1.3). Children then move to a second room where they select an object (e.g., a key corresponding to the shape of the locked box in Room 1) to bring to Room 1 after a brief delay. To select the correct object, children must anticipate that the object could fulfil a future need in the previous room (e.g., opening the locked box to retrieve the stickers; Suddendorf & Busby, 2005; Suddendorf et al., 2011). In some adaptations of the Spoon test children also explain their object choice. When they select the correct item, children tend to reference the previously encountered problem in their explanations (e.g., Caza & Atance, 2019; Suddendorf et al., 2011). Research using the Spoon task and its adaptations shows that children more successfully fulfill physiological (e.g., hunger; Caza & Atance, 2019) and psychological (e.g., boredom; Atance & Sommerville, 2014; Caza & Atance, 2019; Suddendorf & Busby, 2005) future needs with age. However, children's performance may be negatively affected by the domain of the future need being fulfilled (i.e., performance was worse for psychological versus physiological needs; Caza & Atance, 2019) and the delay period between the first and second room (e.g., performance was worse for 15-minute vs. 5-minute delays; Scarf et al., 2011).

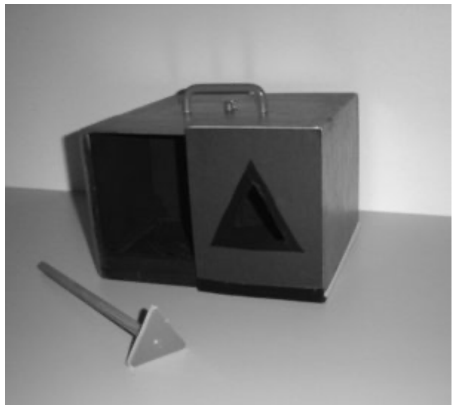

Figure 1.3. The Spoon task. Child encounter a locked box (top) in Room 1. Then, they move to Room 2 where they select a key (bottom) to bring to Room 1. Once back in Room 1, if children select the appropriate key, they can use it to open the box and retrieve stickers. Taken from Suddendorf, T., Nielsen, M., & Von Gehlen, R. (2011). Children's capacity to remember a novel problem and to secure its future solution. *Developmental Science*, *14*, 26-33.

Recently, the Spoon task has been adapted to explore children's spontaneous episodic foresight. For example, Caza and Atance (2019) examined 3-to 5-year-old children's spontaneous future talk and found that children who selected the correct room to leave an item for future use made more spontaneous references to the future event during the task compared to children who selected the incorrect room. However, there was no effect of age on children's production of future talk despite age effects on task performance. Thus, developmental changes in children's episodic foresight from 3 to 6 are generally captured across studies using episodic foresight tasks, like the Spoon and Picture-book tasks. However, children's explanations on the Spoon and Picture-book tasks may capture more subtle changes in the development of children's episodic foresight which will be investigated in my dissertation.

Planning

The fourth future thinking domain, planning, involves the formation and construction of future goals, and envisioning steps or actions to achieve a future goal (Atance, 2008; Shapiro & Hudson, 2004). Planning is often classified as an executive functioning ability (e.g., Bishop et al., 2001; Welsh, Pennington, & Grossier, 1991). In line with the cognitive complexity and control theory (Zelazo & Frye, 1998), it has been proposed that planning may rely on conditional reasoning (e.g., if-if-then reasoning) rather than the inhibition of inappropriate actions (Frye, 2000). Nevertheless, the ability to flexibly represent time and temporal order is also thought to be important for planning development (e.g., see McCormack & Atance, 2011 for review). Generally, substantial improvements in planning occur between 3 and 5 years of age. For example, 3-year-old children may be able to execute plans to meet a single goal, while 4-year-olds are better able to sequence future events (e.g., multi-step plan for going to the grocery store), however, by 5 years old they become more proficient at independently executing more complex plans and adapting these plans according to new goals (Hudson & Fivush, 1991; Hudson et al., 1995; Friedman, 1990). Tower tasks, such as the Tower of Hanoi (Welsh, 1991) and the Tower of London (Shallice, 1982), are widely used to measure preschooler's planning ability. In the Tower of Hanoi task, children must plan the movement of disks from a start state to an end state that matches that of the experimenter, while adhering to a set of rules (Figure 1.4; e.g., only one disk can be moved at a time, smaller disks cannot be stacked on larger disks, and disks cannot be placed on the table; Bishop et al., 2001). Children progress through several levels which increase in difficulty.

On tower tasks, older children generally outperform younger children by achieving higher levels of difficulty marked by planning more difficult sequences of moves and using fewer moves to achieve the goal disk configuration (Atance & Jackson, 2009; Kaller et al., 2008).

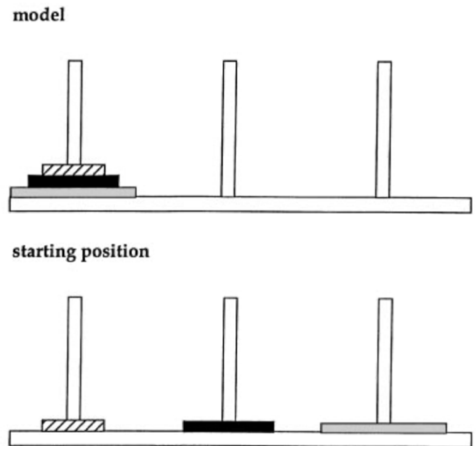

Figure 1.4. The Tower of Hanoi task. Child are presented with disks on pegs in a starting position (bottom) and must adhere to a set of rules while moving the disks to an ending configuration matching the model (top). Taken from Bishop, D. V. M., Aamodt-Leeper, G., Creswell, C., McGurk, R., & Skuse, D. H. (2001). Individual differences in cognitive planning on the Tower of Hanoi task: Neuropsychological maturity or measurement error?. *The Journal of Child Psychology and Psychiatry and Allied Disciplines*, *42*, 551-556.

Route planning tasks, such as the Truck Loading task (Fagot and Gauvain, 1997) where children plan the delivery order of coloured invitations that match the order of coloured houses on a street similarly capture advances in children's planning across early childhood (e.g., Carlson et al., 2004; Atance & Jackson, 2009). The development of children's planning has also been found using parent-report measures, like the Plan/Organize subscale of the Behavior Rating Inventory of Executive Function (Gioia et al., 2003; e.g., "Has trouble thinking of a different way to solve a problem or complete an activity when stuck"), which is a valid measure of children's executive abilities (Duku & Vaillancourt, 2014). Generally then, children become more proficient planners during the preschool years and develop the ability to carry out more complex, multi-step plans for the future into later childhood.

Delay of Gratification

Delay of gratification, the last key domain of future thinking, involves the voluntary postponement of an immediate reward for the sake of a greater future reward (Mischel et al., 1989). Two paradigms are primarily used to measure children's delay of gratification. The first and more widely used is the maintenance paradigm (also known as the classic *marshmallow test*, e.g., Shoda, Mischel, & Peake, 1990) where children are presented with one consumable treat, such as a marshmallow, and told that if they wait (e.g., 15 minutes) until the experimenter returns to consume the treat then they can have multiple treats. Children's ability to delay gratification is measured by the length of time they delay the reward. In the choice paradigm, children are presented with the choice of a smaller quantity of items immediately or a larger quantity of the item in the future across multiple trials (e.g., one sticker now versus three stickers later). Children are scored based on how many delay choices they make. Across these tasks, 3-year-olds typically fail to delay and opt for the immediate reward more often, while 4-year-olds are better able to delay for the future reward (e.g., Atance & Jackson, 2009; Imuta et al., 2014; Prencipe & Zelazo, 2005). However, these developmental improvements in delay of gratification may also vary according to the quantity or visibility of the reward with children waiting longer for larger (e.g., Lemmon & Moore, 2007; Steelandt et al., 2012) and non-visible rewards (Mischel & Ebbesen, 1970). For example, Lemmon and Moore (2007) found that 4-year-olds often preferred the "later" option when the presented quantities were of a 1:5 ratio, whereas 3-year-olds tended to choose the "delay" option regardless of the delayed reward quantity. Further, when the delayed reward was made substantially larger (i.e., 40 pieces of a cookie), even 2-year-olds have been shown to sustain a delay period of up to 16 minutes (Steelandt et al., 2012). Emerging research has found that children's ability to delay on the marshmallow task has increased over the past 50 years such that children of today wait longer (i.e., approximately 2 minutes longer) for the delayed marshmallow than children of 50 years ago suggesting a possible cohort effect (Protzko, 2020).

One theory used to explain children's performance on delay tasks is the hot/cool systems framework (e.g., Mischel et al., 2011). It is suggested that in 3-year-olds, the desirable treat or reward may automatically trigger the "hot" system resulting in children having difficulty overcoming the pull of the immediate reward. However, as children get older, they are better able to activate their "cool" system, which allows them to envision the future benefits of delaying and receiving a larger reward (e.g., Garon et al., 2012). Imuta et al. (2014) found support for this theory using a modified choice paradigm where the now versus later quantity of stickers were added to one pile, rather than separated in now vs. later piles. The researchers found that by diverting children's attention away from the immediate reward (i.e., reducing activation of the "hot" system), 3-year-olds were better able to delay and performed comparably to 4-year-olds. Overall, like the other domains of future-oriented cognition, children's ability to delay gratification improves across early childhood, but may be subject to individual differences (e.g., Shoda, Mischel, & Peake, 1990). For example, Twito (2019) found that 7-year-olds who valued conservation (i.e., value to maintain the "status-quo") preferred immediate, smaller rewards, while 7-year-olds who valued self-enhancement preferred later, larger rewards.

Effects of Perspective Taking and Conflict

Research has identified several factors that influence children's future thinking performance. The first factor that is shown to aid future thinking, particularly in young children, is psychological distance. On most future thinking tasks, children are asked to reason about their personal futures, however when children are asked to reason about the future and make future decisions from a more distant perspective (e.g., another child, adult, or their future-self), a so called "other-over-self" advantage is found (e.g., Bélanger et al., 2014; Lee & Atance, 2016; Mahy et al., 2020; Mazachowsky et al., 2019; Prencipe & Zelazo, 2005; Russell et al., 2010). It is thought that mentally separating from oneself can facilitate self-control and allow for more optimal decisions (e.g., White & Carlson, 2016). For example, Prencipe and Zelazo (2005) found that 3-year-olds chose to delay their rewards on a delay of gratification task more often when they were making the decision for the experimenter compared to when making the choice for themselves, but this same effect was not found with 4-year-olds. Mahy et al. (2020) similarly had children make choices between various quantities of rewards (e.g., one candy now or four candies later) for themselves and for an experimenter. An other-over-self advantage was found for 3-year-olds (but not for the older, 4-to 7-year-old children) such that they chose to delay rewards more frequently for the experimenter compared to themselves. In the episodic foresight domain, children have also been found to better predict their future preferences (e.g., Bélanger et al., 2014; Lee & Atance, 2016) and anticipate future physiological states (e.g., Mazachowsky et al., 2019) from a more distant perspective.

The second factor, which impedes rather than facilitates future thinking, is conflict between current and future states. Early perspectives, like that of Bischof-Köhler (1985), proposed that non-human animals have difficulty forecasting future needs that are not needed in the present (i.e., the Bischof-Kohler hypothesis). Accordingly, a non-human animal may not anticipate needing water in the future if they are not currently experiencing thirst (but see Correia et al., 2007, who challenge this view). The presentism bias (Gilbert et al., 2002) describes this experience in humans, where an individual's future decision may be influenced by a current motivational state (e.g., emotional, physiological). This phenomenon has been well documented in adults finding that individuals buy more food grocery shopping when they are currently hungry (Nisbett & Kanouse, 1969). In children, research has found that their future preferences are similarly biased by a salient physiological present state. For example, using the Pretzel task

(Atance & Meltzoff, 2006), children's thirst is induced by having them consume pretzels, then children are asked to report their preference for the next day: pretzels or water. Despite a baseline preference for pretzels, thirsty children, biased by their current state, often choose water over pretzels for the future (e.g., Atance & Meltzoff, 2006; Kramer et al., 2017; Mahy, 2016; Mahy et al., 2014; Mazachowsky et al., 2019). Importantly, induced-state episodic foresight tasks, like the Pretzel task, show no developmental increases in children 3 to 13 years old (e.g., Atance & Meltzoff, 2006; Kramer et al., 2017; Mahy, 2016). Thus, both children and adults have difficulty reasoning for the future when experiencing a salient current state.

Limitations of Currently Used Measures

Despite the various methods (e.g., naturalistic, parent report, behavioural) used to measure future thinking development in children, the currently used methodology is limited in several ways. First, there are a lack of validated parent reports that assess multiple domains of future-oriented cognition. Parent reports are valuable for capturing more naturalistic future thinking that vary in motivational and cognitive demands that children may display across multiple contexts in daily life (e.g., home, school, extracurricular activities). Most of the currently available parent reports in published works only capture a single domain of future-oriented cognition and may not have well-established psychometric properties. Currently, parent reports exist to measure young children's PM, planning, and saving. To measure PM, the Retrospective and Prospective Memory Questionnaire (PRMQ) was adapted from an adult version by Kliegel and Jäger (2007) and was found to capture developmental improvement in 2- to 6-year-old children's everyday memory and relate to children's prospective memory performance in the laboratory using a card-sort task. Adapted from an adult prospective memory scale (Hannon et al., 1995), the Children's Everyday Memory Questionnaire (Mazachowsky et al., 2021) also captures the development of 3- to 11-year-olds' PM, but distinguishes between short-term habitual, long-term episodic, and internally cued PM tasks. This measure is shown to be reliable but has yet to be validated with behavioural performance. As previously discussed, the Behavior Rating Inventory of Executive Function Preschool (BRIEF-P; Gioia et al.,1996) includes a planning/organizing subscale that measures children's planning impairments. The BRIEF-P has established reliability and validity (e.g., Duku & Vaillancourt, 2014; Bausela Herreras, 2019), however, it was originally intended as a measure of executive impairment in clinical samples and thus, it may not be ideally suited for measuring typically developing children's future planning in daily life. In the saving domain, research has begun to establish parent-reported saving measures showing that children's in-lab saving may relate to children's spending tendencies in daily life (Smith et al., 2018). Therefore, parent reports are available to measure children's PM, planning, and saving, but only capture one domain of future thinking.

In 2020, Mazachowsky and Mahy created a parent report, the Children's Future Thinking Questionnaire (CFTQ) to measure children's future thinking across five domains (i.e., saving, prospective memory, episodic foresight, planning, and delay of gratification). The original questionnaire consisted of 79 items, which showed good reliability, and validity for two of the five subscales (i.e., parents' ratings of their children's planning and episodic foresight related to their children's performance on a corresponding behavioural measure in the lab). However, it cannot be determined from these results whether the lack of relation between the other future thinking subscales and the corresponding behavioural tasks were due to the specific tasks used. An important next step in establishing the psychometric properties of the CFTQ is to determine whether the future thinking subscales of the CFTQ relate to a novel set of behavioural measures than those used previously. Thus, Study 1 of my dissertation will examine the cross-validation of the refined 44-item CFTQ.

The second limitation of the currently used methodology is that two of the most widely used methods in the episodic foresight domain, the Picture-book and the Spoon task, are forced choice tasks (i.e., children make a choice from a list of provided options). Choice tasks may not fully capture the extent of children's future thinking capabilities, such as children's ability to spontaneously decide how to fulfil a future need. For example, it is likely that if children encounter a problem in everyday life, such as a tear in their artwork, they will have to independently generate which item (e.g., tape) could later be used to fix the problem.

To better capture children's generative abilities, Atance et al. (2019) created a novel version of the Spoon task that required children to spontaneously generate a correct item to fulfill a future need without being provided with an array of possible options. Although, children were successfully able to generate an appropriate item (e.g., a carrot) to solve the future problem (e.g., animal who loves carrots but does not have any), their performance was worse on the generative compared to the forced-choice condition. Children's difficulty in the generative condition may reflect their inability to rely on semantic associations between the location and provided item choices when they are required to generate the item independently. Nevertheless, older children were still more proficient at spontaneously generating appropriate items compared to younger, 3- and 4-year-olds (Atance et al., 2019). These results demonstrate that children can generate their own items on the Spoon task but doing so is perhaps more demanding of their future thinking abilities. An important question then is whether children would be capable of also spontaneously generating items when imagining visiting novel locations on the Picture-book task and whether they would demonstrate future thinking in their explanations. Study 2 of my dissertation will explore children's generative episodic foresight using a novel, open-ended version of the Picture-book task.

Finally, in previous literature several researchers have challenged whether choice tasks draw upon self-projection and future thinking capabilities or whether they instead rely on associative learning or other cognitive abilities (e.g., memory for the past problem; Atance & Sommerville, 2014; Atance et al., 2015; Hayne et al., 2011; Hudson et al., 2011; Martin-Ordas et al., 2014). For example, it is possible that children may draw upon semantic associations, such as the association between a desert and sun prompting them to choose the correct response of sunglasses, which would indicate successful performance but could be achieved without using episodic foresight.

While the Picture-book task has been particularly criticized for not drawing on future projection (e.g., Martin-Ordas et al., 2014; Suddendorf et al., 2011), the Spoon task is thought to better align with Suddendorf et al.'s (2011) criteria for episodic foresight tasks. The criteria outline that episodic foresight tasks should consist of single trials to avoid stimulus-reward relationships, present a variety of novel problems to avoid reliance on previous learning and show flexibility in future thinking, and require future action in diverse temporal and spatial contexts. These criteria are exemplified in Suddendorf et al.'s (2011) version of the Spoon task, where children were given the choice between various types of keys, thus limiting their ability to use semantic knowledge of the association between lock and key to solve the single-trial task (Martin-Ordas et al., 2012). However, not all versions of the Spoon task adhere to these criteria. For example, when the item choices were all different items, Atance and Sommerville (2014) found that children's performance was predicted by development in children's memory for the past problem, but not development in their episodic foresight. This finding suggests that the

Spoon task may not always engage future self-projection but rather rely on memory processes. Therefore, Study 3 of my dissertation will attempt to determine whether children may be differentially engaging in episodic and future thinking processes on the Spoon and Picture-book tasks. One way to determine task differences is through the examination of children's explanations that accompany their item choices to see whether children refer to the future (i.e., use future temporal terms) and draw on their past, personal experiences to construct future events more on the Picture-book task compared to the Spoon task.

The Current Research

Methodological advancements in the measurement of children's future thinking will be explored across three studies.

Study 1 (Mazachowsky & Mahy, 2020) broadly examined children's future-oriented cognitive development across the domains of saving, prospective memory, episodic foresight, planning, and delay of gratification using a new parent-report measure, The Children's Future Thinking Questionnaire (CFTQ). This study was published along with a series of other studies involved in the establishment of the psychometric properties of the CFTQ. Of relevance to my dissertation is Study 3 in the manuscript, which involved the cross-validation of the refined, 44-item CFTQ. One hundred and one parents of a 3-to 7-year-old child completed the 44-item CFTQ and their child completed a set of behavioural tasks tapping each of the five domains measured on the CFTQ. Our results showed that each of the five future thinking subscales showed generally good reliability and the full scale showed high internal consistency. Both subscales and behavioural tasks detected development in children's future thinking abilities. Providing further evidence for the validity of the refined measure, parent's ratings of children's abilities were significantly related to children's performance on the corresponding tasks (except for the PM task). Overall, Study 3 provided further evidence for the reliability and validity of the CFTQ.

The second and third studies of my dissertation will focus on one domain of future thinking, children's developing episodic foresight abilities, using novel task adaptions and open-ended responses.

Study 2 (Mazachowsky, Atance, Mitchinson & Mahy, 2020) examined 3-to 5-year-old children's ability to independently generate solutions to future problems using an adaptation of the popular episodic foresight task, The Picture-book task (Atance & Meltzoff, 2005). In the new, open-ended version of the task, 48 children generated their own items to take to a future location (i.e., no options are provided) and provided an explanation for their choice. We also coded children's explanations for their item choices to determine the temporal focus (e.g., present-oriented, future-oriented) and episodicity (e.g., episodic, semantic) of their explanations. We found that children were successfully able to generate items that would be useful in the future in response to open-ended questions and that this ability improved with age. Further, children's explanations were mostly present-oriented, but included similar rates of episodic and semantic details.

Study 3 of my dissertation (Mazachowsky, Atance, Rutt, & Mahy, revisions requested) also examined children's explanations on two episodic foresight tasks to address the theoretical issues raised in the literature regarding the degree to which some episodic foresight tasks engage episodic or future-oriented processes. We also explored the impact of conflict (i.e., presenting choices that would elicit either high or low conflict between children's current and future desires). One-hundred and fifty-eight 3-to 5-year-olds completed a high or low conflict version of the Spoon and Picture-book tasks. Children's explanations were coded based on their temporal focus (i.e., future vs. non-future), episodicity (i.e., episodic vs. non-episodic), and use of first-person personal (e.g., “I”, “my, “mine” etc.) and other (e.g., “you”, “their”, “his” etc.) pronouns. We found that children provided more future-oriented explanations that included more first-person personal pronouns on the Picture-book task compared to the Spoon task. However, explanations did not differ in episodicity or frequency of other pronoun use. Further, item choice performance and age (but not conflict) predicted whether explanations were future-oriented or episodic.

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CHAPTER 2

Study 1: Constructing the Children's Future Thinking Questionnaire: A reliable and valid measure of children's future-oriented cognition[1]

The ability to anticipate future states and needs (Bélanger et al., 2014), known as future-oriented cognition, is a critical skill that children must develop for successful daily functioning and planning. This act of travelling forward through time in one's own mind is considered evolutionarily advantageous and is thought to have played a role in human survival (Suddendorf & Corballis, 2007). Indeed, even today failure to orient oneself towards the future may have negative consequences for academic performance, personal safety, and social functioning (Mahy et al., 2014). For example, a child who forgets to bring a gift to their friend's birthday party may experience negative social consequences—that child may not be invited to their friend's party again. Notably, negative long-term outcomes associated with children's difficulty with future thinking and planning extend far into adulthood. In fact, research shows that better future-oriented abilities in childhood, in domains like delay of gratification, are predictive of important positive outcomes including better mental and physical health, higher educational attainment, and lower rates of incarceration (Moffitt et al., 2011; Shoda et al., 1990). Thus, the accurate and reliable measurement of future-oriented cognition during childhood is important in determining the early development of this critical skill, predicting long-term adult outcomes, and potentially intervening with children who have poor or delayed future-oriented cognitive abilities.

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[1] This chapter is based on the published article: Mazachowsky, T. R., & Mahy, C. E. (2020). Constructing the Children's Future Thinking Questionnaire: A reliable and valid measure of children's future-oriented cognition. *Developmental Psychology*, *56*, 756-772. Only Study 3 is relevant to the current dissertation. Study 1 and 2 were part of my master's thesis and are provided for context to Study 3.

Future-oriented abilities are thought to rely on similar regions of the brain. Neuroimaging research suggests that the various types of future thinking, such as remembering, envisioning the future, prospection, and imagining, may activate a common neural network called the default mode network (Buckner & Carroll, 2006). For example, Østby et al. (2012) found that functional connectivity in the default mode network was associated with the subjective quality (e.g., vividness) of imagination of future events in children and adolescents. Thus, research supports a common network involved in future-oriented thinking.

Despite the importance of future-oriented abilities and the frequency at which we consider the future in daily life (D'Argembeau et al., 2011), future decision making is not always optimal. In an attempt to explain why an individual may (or may not) make accurate decisions for the future, Ersner-Hershfield and colleagues (2009) proposed the *future-self continuity hypothesis*. This view posits that individuals are motivated to consider future outcomes or rewards if they feel a connection between their current and future-self. Thus, if an individual considers their present-self as strongly connected to their future-self they should be more likely to do things in the present that will benefit them in the future, such as allocate money towards retirement (e.g., Hershfield et al., 2011). With age, the current-self might become more connected to the future-self as children develop the ability to think about and plan for their future selves.

What drives these age-related changes in children's future-oriented cognition? There are several possible mechanisms including development in areas of (1) future projection, (2) episodic memory, (3) executive function, and (4) language. First, following *the future-self continuity hypothesis*, children's ability to mentally project themselves through time and connect their current-self to their future-self might drive age-related increases in future-orientation. In line with this idea, Buckner and Carroll (2006) suggest prospection emerges in the preschool years along with the other forms of self-projection that include episodic memory, navigation, and theory of mind. Second, episodic memory has also been implicated in future thinking as proposed by the *constructive episodic simulation hypothesis* (Addis & Schacter, 2008; Schacter & Addis, 2007). This hypothesis proposes that episodic memory provides the details used in future simulation and helps to construct flexible and coherent future simulations. Indeed, generating past and future events are found to engage the common core network of neural regions (Addis & Schacter, 2008). Third, the development of children's executive functions, like cognitive flexibility and inhibition, may allow them to project themselves into future scenarios and disengage from and inhibit interference from the present to imagine ones' future. The role of executive functions in the domains of future-orientation, such prospective memory and planning, has been reported in the literature (e.g., Mahy et al., 2014; Miyake et al., 2000). Finally, improvement in language may also support the development of future-oriented cognition as children gain more complex language to express future-oriented thoughts. Three-year-old children start to use verbs that refer to the future (e.g., going to; Harner, 1981), but generally use less future-talk (e.g., "it's gonna be hot") than older children (Atance & Meltzoff, 2005). Further, Atance and Jackson (2009) found that children's receptive vocabulary was related to a variety of future-thinking tasks including planning, prospective memory, and delay of gratification. These potential mechanisms might be best explored by examining children's future-oriented capacities in more naturalistic contexts and across a wide variety of settings where children's true abilities are likely to be expressed.

The Development of Future-Oriented Cognition

Around the age of three, children begin to develop the ability to think about, plan for, and anticipate the future, as well as remember to carry out their future intentions (Atance & O'Neill, 2005; Kliegel & Jäger, 2007). Though children often struggle with accurately thinking and planning for the future at this young age (e.g., Hayne et al., 2011), by 5 or 6 years of age this ability is much improved (Atance & Meltzoff, 2005). Thus, generally, development of children's future-oriented abilities improves with age. However, given that future-oriented cognition encompasses different domains or abilities, the developmental trajectory of each type of future orientation may differ slightly. The current study will examine five abilities of future-oriented cognition consistently addressed in the literature (i.e., saving behaviour, prospective memory, episodic foresight, planning, and delay of gratification). Next, the developmental trajectory of these five domains in childhood will be reviewed.

Saving Behaviour

Saving behaviour focuses on children's ability to reserve resources in the present for the sake of future enjoyment (Metcalf & Atance, 2011). The small body of literature investigating children's ability to save for the future provides mixed evidence as to whether there are age-related increases in saving ability especially in preschool-aged children. For example, research that has examined young children's saving behaviour using a marble game has found that 3- to 6-year-olds did not differ in the number of marbles they saved for future use with a large, exciting marble game (Kamawar et al., 2018; Metcalf & Atance, 2011). In contrast, when children were explicitly told about the opportunity to save marbles during the marble game, Atance et al. (2017) found age-related increases in 3-to-5-year-old children's saving behaviour. Research measuring savings in older children using a board game, where children can buy toys, save money, and avoid temptation, found 6-year-olds spent more tokens than 12-year-olds (Otto et al., 2006). In general, the small body of literature investigating children's ability to save for the future provides mixed evidence as to whether there are age-related increases in saving ability especially in the preschool period.

Prospective Memory

Prospective memory is defined as the ability to remember to carry out future intentions (Kliegel & Jäger, 2007). One commonly used behavioural measure of prospective memory are card sort tasks (e.g., Kvavilashvili et al., 2001) that involve an ongoing activity (e.g., naming everyday objects on cards) with an imbedded prospective intention (e.g., placing animal cards in a box behind the child). Generally, behavioural tasks measuring children's prospective memory ability show age-related increases. On card sort tasks for example, 2- and 3-year-old children perform quite poorly, 4-to-6-year-old children show some improvement in performance, and 7-year-old children are fairly good at remembering to carry out the prospective intention (Kliegel & Jäger, 2007; Kvavilashvili et al., 2008; Kvavilashvili et al., 2001; Mahy et al., 2014; Ślusarczyk & Niedźwieńska, 2013). Prospective memory has also been investigated in older children (i.e., 6-to-12-year-olds) using a driving simulation task and similarly shows age-related increases in prospective memory ability with younger children forgetting to fuel their car more frequently than older children (Kerns, 2000). Thus, research supports increases in prospective memory ability across early and middle childhood.

Episodic Foresight

Episodic foresight (the ability to mentally project oneself into a future situation or event; Atance & O'Neill, 2001) shows a similar developmental trajectory to prospective memory. On the Picture-Book task, Atance and Meltzoff (2005) found that older children were better than younger children at anticipating future physiological states likely to be experienced in future locations. More specifically, when given a choice of three items (e.g., soap, sunglasses, or a seashell) to bring with them to a novel future location (e.g., a desert), 4- and 5-year-olds scored significantly higher than 3-year-olds in choosing the correct item (Atance & Meltzoff, 2005). Similarly, using the Two-Rooms task (also referred to ask the Spoon task; Suddendorf & Busby, 2005) age-related increases in children's episodic foresight are also found. Although there are variations of the Two-Rooms task, it generally requires children to bear the future in mind to solve a novel problem. For example, in Suddendorf and Busby's (2005) version of the task, children are first introduced to an empty room with only a puzzle board and then introduced to a second room with toys. Before going back to the empty room, children choose a toy (one of which are puzzle pieces) to bring back to the empty room. Children who bear the future in mind should select puzzle pieces to bring with them to the empty room to reduce boredom. On this task, research finds older children (e.g., 4- and 5-year-olds) generally consider the future more often than younger children (e.g., 3-year-olds; Suddendorf & Busby, 2005; Suddendorf et al., 2011). Importantly, verbal measures of episodic foresight show a similar developmental pattern. For example, when asked to verbally report something they are likely to do tomorrow, majority of 4-year-old children were able to produce correct answers to future questions compared with a minority of 3-year-olds (Busby & Suddendorf, 2005). Overall, studies examining episodic foresight show age-related increases in early childhood across a variety of behavioural measures.

Planning

Forming goals, constructing plans, and envisioning the actions necessary to achieve those future goals (Shapiro & Hudson, 2004) describes the ability to plan for the future. Planning is primarily measured using three types of lab-based tasks: tower tasks (e.g., Tower of Hanoi; Carlson, Moses, & Claxton, 2004), route tasks (e.g., Truck Loading; Carlson et al., 2004) and script-based tasks (e.g., creating event scripts for going grocery shopping; Hudson et al., 1995). On tower tasks, children's ability to plan the movement sequence of items generally increases with age (e.g., Kaller et al., 2008). For example, Kaller et al. (2008) found lower planning accuracy in 4-year-olds compared to 5-year-olds using a tower task. Route-planning tasks also show that young children have trouble planning ahead. Carlson et al. (2004) found that 3-year-olds incorrectly planned the order of invitations for delivery more often than 4-year-olds. However, there is evidence that children as young as 3 years are still able to construct plans in advance of familiar events on script-based tasks, such as formulating plans for going to the beach (Hudson et al., 1995). Thus, although young children may begin to develop the ability to plan and use scripts at around age three, more flexible, unique, and adaptive planning may emerge as the child develops.

Delay of Gratification

Delay of gratification is the voluntary postponement of immediate gratification for the sake of greater future gains (Mischel et al., 1989). Though delay of gratification has been measured using the classic marshmallow task (e.g., Mischel et al., 1972), choice tasks are also used to measure delay of gratification and show a similar developmental trajectory to the other four domains of future-oriented cognition. For example, when given the choice between receiving one sticker immediately or receiving a larger quantity of stickers at the end of the testing session, Prencipe and Zelazo (2005) found 4-year-olds chose the delayed reward significantly more than 3-year-olds.

In general, research in the five key domains of future-oriented cognition (saving, prospective memory, planning, episodic foresight, and delay of gratification) show that the ability to think about, plan for, and anticipate the future largely develops with age especially in the early childhood years. Although previous research shows mixed results for developmental increases in saving ability, the research in this area is also limited. To date, most measures in these domains are behavioural, that is, they rely on examining children's behaviour on a task, often in a laboratory context, and at one point in time. Thus, the current study seeks to develop a new measure of children's future-oriented cognition in these five key domains in children 3-to-7-years old.

Limitations of Current Behavioural Tasks

Despite the extensive research using behavioural tasks for measurement of the key domains of children's future-oriented cognition, there are a number of limitations associated with the behavioural measures including: (1) a lack of coherence among behavioural tasks measuring children's future-oriented cognition after controlling for age (Atance & Jackson, 2009), (2) high demand on children's verbal abilities that might limit the expression of future-oriented concepts (Suddendorf & Busby, 2005), (3) low ecological validity in that tasks might not reflect real life functioning, (4) less representative samples and inefficient data collection given the selective sample and time/resources invested into lab testing, (5) absence of the parent or adult perspective that could offer more accurate and complete understanding of children's behavior (e.g., other parent-report measures of children's temperament and behavior have shown to be reliable and valid; Children's Behaviour Questionnaire (CBQ); Rothbart et al., 2001; Children's Social Understanding Scale (CSUS); Tahiroglu et al., 2014). A parent-report questionnaire would offer many benefits and would address these limitations by examining whether domains of children's future-oriented behaviour are related or distinct, avoiding placing high verbal demands on children, including questions that vary in context to improve ecological validity, including a more diverse economic and ethnic sample and allowing for more efficient data collection, and including parental insight into children's behaviour.

A goal of the current study was to create a new measure of future-oriented cognition, which will attempt to overcome some of the limitations of behavioural tasks. The proposed parent-report measure will be an important contribution to the field as it will offer a parent's perspective on children's abilities in various areas of future-oriented cognition (e.g., saving, prospective memory, episodic foresight, planning, and delay of gratification) in varied contexts (e.g., home, school, extracurricular activities). Importantly, no reliable or valid parent-report questionnaire currently exists to evaluate children's future-oriented cognition.

The Current Study

The overarching objective of the current research is to develop a parent questionnaire to better capture the growth of 3- to 7-year-old children's future-oriented cognition when rapid development of these abilities occurs. To this aim, we will establish a reliable and valid parent-report questionnaire that measures five core domains of future-oriented cognition (saving, prospective memory, episodic foresight, planning, and delay of gratification) in 3- to 7-year-old children. Broadly, the current study will address three main research questions: (1) can the questionnaire detect age-related development in future-oriented cognitive abilities? (2) does the questionnaire and its five subscales show reliability (internal consistency and test-retest reliability)? and (3) does the questionnaire and its five subscales show validity (i.e., are parents able to accurately assess their child's future-oriented cognition)?

To answer these research questions, four studies were conducted. Study 1 built upon previous pilot data (Mahy et al., unpublished data) by distributing the questionnaire to parents on *Amazon's Mechanical Turk* (MTurk) to determine if the 79 items on the newly constructed questionnaire were understandable to parents and appropriate for 3- to 7-year-old children. Study 2 involved the distribution of the questionnaire to parents in order to assess internal consistency reliability and brought a subset of these parents and their children into the laboratory to assess validity using behavioural tasks. Based on Study 2, the questionnaire was refined to 44 items. Study 3 tested the reliability and validity of the newly refined 44-item questionnaire with a new sample of parents and children using a new set of behavioural tasks. Finally, Study 4 examined the test-retest reliability of the 44-item questionnaire with parents on MTurk. Together, these studies resulted in the creation of a reliable and valid questionnaire measure that detects age-related development in young children's future-oriented cognition.

Preliminary Research

Initial development of a 22-item questionnaire on children's future-oriented cognition (Mahy et al., unpublished data) provided the impetus for the creation of a longer questionnaire with multiple subscales. The original 22-item questionnaire was administered to 90 parents and was found to be positively related to 3-to-7-year-old children's future thinking performance measured by four tests in the laboratory (planning for the future, delay of gratification, and two episodic foresight tasks). Using the pilot questionnaire as a starting point, an 88-item questionnaire with five subscales, titled the *Children's Future Thinking Questionnaire* (CFTQ) was developed. After initial item development by the authors, seven published scholars in the field of future-oriented cognition were contacted to provide feedback on the questionnaire items. Nine items were removed based on these experts' comments suggesting that these items were either not developmentally appropriate, confusing, too advanced, or unrealistic. Thus, the revised version of the CFTQ was composed of 79 items.

Study 1

Study 1 involved the initial distribution of the 79-item CFTQ to parents from the United States using the online platform, *Amazon's Mechanical Turk* (MTurk). The goals of this first study were to ensure that: (1) the questionnaire was appropriate and understood by parents before the wider distribution of the questionnaire to parents in Study 2, (2) parent ratings on the CFTQ were positively correlated with their child's age, and (3) there was evidence of internal consistency within each subscale and in the full scale.

Method

Participants

Of the participants who completed the qualification survey on MTurk (*N* = 924), less than half of those participants (*n* = 383) met the inclusion criteria required for the CFTQ. Further, only 234 qualified participants proceeded to complete the CFTQ. From the 234 questionnaires, data from 155 participants met our pre-specified criteria. Our criteria required that participants were parents of at least one 3-to 7-year-old child, who was typically developing and fluent in English, and were residents of the United States. Only parents who met these criteria were invited to complete the CFTQ. Fifteen participants were eliminated for having more than 25% missing data (i.e., truly missing or "don't know", "does not apply", or "prefer not to answer" responses). Thus, the final sample consisted of 145 participants (26 parents of a 3-year-old child, 39 parents of a 4-year-old child, 37 parents of a 5-year-old child, 30 parents of a 6-year-old child, and 13 parents of a 7-year-old child). The majority of parents had a post-secondary education (86.2%) and were from middle-class backgrounds (73.4% earning over $40,000 annually per household). Sixty-one percent were mothers, 38% were fathers, and 1% were guardians.

Children's Future Thinking Questionnaire

Children's future-oriented cognition was measured using the 79-item parent-report questionnaire, the CFTQ. The CFTQ has five subscales that correspond to five future-oriented abilities: saving, prospective memory, episodic foresight, planning, and delay of gratification. Parents indicated their agreement with 79 statements on a 6-point Likert scale (1: *strongly disagree*, 2: *disagree*, 3: *somewhat disagree*, 4: *somewhat agree*, 5: *agree*, 6: *strongly agree)*, or selected one of the additional response options (*don't know*, *does not apply*, *prefer not to answer*). The saving subscale consisted of 14 items and measured children's ability to save (e.g., money, material objects, time, physical space) for future use or consumption. The prospective memory subscale consisted of 15 items and measured children's ability to remember to carry out their future intentions. The episodic foresight subscale consisted of 17 items and measured children's ability to mentally project themselves into the future to think, imagine, or anticipate future states. The planning subscale consisted of 17 items and measured children's ability to construct plans and form goals for the future. The final subscale, the delay of gratification subscale, consisted of 16 items and measured children's ability to postpone gratification in the present for greater future gains. Completion of the CFTQ took approximately 20 minutes.

Procedure

Participants completed a pre-screening survey prior to completion of the CFTQ to ensure that all parents met pre-specified criteria. Participants first provided consent and answered a demographics questionnaire before completing the CFTQ. After data collection, we confirmed that all participants met the inclusion criteria for the study. Additionally, participants who took less than 10 minutes to complete the questionnaire were eliminated, based on the average fastest possible completion times of three research assistants. All procedures were approved by the

Research Ethics Board at Brock University (*Constructing a Parent-Report on Children's Future Oriented Cognition* [file: 15-105-MAHY]).

Results and Discussion

Missing data consisted of "don't know", "does not apply", and "prefer not to answer" responses, as well as truly missing responses (i.e., blank responses). A negligible amount of missing data (< 1%) constituted truly missing responses. Across all subscales, 21 (14.9% of the final sample) participants had more than 10% missing data. Thus, the newly developed questionnaire items seemed generally understandable to parents and developmentally appropriate for children 3-to-7-years old, given that few parents' responses constituted missing data. Missing data values for the 79 items were replaced using Estimation Maximization. The full-scale score was calculated by taking the mean of all 79 items on the questionnaire and subscale scores were calculated by taking the mean of all items within a given subscale. For all correlational analyses two-tailed tests were performed.

Full Scale and Subscale Correlations with Age

Children's age in months was significantly positively correlated with saving, prospective memory, episodic foresight, and planning subscale scores as well as the full-scale score, *r*s (143) ranged from .25 to .30, *p*s < .01. However, there was no significant relation between children's age and the delay of gratification subscale score, *r* (143) = .15, *p* = .08, although the correlation was in the expected positive direction. These results generally align with current research using behavioural tasks (e.g., Atance & Jackson, 2009), which support age-related increases in future-oriented abilities in early childhood. Further, relations between subscales remained significantly positively related even after controlling for child's age in months, *pr*s (140) ranged from .55 to

.78, *p*s < .01, providing confidence that the relation between domains of future-oriented cognition was not driven by maturational factors alone.

Internal Consistency

Using Cronbach's alpha, the saving (α = .83), prospective memory (α = .91), episodic foresight (α = .85), planning (α = .88), and delay of gratification (α = .80) subscales and full scale (α = .96) showed high internal consistency. These initial results for the reliability of the CFTQ subscales were encouraging and suggested that items in the subscales and full scale were measuring similar constructs.

Overall, the initial distribution of the CFTQ to parents on MTurk yielded promising results and encouraged further distribution of the questionnaire to parents in Study 2. The results of Study 1 suggested that: (1) the questionnaire items were understandable to parents and developmentally appropriate for 3-to-7-year-olds (2) the subscales were capturing age-related changes in future-oriented abilities, and (3) the subscales and the full scale showed high reliability.

Study 2

Given the encouraging results of Study 1, Study 2 involved administering the 79-item CFTQ to a larger sample of parents, from Canada and the United States, in order to remove weak items from the scale to create a shorter, reliable, and valid CFTQ. After establishing the shorter version of the CFTQ, Study 2 had four goals: (1) to examine the reliability of the five subscales to ensure that each subscale was measuring the same construct, (2) to ensure that the CFTQ subscales and the full scale correlated with children's age, (3) to examine the validity of the CFTQ by examining parent responses and children behavioural performance on future-oriented cognition tasks in subset of 80 parent-child dyads, and (4) to examine the internal structure of the measure and investigate whether the five subscales were independent (i.e., do the five subscales represent five distinct components of future-oriented cognition?) or represented a single factor.

Method

Participants

Two hundred and ninety parents with children ranging from 28 to 103 months participated. A subset of 81 of these parents (74 mothers, 7 fathers) and their children (17 3-year-olds, 16 4-year-olds, 16 5-year-olds, 16 6-year-olds, 16 7-year-olds; M_{Age} = 65.42 months, *SD* = 17.58; 45 girls) were tested in the laboratory. Overall, reports from 36 parents were excluded for reasons of: more than 25% missing data (*n* = 18), data entry error (*n* = 1), duplicate participation (*n* = 1), parent misunderstanding (*n* = 2), atypically developing child (*n* = 2), child not being 3 to 7 years old (*n* = 4), or child birthdate errors (*n* = 8). The final sample consisted of 255 participants (49 parents of 3-year-olds, 45 parents of 4-year-olds, 66 parents of 5-year-olds, 50 parents of 6-year-olds, and 45 parents of 7-year-olds). Parents were recruited from community events, daycares, and an existing university database. The majority of parents had a post-secondary education (91.4%) and were from middle-class backgrounds (6% earning less than $25,000, 8% earning $25,000 – 40,000, 20% earning $40,000 - $75,000, 19% earning $75,000 – $100,000, 40% earning more than $100,000, 7% undisclosed). Eighty-seven percent were mothers, 10% were fathers, and 2% were guardians.

Measures and Procedure

Parents provided consent, completed a demographics questionnaire, and then completed the 79-item CFTQ. Parents either completed a paper-and-pencil or online version of the questionnaire (98% of final sample completed the paper-pencil version). Several parents recruited from the university database elected to complete the online version of the questionnaire as opposed to completing the questionnaire in the laboratory. Subscale and full-scale means did not significantly differ with administration type (i.e., online vs. paper-pencil), *ts* (253) ranged from .66 – 1.28, *ps* > . 05. Questionnaire items were presented in the same fixed-order in both versions.

For the parents who came into the lab, after parents filled out the CFTQ, their child completed seven behavioural tasks in a fixed order in a separate testing room. Five of the tasks corresponded to the future-oriented constructs measured on the CFTQ, while the receptive vocabulary and executive functioning tasks were used as control measures when examining the relation between subscales, and the relation between children's performance on behavioural measures and parent's ratings on the corresponding task. We controlled for children's executive functioning and vocabulary since these capabilities could be mechanisms underlying the development of children's future-orientation. All procedures were approved by the Research Ethics Boards at Brock University, Dalhousie University, and the University of North Carolina Greensboro (*Constructing a Parent-Report on Children's Future Oriented Cognition* [file: 15-105-MAHY]).

The Picture-Book task (Atance & Meltzoff, 2005) measured episodic foresight. Children selected one of three items (e.g., winter coat, life jacket, ice cubes) to bring to a specific location (e.g., a snowy forest). There was always a correct answer (e.g., winter jacket) that addressed a future state (e.g., getting cold) as well as a semantically related distractor item (i.e., ice cubes) and another distractor item (i.e., life jacket). After children selected an item, they were asked to provide a verbal explanation for their choice, which was scored as future-oriented or not. Children were given a total score out of six that combined item choice and future-oriented explanation scores for three different locations. Two children were excluded from the final analysis due for failure to provide a response.

The Truck Loading task (see Carlson et al., 2004) measured planning. Children followed several rules to deliver coloured invitations to matching houses that lined a one-way road. Level 1 started with the delivery of two invitations and an additional house was added at each difficulty level (4 levels total). For each difficulty level, children were given two trials and they were reminded of any rule violations after failing any given trial. Children had to successfully deliver the invitations on at least one of the two trials to move to the next level. Planning performance was scored out of four, based on the highest difficulty level children achieved.

Choice Delay (adapted from Prencipe & Zelazo, 2005) measured delay of gratification. Children were asked to choose between receiving one sticker immediately or a larger quantity of stickers at the end of the testing session. There were four trials (1 vs. 2, 1 vs. 4, 1 vs. 6, and 1 vs. 8 stickers) and children were scored based on how many times they chose the delayed reward (0 = *sticker now*, or 1 = *sticker later*) out of the four trials (scores ranged from 0 to 4). One child was excluded from the final analysis due to failure to follow task instructions.

In the main prospective memory task (adapted from Mahy & Moses, 2011), children were instructed to place cards with animal pictures into coloured boxes that corresponded to a coloured dot on each card (the ongoing task) to help Joe the zookeeper. Then they were told that they needed to help Joe catch any escaped monkeys so if they saw a monkey card, they should place it in a box behind them (the prospective memory task). Children then drew pictures during a 3-minute delay period before starting the ongoing task. Monkey pictures were presented in the 9th, 20th, and 35th positions in a stack of 40 cards. After children finished, they were asked a control question ("What were you supposed to do when you saw a monkey") to make sure they remembered what they were supposed to do. If children were unable to recall the prospective intention after this control question, three additional probing questions were used, increasing in specificity, until children could report the prospective memory intention (i.e., “What else did you have to do in this game?”, “What did you have to do when a monkey was on one of those cards?”, “What did you have to do to help Joe the zookeeper?”). Children who could not report the prospective memory intention following these questions (n = 6) were excluded from the analysis for failing to retrospectively recall the prospective memory instructions (i.e., retrospective memory failure). Children were given a prospective memory score out of three based on the number of monkeys they placed in the box. One child was also excluded for failure to follow task instructions.

Naturalistic prospective memory was also measured using two tasks (adapted from Guajardo & Best, 2000) where children were asked to remind the experimenter for: (1) a sticker from a box (naturalistic sticker task) and (2) their drawing to take home with them (naturalistic drawing task). If children failed to ask for the sticker/drawing within 30 seconds of the experimenter telling children the appropriate task/session was over, the experimenter provided the first prompt: “Was there something you were supposed to remember?”. If children still failed to ask for the item, they were given a second prompt: “Was there something you were supposed to ask for when we were done the truck game/at the end of the session?”. Children were given a prospective memory score of one if they asked for the item spontaneously after the appropriate task/session was over (i.e., without any prompting), or a score of zero if they failed to ask for the item spontaneously. Given that both of these tasks measured naturalistic prospective memory, a composite score was created. From the final analysis, six children were excluded from the naturalistic sticker and one child was excluded from the naturalistic drawing task due to failure to follow task instructions.

The Marble Game (adapted from Metcalf & Atance, 2011) measured saving behaviour. Children decided whether to use three marbles on a small marble game immediately or save their marbles for a large, more exciting marble game later. Children were introduced to two rooms; Room 1 that contained a small marble game and Room 2 that contained a large marble game. The experimenter explained that children only had three marbles to use in both rooms and then asked children how many marbles were available to use to confirm the rules. Next, children were taken to Room 1 for 1 minute to play with the small marble game and then, children were taken to Room 2 to play with the large marble game. Saving was scored out of three based on how many marbles the child saved for Room 2 with the large marble game. From the final analysis, three children were excluded because they were not asked to confirm the rules and one child was excluded for equipment failure.

Simon Says (adapted from Strommen, 1973) measured inhibitory control. Children were instructed to follow the experimenter's commands, but only when the experimenter began the command with "Simon says", otherwise they should stay still (non-imitation trials). Children were scored on the five non-imitation trials (0 = *commanded movement*, 1 = *partial movement*, 2 = *different movement*, 3 = *no movement*) and given a total score out of 15 (higher scores indicated better inhibitory control). Five children were excluded from the final analysis due to failure to follow task instructions.

The Peabody Picture Vocabulary Test (*PPVT-IV*; Dunn & Dunn, 2007) measured receptive vocabulary. Children were asked to select one picture out of four that matched a word read aloud by the experimenter. The PPVT-IV continued until children made eight errors in a block of 12 trials. Children received a raw score accounting for the highest level achieved and the number of errors made. Five children were excluded from the analysis for failure to complete the task or select a response.

Results and Discussion

The overarching goals of Study 2 were to create a shorter and reliable questionnaire measure and to examine the validity of the newly refined CFTQ by comparing a subset of parent's responses to children's behavioural performance in the laboratory. Scale items were eliminated from the 79-item version of the CFTQ based on evaluation of three criteria. First, items with more than 20% missing data (i.e., combined *don't know*, *does not apply,* or *prefer not to answer* responses) were removed (n = 9). Second, items with low item-total correlations (< .20) with their subscale were deleted (n = 3). Third, items with low or negative correlations with children's behavioural performance on corresponding tasks were removed (n = 20). Three additional items were removed since they were too complex or did not apply to children without siblings. In addition, capturing each ability across multiple contexts (i.e., subscale broadly captured the respective domain) and appropriate coverage of the five domains of future-oriented cognition (i.e., approximately equal number of items per subscale) was also considered during item selection. Thus, the newly formed CFTQ was composed of 44 items (see Appendix A) after evaluation of the aforementioned criteria.

Missing data consisted of "don't know", "does not apply", and "prefer not to answer" responses, as well as truly missing data (i.e., blank responses). A negligible amount of missing data (< 1%) constituted truly missing responses. Missing data values in the scale were replaced using Estimation Maximization procedure. For all correlational analyses two-tailed tests were performed.

Internal Consistency

The 44-item CFTQ showed good internal consistency reliability for each subscale, with the exception of the saving subscale that showed slightly lower internal consistency (see Table 2.1). Critically, internal consistency for the full scale remained high even without replacing missing data suggesting that the 44-item CFTQ overall was a reliable measure.

Full Scale and Subscale Correlations with Age

Children's age in months was significantly positively correlated with the subscale scores and the full-scale score (Table 2.1). Thus, the 44-item CFTQ captures the development of future-oriented cognition consistently reported in the literature. After controlling for child age in months, subscales remained significantly correlated, *pr*s (252) ranged from .43 to .78, *p*s < .001. Further, the subscales also remained significantly correlated after controlling for children's age, inhibitory control, and vocabulary (*pr*s (65) ranged from .40 to .77, *p*s < .01), which suggests that these abilities are related over and above the general age-related increases in future-oriented abilities, and other domain-general abilities.

Correlations Between Behavioural Task and Subscale Ratings

See Figure 2.1 for scatterplots between CFTQ subscale ratings and corresponding behavioural tasks. Children's performance on the Picture-Book task and Truck Loading task was significantly related to the corresponding subscale (the episodic foresight and planning subscale, respectively; Table 2.1). Children's performance on the saving, lab-based and naturalistic prospective memory, and delay of gratification tasks, however, were not significantly related to the corresponding subscale although they were all in the expected, positive direction. Thus, children's performance on two of the behavioural tasks were significantly associated with parent's ratings of their ability on the corresponding subscale indicating the validity of the

Table 2.1

Means, standard deviations, Cronbach's alpha, and correlations between subscales, full scale, corresponding behavioural task and child age for Study 2 and Study 3

	Study 2 (N = 255)			
CFTQ Subscale	*M* (*SD*)	α	Correlation with child's age	Correlation with corresponding behavioural task (*n* = 71 - 77)
Saving	4.04 (.63)	.68	.28**	.19
Prospective Memory	4.36 (.78)	.84	.25**	.11 [.11]
Episodic Foresight	3.95 (.67)	.75	.24**	.34*
Planning	4.29 (.73)	.82	.32**	.28*
Delay of gratification	3.92 (.75)	.75	.18**	.19
Full Scale	4.11 (0.59)	.93	.30**	
	Study 3 (N = 101)			
CFTQ Subscale	*M* (*SD*)	α	Correlation with child's age	Correlation with corresponding behavioural task or questionnaire items (*n* = 83 -101)
Saving	3.91 (.67)	.73	.35**	.30**
Prospective Memory	4.23 (.84)	.83	.27**	.14 {-.32**}
Episodic Foresight	3.90 (.75)	.79	.40**	.22*
Planning	4.19 (.71)	.79	.39**	.36**
Delay of gratification	3.84 (.72)	.72	.24*	.37**
Full Scale	4.01 (.60)	.93	.40**	

Note. Standard deviations in parentheses. Naturalistic prospective memory composite correlation in square brackets. BRIEF-P PM items correlation in curly brackets ** $p < .01$, * $p < .05$

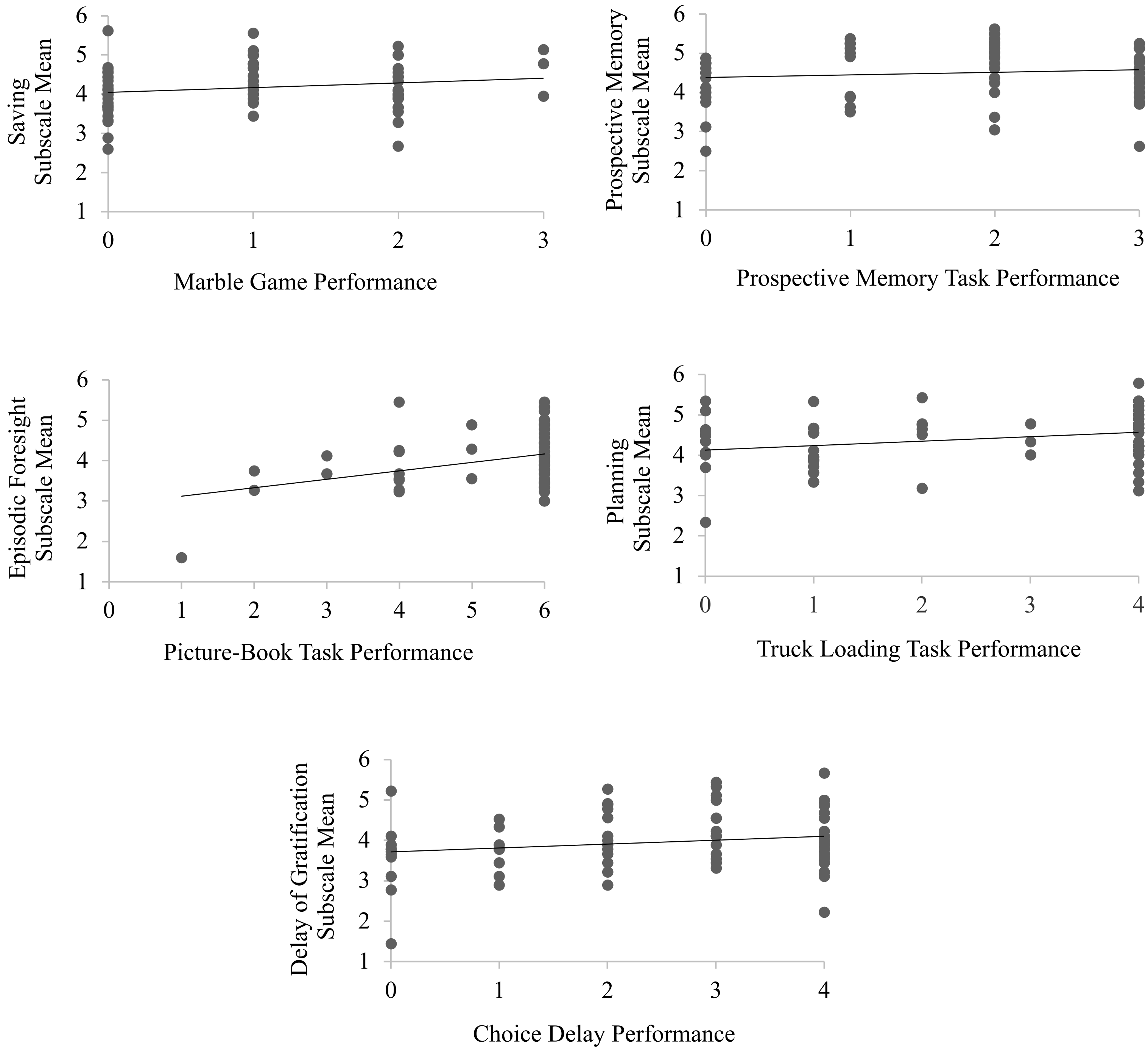

Figure 2.1. Correlations between behavioural tasks and corresponding CFTQ subscale from Study 2.

episodic foresight and planning subscales. Although all correlations were in the positive direction, we may not have had enough power to detect an effect between the other subscales and the corresponding tasks. After controlling for child age in months, inhibitory control (Simon Says; M = 8.15, SD = 6.39), and receptive vocabulary (PPVT-IV; M = 108.50, SD = 29.68), the Picture-Book task remained correlated with the episodic foresight subscale (pr (64) = .24, p = .05), but the remaining tasks and the corresponding subscales were not significant, ps > .05.

Factor Analysis

A principal axis factor analysis was performed to examine the structure of the refined 44-item CFTQ. The Kaiser-Meyer-Olkin measure of sampling adequacy was revealed to be excellent (KMO=.90; Kaiser, 1974). Eigenvalues showed the first five factors accounted for 26.63%, 5.80%, 4.29%, 3.69%, and 3.58%, of the variance. Using varimax rotation, the one-factor solution explained 25.04% of the variance, while the five-factor solution explained 25.30% of the variance. A one-factor solution was preferred given an insufficient number of items loading on additional factors, incomprehensibility of additional factors, and appearance of the scree plot. Thus, the five subscales of the CFTQ appear to converge on a single factor.

In general, Study 2 provided evidence for the reliability of the 44-item CFTQ. Although reliability for the subscales was in the generally acceptable range, the full scale overall showed high reliability. Further, the subscales detected development in children's future-oriented cognition. Parent's ratings of children's abilities on two of the subscales were significantly related to children's performance on the corresponding task and all correlations were in the positive direction, thus providing some evidence of the validity of the refined measure. Finally, a factor analysis provided support for a single factor of future-oriented cognition.

Study 3

Study 3 was conducted to cross-validate the newly refined 44-item CFTQ, to rule out the possibility that correlations in Study 2 were due to the specific behavioural measures that were used. Following a similar procedure to Study 2, a new sample of parents completed the 44-item CFTQ and their child completed a novel set of behavioural tasks tapping the five domains measured on the CFTQ. For Study 3, our goal was to select behavioural tasks that were widely used and well-established in the field to measure the domains assessed on the CFTQ. We also selected tasks that varied from Study 2 in surface features and verbal demands. Specifically, the use of a new set of tasks provided greater confidence that the relation between corresponding tasks and the subscales was due to the CFTQ capturing the future thinking constructs, rather than specific task-subscale relations. Due to the lack of measures available to assess preschool children's saving for the future, our saving measure was adapted from use with older children (and thus had not been widely used with preschool children). Additionally, to broadly assess children's executive functioning in a naturalistic context, parents completed the Behaviour Rating Inventory on Executive Function- Preschool version (BRIEF-P; Gioia et al., 2000) to examine relations between the CFTQ and the BRIEF-P items relevant to more naturalistic future orientation (e.g., planning/organization subscale and items related to prospective memory). We expected that the parent reports should be related to one another if measuring similar constructs (e.g., planning).

Method

Participants

One hundred and five children and their parents participated in the study. Four children were excluded for the following reasons: atypical development (n = 2), previous participation in Study 2 (n = 1), or failure to complete any behavioural tasks (n = 1). The final sample consisted of 101 children (50 girls, 51 boys): 20 three-year-olds (9 girls; *M* = 42.85 months *SD* = 3.83), 20 four-year-olds (7 girls; *M* = 51.80 months *SD* = 5.91), 20 five-year-olds (14 girls; *M* = 66.55 months *SD* = 3.97), 21 six-year-olds (10 girls; *M* = 77.05 months *SD* = 3.81), and 20 seven-year-olds (10 girls; *M* = 89.20 months *SD* = 3.14). Parents also participated (82 mothers, 18 fathers, 1 guardian) by filling out the CFTQ. The majority of children were Caucasian (74%) and from middle class backgrounds (85% earning an income over $40,000). Parents and their children were recruited from a university participant database.

Measures and Procedure

Parents completed the 44-item CFTQ and then the BRIEF-P. Parents took approximately 20 minutes to complete the questionnaires. After parents completed the questionnaires, children completed seven behavioural tasks in a fixed order in a separate testing room. Five of the tasks measured future-oriented constructs corresponding to the subscales of the CFTQ, while the other two tasks measured executive functioning and receptive vocabulary (for use as control measures). All procedures were approved by the Research Ethics Board at Brock University (*Cross-Validation of a Parent Questionnaire on Children's Thinking* [file: 16-319-MAHY]).

The Children's Future Thinking Questionnaire (CFTQ; see Appendix A) measured children's future-oriented cognition in 44 items that tapped into five key domains.

The Behaviour Rating Inventory of Executive Functioning Preschool (BRIEF-P; Gioia et al., 2000) broadly measures children's executive functioning and self-regulation, but also measures aspects of planning and organization. Example items include "Becomes upset with new situations", "Has trouble thinking of a different way to solve a problem or complete an activity when stuck", "Does not realize that certain actions bother others", and "Unable to finish describing an event, person, or story". Parents responded to 63 items and answered according to if their child's behavior had "never, "sometimes", or "often" been a problem in the past 6 months. The planning/organization subscale consisted of 10 items from the inventory. Higher ratings corresponded to greater executive impairment.

The Future-Preferences task (adapted from Bélanger et al., 2014) measured episodic foresight. Children made choices about their own preferences (self-now trials) and the preferences of their future-self (self-future trials) in a counterbalanced order. In the self-now trials, children selected one of two items that they like best now (e.g., newspapers or picture-books). In self-future trials, children were shown a picture of an adult (sex-matched to participant) and asked to choose the item that they would like best as an adult. The adult-item was presented first in half of the trials. Children completed five current and five future preference trials about: drinks (Kool-aid vs. coffee), reading material (picture-books vs. newspapers), games (Play-Doh vs. crossword puzzle), television shows (cartoons vs. cooking videos), and leisure activities (sticker books vs. magazines). If children did not choose the child item on self-now trials, the entire preference trial (current and future) was excluded from analysis. Children were given a proportion score (range = 0-1) by dividing the number of adult items chosen on self-future trials by the number of child items chosen on self-now trials. One child was excluded from the final analysis for failure to choose the child item in any self-now trials.

The Saving Board Game (adapted from Otto et al., 2006) measured saving behavior. Children were introduced to a game board depicting a town with multiple locations. Next, children received four tokens that they could spend on smaller items (e.g., sticker) at certain locations, or they could save three tokens to buy a larger, more desirable item (e.g., plush toy) at the end of the game. Children then selected their target toy (out of four options) to buy at the end of the game. To ensure children understood the rules, they were asked how many tokens they needed to save to buy the target toy. Initially, 79% of children answered this question correctly, but children who answered incorrectly were corrected by the experimenter. The experimenter then randomly selected a card from a pile of eight cards; four cards asked children to visit a location (e.g., toy store) and make spend or save decisions (e.g., buy a pencil for one token, or save the token) and the other four cards asked children to simply visit the location. The wording on the four save/spend cards was counterbalanced so two of the cards mentioned saving first and two cards mentioned spending first. After all eight cards had been selected, children were invited to buy the target toy (they received all items regardless of how many tokens they saved). Children received a score based on the total number of save decisions they made. Because children only needed to save three tokens to successfully buy the target toy, children who saved three or four tokens were given full credit as having saved enough tokens and were assigned a score of three. One child was excluded for failing to make a response.

The Tower of Hanoi (adapted from Carlson et al., 2004) measured planning. This task was introduced to children as the *Monkey Jumping Game* where three wooden disks represented a family of monkeys (a large dad monkey, a medium brother monkey, and a small sister monkey) that lived in trees (three wooden pegs) surrounded by a river. The experimenter explained the rules: (1) bigger monkeys could not sit on smaller monkeys, (2) only one monkey could jump in the trees at a time, and (3) the monkeys could not fall in the river (i.e., be put down on the table). Children were given three rule checks to ensure they understood the rules. The majority of children (74%) answered the three rule check questions correctly and those who answered incorrectly were corrected by the experimenter. Next, children were presented with their own set of monkeys, the copycat monkeys, that would always try to match the final position of the experimenter's monkeys. The experimenter's monkeys always remained on the peg at the far-right end and represented the end goal state. Children were given a practice trial with one disk requiring one move. The game began with two disks requiring one move (level 1) and progressed in difficulty with the last level (level 6) requiring three disks and four moves. At each level, all children were given two trials, where they had to pass at least one trial to proceed to the next level. Children could take as much time as they needed on each trial. After any incorrect trials, children were reminded of the relevant rule. The game ended when children failed two trials on a given level. The total score was based on the highest level completed (range = 0-6).

The Vehicle Card Sort task (adapted from Kvavilashvili & Ford, 2014) measured prospective memory. Children were instructed to name the colour of a vehicle (e.g., cars, trains, trucks) on the cards (the ongoing task) and instructed to say to Bert the Bear "Don't be afraid Bert" if they saw a bicycle on one of the cards (the prospective memory task). Children then drew pictures during a 3-minute delay period before starting the ongoing task. Bicycle pictures were presented in the 7th, 23rd, and 36th positions in a stack of 40 cards. After children finished the task, they were asked a control question ("What were you supposed to do when you saw a bicycle?") to make sure they remembered what they were supposed to do in the game. As in Study 2, if children were unable to recall the prospective intention after the control question was asked, three additional probing questions were asked ("What else did you have to do in this game?", "What did you have to do when a bicycle was on one of those cards?", "What did you have to do so Bert the Bear wasn't scared?") increasing in specificity, until children could report the prospective memory intention. Children were given a prospective memory score out of three. Eighteen children were excluded from the analysis for retrospective memory failure ($n = 15$), failing to complete the task ($n = 1$), or failing to follow task instructions ($n = 2$).

The Gift Delay (Carlson et al., 2004) was used to measure delay of gratification. The experimenter told the child they had a present for them, but they forgot to wrap it. The child's chair was turned around, so they were facing away from the table where the experimenter wrapped the gift. Children were told not to peek until the experimenter told them it was okay to do so. The experimenter then noisily wrapped a small present for 60 seconds. Children were invited to unwrap the gift when the time was up. Children were scored based on an overall peeking score (0 = *full torso turn to peek*, 1 = *peeking over shoulder*, 2 = *no attempt to peek*). Interrater reliability indicated substantial agreement between independent coders, $\kappa = .73$. Two children were excluded from the analysis for failure to follow task instructions.

Cognitive flexibility was measured using the Dimensional Change Card Sort Test from the NIH Toolbox for the Assessment of Neurological and Behavioral Function (NIH-TB; Zelazo et al., 2013) battery of cognition measures. Using an iPad, children selected the stimulus that matched the target stimulus. The criterion matching word (i.e., shape or colour*)* appeared on the screen and was orally delivered via the iPad. First, children practiced matching stimuli by shape (i.e., rabbit and boat) and then by colour (i.e., brown and white). Next, children completed three test trials with stimuli of different shapes and colours. For the test trials, children started matching by colour, then by shape, and finally by shape and colour in order to assess their ability to switch flexibly between criterion. Children completed 40 trials, which took approximately 4 minutes to complete. Scores ranged from 0 to 10, with higher scores indicating better performance. Fifteen children were excluded for being unable to complete the practice trials (n = 2), technical difficulties (n = 1), or failure to complete the task (n = 12).

Receptive vocabulary was measured using the NIH-TB Picture Vocabulary Test (National Institutes of Health, 2012). Using an iPad, four pictures appeared on the screen and children selected the picture that matched the word that was produced by the iPad. The test took approximately 4 minutes. Children's uncorrected scale score was recorded. Four children were excluded for failure to complete the task (n = 3) and experimenter error (n = 1).

Results and Discussion

Missing data consisted of "don't know", "does not apply", and "prefer not to answer" responses, as well as truly missing data (i.e., blank responses). These missing values were replaced using Estimation Maximization procedure. A negligible amount of missing data constituted truly missing responses (<1%). For all correlational analyses two-tailed tests were performed.

Internal Consistency

Each subscale and the full scale of the CFTQ showed strong internal consistency reliability (see Table 2.1). Therefore, the CFTQ overall is a reliable measure, and showed similar subscale reliability as Study 2.

Full Scale and Subscale Correlations with Age

Table 2.1 shows correlations among children's age in months, subscales scores, and the full-scale score. Children's age in months was significantly positively correlated with all subscales and the full scale, *r*s (99) = .24 to .40, *p*s < .02. Importantly, as in Study 2, the CFTQ captured development in future-oriented cognition that is similarly reported in the literature using behavioural measures. Consistent with Study 2, the subscales remained significantly correlated after controlling for child's age, *prs* (98) ranged from .34 to .65, *ps* < .002.

Behavioural Task Correlations with Age

As expected, the five behavioural tasks, measuring the five domains of future-oriented cognition, were significantly correlated with child's age in months, *rs* (81 – 99) = .35 - .70, *ps* <

.001. These results are in line with studies that use these tasks and similarly find age-related improvements in performance across childhood (e.g., Atance & Jackson, 2009; Bélanger et al., 2014; Otto et al., 2006).

Correlations Between Behavioural Task and Subscale Ratings

See Figure 2.2 for scatterplots between CFTQ subscale ratings and corresponding behavioural tasks. The saving, episodic foresight, planning, and delay of gratification subscales were all significantly and positively associated with the corresponding behavioural task (Saving Board Game, Future Preferences task, Tower of Hanoi, and Gift Delay peek resistance score, respectively; see Table 2.1). However, parent ratings on the prospective memory subscale were not significantly related to children's behavioural performance on the card sort task, although the correlation was in the expected, positive direction. Performance on the Gift Delay task and the delay of gratification subscale remained significantly correlated after controlling for age, pr (27) = .45, p = .01. After controlling for child age in months, receptive vocabulary, and cognitive flexibility, the relation between tasks and the corresponding subscales was no longer significant, ps > .05. Further, the full-scale score was significantly related to each of the five behavioural tasks, rs (81 - 99) = .23- .42 ps < .05. Since behavioural tasks were intercorrelated (rs = (80 – 98) = .20 - .49, ps < .07)[2] a composite score of the five behavioural tasks was created. The composite score of behavioural measures was also significantly correlated with the full-scale score (r (80) = .45, p < .001) and remained significantly correlated after controlling for child's age in months, cognitive flexibility, and vocabulary, pr (65) = .29, p = .02. Overall, the relation between children's future-oriented behavioral performance (i.e., the composite score of the five

[2] When we controlled for child's age in months and receptive vocabulary only three correlations remained significant (i.e., The Saving Board Game remained correlated with the Future-Preferences task and the Tower of Hanoi and the Gift Delay remained correlated with the Tower of Hanoi, (prs = (93) = .23 - .28, ps < .03)

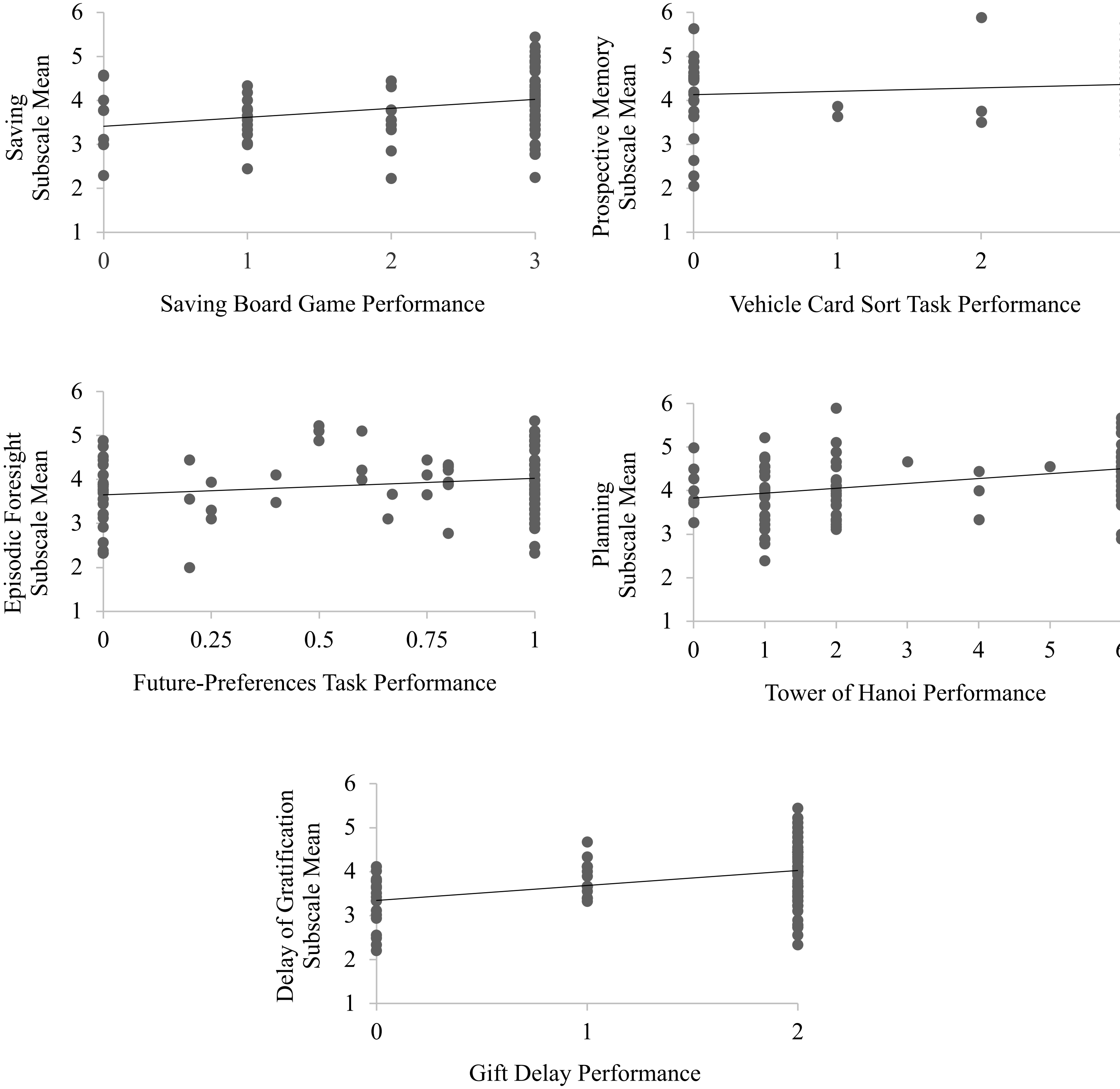

Figure 2.2 Correlations between behavioural tasks and corresponding CFTQ subscale from Study 3.

behavioural measures) supports the overall validity of the CFTQ. The lack of a significant correlation between the prospective memory subscale and the prospective memory task (which was also non-significant in Study 2), may suggest that parents have difficulty reporting on their child's prospective memory ability. One possibility is that items on the prospective memory subscale may also capture children's retrospective memory ability, which contributes to prospective memory failures in daily life. Thus, parents might have difficulty considering children's ability to carry out future intentions (prospective memory component) separately from their ability to remember the content of the intention (retrospective memory component). These possibilities will be further explored in the general discussion.

BRIEF-P and CFTQ Subscale Correlations

See Table 2.2 for correlations between the BRIEF-P and the CFTQ subscales. Results showed that the planning/organization subscale of the BRIEF-P was significantly correlated with all the CFTQ subscales. Specifically, parents who rated their children as having higher future-oriented cognition on the CFTQ also tended to rate their child as having lower impairment in planning/organization on the BRIEF-P. The relation between these measures provides further confidence of the CFTQ's validity especially in regard to future planning/organization.

Given the lack of a significant relation between the prospective memory subscale of the CFTQ and lab-based prospective memory tasks in Study 2, we examined whether the CFTQ's prospective memory subscale was related to BRIEF-P items that tapped into more naturalistic elements of prospective memory (although they likely also tapped into children's retrospective memory ability and absentmindedness). We selected two items ($\alpha = .69$) from the BRIEF-P that

Table 2.2

Correlations between the BRIEF-P Plan/Organization subscale and the CFTQ subscales

Measure	1	2	3	4	5
1. BRIEF-P: Plan/Organize	—				
2. Saving	-.37 **	—			
3. Prospective Memory	-.48 **	.58**	—		
4. Episodic Foresight	-.43 **	.66**	.67**	—	
5. Planning	-.39 **	.68**	.68**	.66**	—
6. DoG	-.45 **	.51**	.37**	.50**	.48**

Note. N = 83-101. ** indicates $p < .01$.

measured children's memory: (1) "When sent to get something, forgets what he/she is supposed to get", (2) "Forgets what he/she is doing in the middle of an activity". These memory items from the BRIEF-P were significantly related to the prospective memory subscale of the CFTQ, r (89) = -.32, p = .002, and remained significant after controlling for child's age in months. Thus, this relation lends some support for the validity of the prospective memory subscale of the CFTQ.

Overall, Study 3 provided further evidence for the reliability of the 44-item CFTQ. The subscales showed generally good reliability and the full scale showed high internal consistency. The subscales and behavioural tasks detected age-related increases in children's future-oriented cognition. Further, parent's ratings of children's abilities on four out of five CFTQ subscales were significantly related to children's performance on the corresponding tasks, thus providing further evidence for the validity of the refined measure.

Study 4

Study 4 involved the distribution of the newly formed 44-item CFTQ at two different points in time to parents online, using MTurk. The main goal of Study 4 was to examine test-retest reliability (between Time 1 and Time 2) of the CFTQ to ensure that parents responded similarly to the questionnaire at two separate times approximately three weeks apart.

Method

Participants

All participants completed a qualification survey ensuring they were parents of a typically developing, English speaking child between the ages of 3 and 7 from the United States. Of the participants who completed the initial qualification survey ($N = 698$), 300 of those participants possessed the inclusion criteria required to complete the CFTQ. At Time 1, 197 participants proceeded to complete the CFTQ, and 136 participants completed the CFTQ at Time 2. Data from 31 participants was excluded at Time 2 for completing the CFTQ under 5 minutes ($n = 1$), errors in child date of birth from Time 1 to Time 2 ($n = 28$), or their child being older than 7 years of age ($n = 2$). Thus, the final sample consisted of 105 parents (22 parents of 3-year-olds, 29 parents of 4-year-olds, 17 parents of 5-year-olds, 19 parents of 6-year-olds, and 18 parents of 7-year-olds). Overall, children ranged in age from 37 to 96 months ($M = 67$ months, $SD = 16.02$). The majority of parents had at least a post-secondary education (58%) and were from middle-class backgrounds (83% earning over $40,000 annually per household). Seventy-four percent of participants were mothers and 26% percent were fathers.

Measures

Children's future-oriented cognition was measured using the 44-item CFTQ (see Appendix A). Parents indicated their agreement to 44 statements on a 6-point Likert scale.

Procedure

Participants first completed a pre-screening survey. This pre-screening survey ensured that participants were residents of the United States and were parents of at least one 3-to-7-year-old child who was typically developing and fluent in English. Only parents who met these criteria were invited to complete the 44-item CFTQ on MTurk. At Time 1 and again at Time 2, participants were asked to provide consent and answer demographics questions and then complete the 44-item CFTQ. Participant completed the 44-item CFTQ for the first time at Time 1 and then completed the CFTQ for a second time at Time 2 approximately 17 to 24 days later (M = 21.25 days, SD = 1.18).

At each time point, we ensured that all participants who completed the questionnaire met the inclusion criteria for the study. All procedures were approved by the Research Ethics Board at Brock University (*Cross-Validation of a Parent Questionnaire on Children's Thinking* [file: 16-319-MAHY]).

Results and Discussion

Missing data consisted of "don't know", "does not apply", and "prefer not to answer" responses, as well as truly missing responses (i.e., blank responses). A negligible amount of missing data constituted truly missing responses (<1% at Time 1 and Time 2). Missing data values for the questionnaire items were replaced using Estimation Maximization.

Test-Retest Reliability for the Full Scale and Subscales

Test-retest reliability between Time 1 and Time 2 for the full scale was excellent, r (105) = .89, $p < .001$. Importantly, test-retest reliability was equally high when missing data was not replaced, r (105) = .88, $p < .001$. All subscales had generally high test-retest reliability, rs (105) = .74 -.88, $p < .001$. The excellent test-retest reliability of the 44-item CFTQ and its five subscales suggests that parents were consistent in their ratings of their child's future-oriented abilities across a period of 2 to 3 weeks, lending further support for the reliability of the CFTQ.

General Discussion

The current study examined the reliability and validity of a newly developed parent-report measure of children's future-oriented cognition in a field that previously relied heavily on behavioural tasks measured in a laboratory environment. Moreover, this study sought to overcome some of the limitations that accompany behavioural measures of children's future-oriented cognition, such as lack of coherence among measures, high verbal demands and low ecological validity. In Study 1, the 79-item CFTQ was distributed to parents on MTurk and provided initial evidence for the reliability of the measure as well as parent's ability to detect age-related development in five key domains of children's future-oriented cognition. Study 2 involved the refinement of the scale, which similarly showed high internal consistency reliability and promising validity. This shorter 44-item version of the CFTQ showed similarly high reliability and strong validity for four of the subscales in Study 3. Using a factor analysis, Study 2 suggested that future-oriented cognition as measured by the CFTQ represented a single factor, rather than five separable domains. Study 4 showed excellent test-retest reliability of the CFTQ.

Taken together, our findings provided support for age-related increases in future-oriented cognition in children 3-to-7 years old, from parent-report and behavioural measures. This aligns with previous findings using behavioural measures that suggest children begin to develop future-oriented abilities around 3 years old and continue to hone these skills into middle childhood and even adolescence (e.g., Atance & O'Neill, 2005; Kliegel & Jäger, 2007). Importantly, parents were able to detect age-related increases in their child's future-oriented abilities using the CFTQ and this similar developmental pattern was found across the five domains of future-oriented cognition. Thus, the CFTQ seems particularly useful for capturing the developmental growth that occurs in children's future-oriented abilities across the preschool years.

Across all studies, the CTFQ demonstrated high internal consistency on all five subscales as well as the full scale. However, it is noteworthy that the delay of gratification and saving subscales consistently showed slightly lower reliability across studies compared to the other subscales. Items in these subscales might not have related to other items as closely given the breadth of items on these subscales. For example, our saving subscale includes items examining children's ability to save money, time, space, and resources, which may have been less related to other items within the subscale. However, fluctuations in reliability across subscales are less concerning given the high reliability of the full scale. Further, the existence of a single factor structure suggests that these domains of future thinking may represent one core ability. This finding is supported by work that suggests domains of future thinking (i.e., simulation, prediction, intention, and planning) may build upon and interact with one another (Szpunar et al., 2014). Neuroimaging research also suggests similar activation patterns in the default mode network in response to future-oriented thinking (e.g., Buckner & Carroll, 2006). Overall, the CFTQ makes an important contribution to the field as a reliable parent-report measure of children's future-oriented cognition.

In addition to examining the CFTQ's reliability, another goal was to examine its validity. In Study 2, we found relations between the planning and episodic foresight subscales and the corresponding behavioural tasks. In contrast, Study 3 found a greater number of subscales (i.e., saving, episodic foresight, planning, and delay of gratification subscales) were associated with the corresponding behavioural task. Although the prospective memory subscale was not significantly correlated with the prospective memory tasks in Study 2 and Study 3, it was correlated with items tapping aspects of prospective memory (likely also including retrospective memory components) measured by the BRIEF-P. Overall, we found support for the validity of the CFTQ.

There are several possible explanations for the lack of relation between the prospective memory subscale of the CFTQ and the prospective memory behavioural tasks. First, it is possible that parents may not be able to assess their child's future thinking as accurately as behavioural measures. This seems unlikely, however, given parent's ability to accurately report on children's cognitive abilities in other areas, such as theory of mind (e.g., Tahiroglu et al., 2014) and on the other CFTQ subscales.

Second, perhaps that the lack of relation between the prospective memory subscale and corresponding behavioural measures arose from specific task demands of behavioural measures. For example, children performed much worse in Study 3's prospective memory task that required children to remember and verbalize a specific instruction (i.e., having children tell a toy not to be afraid) compared to the prospective memory task in Study 2 that required a physical action only (i.e., placing the card in a box). The fact that 15 children in Study 3 could not recall the intention retrospectively suggests that children had difficulty remembering what they had to say. Notably, Atance and Jackson (2009) have suggested that future thinking involves multiple processes including working memory and inhibitory control as well as episodic future projection. So, while future orientation is necessary to anticipate future events, it is not sufficient to complete future-oriented tasks. Thus, children's behavioural performance might be strongly affected by memory, executive, and linguistic demands imposed by prospective memory, but parents might struggle to assesses these types of cognitive demands when using the CFTQ.

Third, it may be that behavioural measures of prospective memory conducted in the laboratory differ from children's prospective memory capabilities in everyday life. Parents might be good at estimating their children's future thinking in naturalistic and varied contexts, but behavioural tasks in the lab may be too narrow and have too few trials to capture variance in future-oriented cognition as it is displayed in everyday life. Interestingly, relations between naturalistic and behavioural measures of prospective memory are relatively rare. For example, Unsworth et al. (2012) found that adults' performance on a laboratory prospective memory task was unrelated to the number of self-reported prospective memory failures participants reported during a week in their daily life.

Finally and we believe most likely, parents might be able to report on their children's prospective memory, but are unable to separate (and differentially evaluate) the retrospective and prospective components involved in prospective remembering. Notably, prospective memory is not a pure process and also relies on retrospective memory and executive control (e.g., Kliegel & Jäger, 2007; Mahy et al., 2014). While we controlled for retrospective memory failures in the laboratory-based prospective memory tasks, parents were unlikely to separate prospective memory failures due to poor retrospective memory (i.e., forgetting what you had to do) versus prospective memory (i.e., forgetting to carry out the intention at the appropriate time). Supporting this argument, when children's naturalistic prospective memory in Study 2 was scored more leniently to include children who failed the task due to forgetting the intention (i.e., due to a retrospective memory error), children's performance was positively related to the prospective memory subscale of the CFTQ[3]. Thus, parents are likely including instances where children's forgetting was caused by retrospective memory failures when evaluating their children's prospective memory. Further, some CFTQ items likely tap children's memory for the

[3] When children who needed none, one, or two prompts to recall the future intention were scored as correct (see Guajardo & Best, 2000), the naturalistic task composite score was significantly related to the PM subscale, r (69) = .25, p = .03.

content of the prospective memory intention more than children's ability to carry out the future intention (e.g., "Remembers what time he/she is supposed to be places (e.g., at 3 p.m. he/she is due at a friend's house")). This could also explain why we found significant relations between our prospective memory subscale and the two BRIEF-P items, which may also tap into retrospective memory and absentminded failures. Importantly, although prospective memory might be harder for parents to accurately assess, the one-factor structure of the CFTQ and the relation between the full scale and behavioural task composite score in Study 3 provides evidence that the CFTQ overall is a valid measure of children's future-oriented cognition. Thus, the scale may be most useful as a global measure of children's future-oriented cognition, rather than a measure of individual future-oriented abilities, like prospective memory.

One of the primary objectives of the creation of the CFTQ was to overcome the limitations that accompany behavioural methods of assessing children's future-oriented cognition. The first limitation that the current study aimed to address was the lack of coherence among behavioural tasks measuring children's future-oriented cognition (see Atance & Jackson, 2009). In line with Atance and Jackson's (2009) findings, the relations among our behavioural measures fell below significance when we controlled for age and receptive vocabulary, suggesting that these abilities do not cohere well once developmental increases are accounted for. We similarly found that after controlling for age, relations between most subscales and the corresponding behavioural measures were no longer significant suggesting that the CFTQ is detecting age-related changes in these domains. In contrast to the lack of relation among behavioural measures of future thinking, each of the five subscales of the CFTQ remained correlated, even after controlling for age, which suggests that the CFTQ is able to detect shared variance in future-oriented thinking across the five domains, over and above what relates to age.

The second limitation of behavioural tasks is that they often place a high demand on children's verbal abilities (e.g., Suddendorf & Busby, 2005). The CFTQ directly addresses this limitation by eliminating any verbal demand on children by having parents report on their children's abilities. Third, to address the lack of representativeness in typical samples collected at a university laboratory, the CFTQ can be distributed to parents online and has the ability to reach participants from diverse economic, social, and ethnic backgrounds. Fourth, the CFTQ also overcomes the lack of ecological validity associated with laboratory-based measures by having parents report on their children's future-oriented cognition in the child's daily life and across varied contexts. The ecological validity of the CFTQ is documented by the relation between our prospective memory subscale and more naturalistic measures of prospective memory, such as the BRIEF-P (Study 3). However, the ecological validity of the other CFTQ domains is less well supported since many of the behavioural tasks used in the current study were lab-based. Future studies should consider examining the relation between children's performance on more naturalistic future-oriented cognition measures and the CFTQ to better determine the ecological validity of the measure. Finally, relying solely on behavioural tasks excludes the important perspective of the parent. In general, parents are able to accurately report on their children's future-oriented cognition and their perspective may be especially valuable when trying to measure very young children's abilities across a variety of contexts (e.g., home, school, extracurricular activities).

As the first parent-report measure of children's future-oriented cognition across multiple domains, there are some limitations to the CFTQ. Mainly, the CFTQ seems to detect age-related changes in children's future-oriented cognition but does not seem to be particularly strong in detecting individual differences in this ability, given that the relations between most subscales and behavioural tasks disappear after controlling for age. However, overall, the CFTQ did relate to all behavioural tasks combined, after controlling for age, lending support for its ability to detect individual variation in children's future-oriented cognition broadly speaking. Nevertheless, the CFTQ seems to be a more valuable measure of developmental change in children's future-oriented abilities than individual differences.

There are several important directions for future research using the CFTQ. First, the CFTQ could be adapted for teacher reports, which could be paired with parent reports and behavioural measures to provide a more complete picture of children's future-oriented cognition across a variety of contexts (i.e., school, home, and the laboratory). Second, future work could examine the ability of the CFTQ to capture deficits or differences in future-oriented cognition in atypical populations. Given that children with autism spectrum disorder have deficits in future-oriented cognition (e.g., Altgassen et al., 2009), the CFTQ is a promising tool with which to assess future-oriented cognition and its development in special populations.

Taken together, these studies suggest that parents provide important insight into their children's future-oriented cognition. Parent reports are important for capturing a complete understanding of children's future-oriented development, in varied contexts, which is missed when behavioural measures are used on their own. The CFTQ is a reliable and valid measure of children's future-oriented cognition—one that can capture developmental growth of children's future-oriented development. The CFTQ will be a useful tool for answering new research questions in the burgeoning field of children's future-oriented cognition and will complement currently available behavioural measures.

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Appendix A

Children's Future Thinking Questionnaire Items

Reverse items are marked by (R)

Saving

1. Does not consider how long it will take to save up for a desired item (e.g., does not consider how many stickers he/she must earn to get a prize) **(R)**
2. Tries to find ways to decrease the amount of time it takes to complete a task (e.g., uses the fastest route to a friend's house when he/she is running late, or uses a box to collect items more quickly when cleaning up)
3. Saves items for a time when he/she might be bored (e.g., saves a new book to read while waiting in doctor's office).
4. Saves a seat for someone who has not yet arrived (e.g., at the dinner table or at a play).
5. Saves an item to show someone at a later date (e.g., saves artwork to show a relative visiting later in the week).
6. Eats a large snack and saves no room for dinner. **(R)**
7. Saves money in a piggy bank for future purchases.
8. Discards items he/she needs at a later time (e.g., throws away items that are needed later for an arts and crafts project). **(R)**
9. Saves energy for a physically demanding task (e.g., relaxes during the day to save energy for an evening soccer game).

Prospective Memory

1. Remembers what items need to be purchased/picked-up (e.g., reminds parent to pick up cereal from grocery store).
2. Remembers what time he/she is supposed to be places (e.g., at 3 p.m. he/she is due at a friend's house)
3. Remembers to pass on messages to family/friends (e.g., tell mom/dad to pick up pizza for dinner when mom/dad picks you up from school).
4. Gives reminders to parent or others of something he/she forgot (e.g., reminds his/her parent to pick up Halloween treats for the class).
5. Forgets what is scheduled for the week (e.g., music lessons after school). **(R)**
6. Remembers to bring required items to school/daycare (e.g., change of clothes for gym class or a show and tell item to school).
7. Remembers to bring appropriate items to specific occasions (e.g., brings a gift to a friend's birthday party, or wears a Halloween costume to school on Halloween).
8. Forgets to bring appropriate clothing for changes in weather (e.g., forgets rain jacket or umbrella when it is going to rain). **(R)**

Episodic Foresight

1. Fails to understand that current and future desires can differ (e.g., when he/she wakes up in the morning full of energy, he/she may not think he/she will be tired at nighttime). **(R)**
2. Fails to understand that his/her activity preferences may change over time (e.g., he/she claims he/she will always love coloring). **(R)**
3. Understands that he/she may be hungry later even though he/she has just eaten a large meal.
4. Fails to anticipate future physical states (e.g., doesn't think about bringing a jacket to the park). **(R)**
5. Accurately recognizes the responsibilities involved in taking care of another living thing in the future (e.g., new pet or watering a plant).
6. Understands that even though he/she is not interested in an activity now, he/she may be interested in that activity at a later time (e.g., he/she might not want to play with his/her sibling today, but may want to play with them tomorrow).
7. Fails to understand that if he/she feels sick now, he/she will start to feel better in the days to come. **(R)**
8. Underestimates future physiological needs (e.g., fails to go to the bathroom before a long walk). **(R)**
9. Thinks about what might be needed for future excursions (e.g., bringing toys/books on a long car ride).

Planning

1. Will dive into a complicated problem without thinking about possible strategies to use to solve the problem (e.g., starts a puzzle before grouping pieces by colour). **(R)**
2. Plans what may be required for school/daycare that week (e.g., he/she plans what show and tell item to bring for show and tell).
3. Does not plan what he/she is going to take on a vacation (e.g., does not pack items for a trip in his/her suitcase). **(R)**
4. Involves him/herself in the planning of his/her personal space (e.g., requests specific colour when bedroom is being redecorated).
5. Sets goals and takes steps to achieve those goals (e.g., wishes to learn to swim and asks parent to enroll him/her in swimming lessons).
6. Involves him/herself in the planning of social events (e.g. he/she tells parents which friends he/she would like to invite to his/her party).
7. Does not plan to take appropriate items with them when going out (e.g., does not plan to bring a snack with him/her on a day trip). **(R)**
8. Seeks the information required for an activity ahead of time (e.g., asks teacher if he/she can bring his/her pet for show and tell).
9. Does not plan for future situations ahead of time (e.g., does not plan to bring a gift to his/her friend's birthday). **(R)**

Delay of Gratification

1. Will not eat healthy foods at dinner even if he/she won't get dessert as a consequence. **(R)**

2. Would rather watch TV/play video games right away, for a short period of time, than for a longer amount of time later. **(R)**
3. Wants to open all his/her presents immediately rather than waiting for the appropriate day (e.g., birthday, Christmas, Hanukkah, etc.). **(R)**
4. Settles for an item he/she does not really want if he/she can have it right away (e.g., settles for a less desirable toy). **(R)**
5. Prefers to win one item with less effort rather than win two items with more effort (e.g., stickers). **(R)**
6. Will wait in a long line to receive something he/she considers valuable (e.g., he/she will wait in long line to get a picture with a mascot versus simply seeing the mascot).
7. Will complete a less enjoyable activity so he/she can participate in a fun activity later (e.g., playing with friends or watching TV).
8. Forgoes a small treat in the present to receive a larger treat in the future (e.g., he/she would rather have two cookies after dinner versus one cookie before dinner).
9. Would rather eat one bite of cake immediately rather than wait longer to eat a whole piece of cake. **(R)**

CHAPTER 3

Study 2: "What Should You Bring with You to This Place?": Examining Children's Episodic Foresight Using Open-Ended Questions[4]

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 et al., 2015) as well as avoid future problems (e.g., obesity; Dassen et al., 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 et al., 2016).

Research has examined the development of episodic foresight in children as young as 3-years-old (e.g., Atance et al., 2015; Atance and Meltzoff, 2005; Scarf et al., 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

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wide range of different episodic foresight tasks (e.g., Atance & Meltzoff, 2005; Bélanger et al., 2014; Hayne et al., 2011; Suddendorf & Busby, 2005; Suddendorf et al., 2011).

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 et al., 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, 2010). 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) 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 et al., 2012; Russell et al., 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 using 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 daily (e.g., Moffett et al., 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).

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 et al., 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 that 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 favourite 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 & Meltzoff, 2005; Atance & Jackson, 2009; Hanson et al., 2014; Mahy et al., 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 crib) 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

In this task (adapted from Atance & Meltzoff, 2005), 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 3.1 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, $\kappa = .95$, $p < .001$.

Table 3.1

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

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 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 3.1 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 et al. (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 3.2 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 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 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 3.2 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, $\kappa = .89$, $p < .001$.

Table 3.2

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

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 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 3.3 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 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* χ^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 positively related to age in months, $r(46) = .39$, $p = .01$.

Table 3.3

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. $N = 48$.

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 (n = 61), 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* χ^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 positively 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, χ^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 behavioural 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 et al., 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 et al., 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 pre-requisite 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 endeavour. 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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CHAPTER 4

Study 3: Verbal explanations and item choices as joint indices of children's episodic foresight[5]

Thinking about the future is a frequent daily occurrence (e.g., D'Argembeau et al., 2011) and an essential skill that develops across the lifespan (Abram et al., 2014). For example, whereas most adults can easily imagine that warm clothing and ski gear will be needed for an upcoming ski trip, children tend to experience more difficulty and may erroneously predict a later need for items that are enticing to them right now (e.g., stickers), but inappropriate for the future in which they will find themselves. The capacity to mentally project oneself into the future and act with that imagined future in mind is referred to as *episodic foresight* (EpF; Suddendorf, 2010). EpF first emerges in early childhood and generally improves with age (Atance & Meltzoff, 2005; Suddendorf & Busby, 2005). However, researchers have debated whether some of the measures of episodic foresight truly capture future self-projection or whether they capture other abilities (e.g., Atance et al., 2019; Dickerson et al., 2018; Hudson et al., 2011). The main motivation of this study was to determine the degree to which episodic foresight is captured on commonly used episodic foresight tasks: the Spoon and the Picture-book. Further, our secondary aim was to explore the factors that may affect children's tendency to think in a future-oriented and episodic manner on such tasks.

The ability to mentally travel forward in time is proposed to arise from episodic (remembering) and semantic (knowing) memory (Tulving, 1972; 1984). Semantic memory is thought to develop earlier than episodic memory and stores information about the world from

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[5] This chapter is based on the in-revision article: Mazachowsky, T. R, Atance, C. M., Rutt, J. L., & Mahy, C. E. V. (revisions requested). Verbal explanations and item choices as joint indices of children's episodic foresight.

past events not tied to a specific experience (Tulving, 1985; 2005), such as knowing that beaches have sand. In contrast, episodic memory is a later developing system, which processes information about personal events (e.g., what happened and where it occurred) including temporal markers (e.g., when it occurred; Tulving, 1984; 2005), such as remembering the trip you took to the beach last week. A defining feature of episodic memory, however, is autonoetic (self-knowing) awareness allowing for the placement of oneself in a past or future time (i.e., self-projection) and thus a sense of self that is continuous in time.

Research supports the earlier development of semantic (vs. episodic) memory; for example, in one study 3- and 5-year-olds provided more information when generally describing an event (i.e., a script; "What *happens*…) than when describing an episodic memory of the same event ("What *happened*…). Young children also tend to provide general knowledge of events for both scripts and episodic episodes (Hudson & Nelson, 1986). Thus, both these distinct memory systems (e.g., Wheeler et al., 1997) are speculated to play a role in future thinking (Atance & O'Neill, 2005). However, episodic memory is particularly thought to aid in constructing and recombining details from one's past experiences in a novel way (see the *constructive episodic simulation hypothesis*; Addis & Schacter, 2008; Schacter & Addis, 2007) to envision the self in the future. In fact, neuroimaging studies report a common neural network (i.e., default mode network) involved in recalling one's past and imagining one's future (e.g., Schacter & Addis, 2007).

EpF is argued to first emerge in children as young as 3 years old and develops across childhood and into early adulthood (Abram et al., 2014; Atance & Meltzoff, 2005; Suddendorf & Busby, 2005). In children, the development of EpF may be gleaned from a variety of verbal and non-verbal measures. For example, in one verbal task, children answered questions about events that will occur in the future (e.g., “What are you going to do at bedtime tonight?”), events that occurred in the past (“What did you do at bedtime last night?”), and events more generally (i.e., scripts; “What do you do at bedtime?”; Quon & Atance, 2010). Three-and 4-year-olds provided less accurate responses overall and relied more on semantic memory (i.e., showed greater use of scripts) compared to 5-year-olds. Generally, then, young children (e.g., 3-year-olds) may use their semantic knowledge to support their EpF, which may be limited to considering routine events, in simple contexts. In contrast, advancements in EpF may be evidenced by more independent thinking about the future across complex and novel future events, possibly permitted by improvements in other cognitive abilities (e.g., memory, executive function, language; Hudson et al., 2011).

In recent years, researchers have argued for the importance of testing children’s episodic foresight using non-verbal measures, since verbal measures can either under- or over-estimate children’s competence (see Suddendorf & Busby, 2005 for discussion). Two of the most popular means to do so include the “Spoon” task (e.g., Suddendorf et al., 2011) and the Picture-book task (e.g., Atance & Meltzoff, 2005). The Spoon task (Suddendorf & Busby, 2005) evaluates children’s ability to solve a novel problem in the future, such as selecting an appropriate tool for future use. In a typical Spoon task, children encounter a problem in one room (e.g., a puzzle board without puzzle pieces, a locked box) and are then brought to another room for a brief delay. Children are then told that they will be returning to the original location and presented with an array of items including one (e.g., puzzle pieces, a key) that can solve the problem or fulfil a future need in the previous room (e.g., bringing puzzle pieces to avoid boredom or a key to open a locked box to retrieve an object; Suddendorf & Busby, 2005; Suddendorf et al., 2011). Research using the Spoon task and its variants show age-related improvements in children’s ability to select the item that will fulfill physiological (Caza & Atance, 2019) and psychological (e.g., Atance & Sommerville, 2014; Caza & Atance, 2009; Suddendorf & Busby, 2005) future needs.

The Picture-book task is commonly used to measure children's ability to anticipate their future needs in a specific novel location. In the original version of the task, 3- to 5-year-olds imagine visiting a desert, rocky stream, dirt road, snowy forest, mountain, and waterfall in the future (Atance & Meltzoff, 2005). For each location, children are asked to select an item to bring with them. Whereas the correct item can address a future need or state likely to be experienced in the location (e.g., sunglasses to keep the sun out of one's eyes in the desert), the distractor items (e.g., soap) or semantic associate (e.g., seashell) do not address this need. Results tend to show that 5-year-olds select the correct item more often than 3- and 4-year-olds. Further, 3-and 4-year-olds' errors are often due to selecting the semantic associate over the correct item. Overall, studies using the Picture-book task consistently report developmental improvements in children's ability to select the correct item for the future (e.g., Atance & Jackson, 2009; Hanson et al., 2014; Mahy et al., 2014; Mazachowsky & Mahy, 2020; Mazachowsky et al., 2020).

In both the Spoon and Picture-book tasks, children are sometimes asked to explain their item choices. On the Spoon task, Suddendorf et al. (2011) reported a relation between performance on the non-verbal choice component and children's verbal explanations for their choice; a majority of children who selected the correct item also referred to the future utility of the item in their explanations (e.g., selecting the key "to get stickers"). Atance and Sommerville (2014) also reported correspondence between correct item choices and explanations, but children's explanations were considered correct if they referenced the problem encountered in the previous room or the action they would take in that room and not necessarily whether children referred to the future as in Suddendorf et al. (2011). Using a more naturalistic method, children's spontaneous utterances on an adapted version of the Spoon task have also been examined (Caza & Atance, 2019). In this case, children who correctly placed an item where it would be needed in the future also made more future and past spontaneous remarks during the task than those who failed the task. Thus, research seems to suggest a correspondence between children's success on the item choice component of the Spoon task and temporally focused explanations (i.e., references to future or past).

Children's explanations for their item choices have also been measured and examined in the Picture-book task as an indicator of EpF (e.g., Atance & Jackson, 2009; Atance & Meltzoff, 2005; Atance & O'Neill, 2005; Hanson et al., 2014; Mahy et al., 2014; Mazachowsky & Mahy, 2020; Mazachowsky et al., 2020). However, only some studies have examined verbal and non-verbal components separately (e.g., Atance & Meltzoff, 2005; Atance & O'Neill, 2005; Mazachowsky et al., 2020). Atance and Meltzoff's (2005) investigation of children's explanations revealed that 5-year-olds tended to refer to the future (e.g., "It's *gonna* be hot") and future states (e.g., "I *will* get *hungry*) likely to be experienced in the locations more than younger children. Further, the frequency of future state references also differed across location trials. For example, children who provided the correct item choice referenced a future state the most for the stream location, and the least for the desert location. Other studies examining children's verbal explanations have found that children tend to provide more present than future-oriented references on the task (e.g., Atance & O'Neill, 2005, Mazachowsky et al., 2020) and refer to semantic and episodic details approximately equally (Mazachowsky et al., 2020). Thus, children could be selecting the correct item for future use without engaging in EpF, which challenges the assumption that the Picture-book task requires future thinking (see also, Hayne et al., 2011;

Hudson et al., 2011; Martin-Ordas et al., 2014). This may be particularly true for young children since semantic memory may develop earlier than episodic memory (e.g., Wheeler et al., 1997). Importantly, previous studies have yet to systematically examine the correspondence between item choice performance and explanations with the explicit goal of determining whether these tasks are drawing on episodic and future-oriented processes.

As with the Picture-book task, the extent to which the Spoon task succeeds in tapping episodic foresight has also been questioned (Atance et al., 2019; Dickerson et al., 2018; Martin-Ordas, 2017; Moffett et al.., 2018). For example, Atance and Sommerville (2014) found that 3- to 5-year-olds' success in selecting the correct item was accounted for by children's memory for the problem and not by age. This finding suggests that the Spoon task may not require future self-projection to select the correct item but rather relies on memory processes. However, in Suddendorf et al.'s (2011) version of the task children choose between various keys, thus limiting their ability to select the correct item based on the semantic knowledge of the association between lock and key (Martin-Ordas et al., 2012). The Spoon task has also been argued to meet Suddendorf et al.'s (2011) criteria for the engagement of EpF. Specifically, Suddendorf et al. (2011) proposed that EpF tasks should consist of: (1) single trials to avoid stimulus-reward relationships from repeated exposure, (2) novel problems to avoid reliance on previous learning, (3) varied temporal and spatial contexts that require a future action, and (4) a variety of problems to show flexibility in future thinking. Hudson et al. (2011) also suggested that EpF tasks must include the need to consider a specific future event, the self in this future event, and a specific moment in time. Thus, in some cases, the Spoon task may engage episodic and future-oriented processes more than the Picture-book task. The extent to which these two tasks engage episodic and future-oriented processes could be explored through systematic examination of children's item choice explanations.

The over-arching goal of the current study was to examine children's explanations, in conjunction with their item choices, to shed further light on whether episodic processes are engaged during the Picture-book and Spoon tasks; and, also, whether these processes may differ between the two tasks. A secondary goal was to explore the extent to which episodic processes appear to be engaged depending on the level of conflict inherent to the task. Here, "conflict" refers to whether the task is structured in a way that requires children to reason about a future need or desire that conflicts with a present need or desire.

Recently, Atance et al. (2021) examined the effect of conflict on children's performance across four future thinking tasks, including the Picture-book and Spoon tasks. Three- to 5-year-olds were assigned to high-conflict versions of the tasks designed to increase conflict between children's current and future state, or low conflict versions designed to minimize such conflict. For example, in the Spoon and Picture-book tasks, the distractor items in the high-conflict condition were highly desirable to children, but not the optimal choice for the future (e.g., one marshmallow immediately versus a key to open a box containing marshmallows and Smarties in the future). Conflict significantly affected children's performance (as measured by item choice) such that children scored higher in the low-, compared to high-, conflict condition (supporting the predictions of the *presentism bias*; see Gilbert et al., 2002). Further, of note for the current study, Atance et al. (2021) found that, for the Picture-book task, younger children had more difficulty in the high versus low conflict condition compared to older children. Thus, younger children may face particular difficulty overcoming their current state to reason about the future when presented with highly desirable or rewarding immediate choices. Accordingly, success on high-conflict tasks might require more reasoning about the future/episodic foresight – a possibility that may be reflected in children's verbal explanations.

The Current Study

The main goal of the current study was to provide an in-depth analysis of children's explanations that accompanied their item choices on two episodic foresight tasks: Spoon and Picture-book. Children's explanations were coded for temporal focus (future-oriented or non-future-oriented) and episodicity (episodic or non-episodic) to compare children's engagement in episodic and future-oriented thinking between tasks. We also coded for use of first-person personal (e.g., "I", "my") versus other (e.g., "you", "she") pronouns, since the use of pronouns may provide insight as to whether children were considering their personal futures (i.e., the extent to which they were engaging in self-projection; Hayne et al., 2011). We predicted that children's explanations for their item choices on the Spoon task would be more future-oriented, episodic, and contain more first-person personal pronouns compared to the Picture-book task given past suggestions that the Picture-book might rely more on semantic associations and reliance on scripts.

The secondary goal was to examine the contributions of age, conflict, and item choice performance on children's use of future orientation and episodicity in their explanations separately for each task. We hypothesized that there would be: (1) an effect of age, such that older children's explanations would be more future-oriented and episodic compared to younger children's explanations across conflict conditions; (2) an effect of conflict, although no direction was predicted because low conflict may allow children to engage in future-oriented processes more easily or, alternately, may decrease engagement such that children produce more present-oriented, preference-based, or semantic explanations; (3) an interaction between conflict and age, such that children's explanations would be more future-oriented and episodic as they get older in the high-conflict compared to low conflict condition (i.e., older children may be better able to overcome conflict and engage future-oriented processes than younger children); and (4) an effect of item choice performance, such that children who selected the correct item should correspondingly provide more future-oriented and episodic explanations compared to children who selected the incorrect item. We also explored the interactions between age and item choice performance, and item choice performance and conflict although we did not make any specific hypotheses for these interactions. In addition, we further examined whether this pattern of results would hold for children who made the correct item choice (i.e., passed the task).

Method

Participants

One hundred and sixty-five 3-to 5-year-old children participated in the study. Seven children were excluded for: failure to complete the entire experiment ($n = 4$), experimenter error ($n = 1$), uncooperativeness ($n = 1$), and falling outside of the age range at time of test ($n = 1$). The final sample consisted of 158 children (52 3-year-olds: $M_{age} = 42.87$ months, $SD_{age} = 2.66$, 50% female; 53 4-year-olds: $M_{age} = 53.68$ months, $SD_{age} = 3.38$, 49% female; 53 5-year-olds: $M_{age} = 65.30$ months, $SD_{age} = 3.40$, 49% female). The majority of children were Caucasian (65%; 17% mixed ethnicity, 11% identified as another ethnicity, and 7% provided no response) and from families earning more than $80,000 annually (75%). All children were fluent in English (89% reported English as their first language).

Measures

Spoon Task

In the Spoon task (adapted from Atance & Sommerville, 2014; Suddendorf et al., 2011), children visited a room ("the Rainbow Room") with a locked transparent box containing eight Smarties and eight marshmallows. The experimenter showed children that the box containing these treats was locked before proceeding to the testing room. After a delay period of approximately 10 minutes that involved completing several cognitive measures in the testing room (two theory of mind tasks and two executive function tasks not reported here), children were told they were going back to the Rainbow Room and could select one of four items to bring with them. In the low-conflict condition, the distractor items were less desirable for the child's current-self (i.e., scissors, eraser, and ruler) compared to the correct item (i.e., a key). In the high-conflict condition, two of the distractor items were highly desirable for the child's current-self (i.e., one Smartie and one marshmallow) compared to the correct item (i.e., a key) and another distractor item (i.e., ruler). Following their item selection, children explained their choice ("*How come you chose the* ____?"), which was the focus of the current study. After making their item selection, children returned to the Rainbow Room where they obtained the treats regardless of their item choice.

Picture-book Task

In the Picture-book task (adapted from Atance & Meltzoff, 2005), children imagined visiting four novel locations in the future (e.g., a long dirt road, a steep mountain, a waterfall, and a rocky stream) and were asked by the experimenter to select one of the three provided items to take with them to the future location. One of the items was the correct choice (e.g., Band-Aids), which would address a future need at the location (i.e., useful if one were to slip and fall on the rocks), while the other two items were the distractors (e.g., pillow, toothpaste). After making an item selection, children were asked to explain their choice ("*Why do you need to* *bring the__?*"). In the low-conflict condition, the distractor items were less desirable to a child's current-self (e.g., pillow, toothpaste), while in the high-conflict condition, the items (e.g., teddy bear, game) were more desirable to the child's current-self and thus, increased the present-future conflict. The focus of the current study was the explanations children provided for their item choices (for details on the item choices for each location and analysis of children's item choice performance see Atance et al., 2021).

Procedure

Children were tested in an individual testing room in a 45-minute session at the University of Ottawa. The Rainbow Room used for the Spoon task was adjacent to the testing room. Parents provided consent and children provided assent before completing a battery of future thinking and other cognitive measures (which were part of a larger study by Atance et al. 2021 but are not discussed here[6]) in a fixed order including the two EpF measures (the Picture-book task followed by the Spoon task). Children were randomly assigned to a high- (n = 80) or low- (n = 78) conflict condition, which differed according to the item choices children were provided within the two EpF tasks (as described above). After the session, children received a small toy and parents received complimentary parking. All procedures were approved by the research ethics board at University of Ottawa and Brock University.

Coding of Children's Explanations

See Table 4.1 for example explanations and the corresponding coding categories.

Temporal Focus

[6] In Atance et al. (2021), children completed high and low conflict measures (between-subjects), including the Spoon and Picture-book task, from the perspective of the self and another person (within-subjects) resulting in four different protocol versions. The current study only examines children's explanations on the Spoon and Picture-book tasks from the high and low conflict self-perspective conditions. However, we ran chi-squared analyses to check that the protocol version did not affect the temporal focus or episodicity of children's explanations. Our chi-square analyses showed no significant difference in episodicity (episodic vs. non-episodic) or temporal focus (future vs. non-future) between the four protocol versions on the Spoon and Picture-book task, $\chi^2(3) = .33 – 4.15$, ps = .25 - 96.

First, children's explanations were broadly coded for temporal focus across several dimensions (adapted from Mahy, 2016; Mazachowsky et al., 2020): (1) *future*-oriented if the explanations referenced the future or future uncertainty (e.g., *will*, *going to*, *get*, *could*, *should*, *might, in case*, etc.), (2) *present*-oriented if the explanations referenced the present, a general convention, or current state (e.g., *want to*, *have to*, *it's*, *do*, *am,* etc.), (3) *general preference* if the explanations referenced the child's preference for something (e.g., *love*, *like*, *prefer*, *healthy*), (4) *other* if the explanations did not fit the previous categorizations (e.g., referenced the past, provided a single word response), or (5) *no response* if children did not provide an explanation for their choice (e.g., no response, "don't know", "because"). If children's explanations included "I don't know" as well as further explanation (e.g., "because I don't know, I wanna choose"), the second part of

Table 4.1

Examples of children's explanations on the Picture-book and Spoon tasks and corresponding coding category

Example explanation (Task)	Coding Category
Temporal Focus	
"because if it gets rainy" (Picture-book: Waterfall)	Future
"because I am so tired" (Picture-book: Stream)	Present
"because I like crunchy stuff" (Spoon)	General preference
"because I was getting thirsty there" (Picture-book: Dirt road)	Other
Episodicity	
"because when I hungry I gonna eat there" (Picture-book: Mountain)	Episodic
"because it looks different" (Spoon)	Semantic
"so I can go under it so I can be a good boy" (Picture-book: Waterfall)	Both
"to drink" (Picture-book: Dirt road)	Other

the explanation was still coded according to one of the four categories above. Some explanations contained multiple parts or clauses and were assigned to multiple categories (e.g., "I like teddy bears [general preference] because they gonna keep you warm [future-oriented]"). Explanations were coded by two independent coders and disagreements were later resolved by discussion. Agreement for temporal focus coding was almost perfect, $\kappa = .87$.

Episodicity

Second, children's explanations were broadly coded for indications of internal focus (episodic details) related to the specific, future event (i.e., visiting a location in the Picture-book task, or visiting the other room/retrieving candy from the box in the Spoon task) or external focus (i.e., semantic details or details about an unrelated event). Children's explanations were coded as (adapted from Mazachowsky et al., 2020; Levine et al., 2002): (1) *episodic* if the explanations referenced specific details about the event (e.g., happenings during the event, time of day, perceptual details, etc.), (2) *semantic* if the explanations referenced general knowledge about the location (e.g., "because roads are long"), factual details, or details not central to the main event (e.g., "I like cutting paper"), (3) *both semantic and episodic* if the explanations referred to both episodic and semantic details, or (4) *other* if the explanations were too vague or unclear, or if children did not provide a response (e.g., "Don't know", "because"). Agreement was almost perfect between two independent coders, $\kappa = .89$.

Future Event Referenced in Spoon Task

For the Spoon Task, explanations were further coded for exploratory purposes to determine the future event children referred to most frequently in their explanation: (1) opening the box (jar, container, etc.), (2) going to the other room or the door to the other room, or (3) another event or "uncodable". Agreement for future event coding by the two independent coders was almost perfect, κ =.96.

Pronoun Use

Finally, the use of first-person personal, and other pronouns was counted in each explanation. *First-person personal pronouns* included the use of first-person pronouns (e.g., *I*, *me*, *we*, *ourselves*, *myself,* etc.). Explanations of "I don't know" received a first-person personal pronoun count of zero. *Other pronouns* included the use of any other pronoun (e.g., second or third person pronouns; *you*, *he*, *their*, *hers*, *its*, *it*, *yourself,* etc.). Each use of the pronoun was counted even if it was used multiple times throughout the explanation. Agreement by the two independent coders was almost perfect for first-person personal (κ = .98) and other (κ = .99) pronoun use.

Results

Table 4.2 shows frequencies of coding categories for the Picture-book (by location) and Spoon task explanations.

Descriptive Analyses

Temporal Focus

Spoon Task. In the spoon task, 25% of explanations referenced the future, 42% referenced the present, 10% referenced a general preference, 8% were not present or future-oriented (i.e., "other"), 4% included clauses with multiple orientations (83% of them included a part of the explanation that was future-oriented), and 11% did not include a response.

Picture-book Task. Averaged across the four Picture-book locations, 60% of explanations referenced the future, 24% referenced the present, 3% referenced a general preference, 2% were not present or future-oriented (i.e., "other"), 3% included clauses with

Table 4.2

Coding category descriptives for the Picture-book task (by location) and the Spoon task explanations

Coded category	Dirt Road	Mountain	Waterfall	Stream	Picture-book Average	Spoon task Average
Temporal Focus						
Future	50.6%	56.3%	63.9%	67.7%	59.6%	25.3%
Present	30.4% (3.8%)	25.3% (3.2%)	21.5% (2.5%)	18.4% (3.2%)	23.9% (3.2%)	42.4% (9.5%)
Other	1.9%	2.5%	1.9%	1.3%	1.9%	7.6%
No response	10.1%	7.6%	8.9%	5.7%	8.1%	11.4%
Multiple	3.2%	5.1%	1.3%	3.8%	3.4%	3.8%
Episodicity						
Episodic	46.8%	47.5%	59.5%	62.7%	54.1%	50.6%
Semantic	37.3%	37.3%	21.5%	23.4%	29.9%	30.0%
Both	1.9%	1.9%	2.5%	1.3%	1.9%	0.0%
Other	13.9%	13.3%	16.5%	12.7%	14.1%	19.4%
Pronoun use						
First-person personal	.88 [1.19]	.82 [.86]	.63 [.78]	.86 [1.30]	.80 [.78]	.49 [.62]
Other	.48 [.77]	.39 [.79]	.62 [.78]	.68 [1.09]	.54 [.66]	.56 [.71]
Future Event						
Opening box	-	-	-	-	-	44.9%
Going to other room	-	-	-	-	-	11.4%
Other	-	-	-	-	-	43.7%

Note. $N = 158$. Percentage of explanations that referenced a general preference in brackets. Standard deviations in square brackets.

multiple orientations (95% of them included a part of the explanation that was future-oriented), and 8% did not include a response. Further, across the four locations, 17% of children did not provide any explanation that referenced the future, 12% provided one explanation that referenced the future, 13% provided two explanations that referenced the future, 18% provided three explanations that referenced the future, and 40% provided four explanations that referenced the future.

Episodicity

Spoon Task. In the Spoon task, 51% of explanations referenced episodic details, while 30% referenced semantic details, and 19% were categorized as "other". Further, 45% of children's explanations referred to the future event of opening the box, 11% referenced the future event of going to another room, and 44% referenced another future event or no event.

Picture-book Task. Across Picture-book locations, 54% of explanations referenced episodic details, 30% referenced semantic details, 2% referenced both, and 14% were categorized as "other" (e.g., unclear, vague, no response). Across the four locations, 21% of children did not provide an explanation that was episodic, 13% provided one explanation that was episodic, 21% provided two explanations that were episodic, 11% provided three explanations that were episodic, and 34% provided four explanations that were episodic.

First-person personal pronouns

Spoon Task. Children used an average of 0.49 first-person personal pronouns (*SD* = 0.62, range = 0 to 3) and 0.56 other pronouns (*SD* = 0.71; range = 0 to 3) per explanation. The majority of children's explanations on the Spoon task did not include any first-person personal (57%) or other (56%) pronouns.

Picture-book Task. On average, children used 0.80 first-person personal pronouns (*SD* = 0.78; count range = 0 to 19) and 0.54 other pronouns (*SD* = 0.66; count range = 0 to 13) per explanation on the Picture-book task.

Preliminary Analyses

Before performing our main analyses, we further refined our coding categories for interpretability and to reduce infrequently used categories. For temporal focus, first, given that a small number (3-5%) of children's explanations included multiple clauses and the majority of these included a future-oriented clause, we assigned these explanations to one category only. Specifically, for the multiple-clause explanations, if at least one clause was future-oriented the explanation was assigned to the *future* category, while explanations that included at least one present-oriented clause (but not a future-oriented clause) were assigned to the *present* category. Then, because our main interest was whether children were focused on the future in their explanations, or not, we collapsed the *present*, *general preference*, *other*, and *no response* categories to create a *non-future* category. Thus, the temporal focus categories examined in the main analyses were *future* and *non-future*.

For episodicity, because a small number of explanations included *both episodic and semantic* details (i.e., 2% for the Picture-book task, none for the Spoon task), this category was collapsed into the *episodic* category. Then, we collapsed the *semantic* and *other* categories together to create a *non-episodic* category. Thus, the episodicity categories examined in the main analysis were *episodic* and *non-episodic*.

Effect of Task

First, we examined whether explanations, collapsed across both conflict conditions, would be more *future*-oriented (versus *non-future*-oriented) and *episodic* (versus *non-episodic*) on the Spoon, compared to the Picture-book task (collapsed across locations). Further, we were interested in whether the use of first-person personal versus other pronouns would differ between tasks. For the Picture-book task, we took the average pronoun use across the four locations.

To collapse across the Picture-book task locations, the number of future or episodic explanations for each of the four locations was summed (i.e., range of 0 to 4). Children who provided a future-oriented or episodic explanation on three or more trials were given a score of 1 (*future* or *episodic*), or a score of 0 (*non-future* or *non-episodic*) if they provided a future-oriented or episodic explanation on two or fewer trials.

Temporal Focus

Using logistic regression, we entered task type (Spoon and Picture-book) as a within-subjects predictor of temporal focus of children's explanations (*future* or *non-future*). Our analysis indicated that task type significantly predicted temporal focus, *Wald* $\chi^2(1) = 35.54$, $p < .001$, Exp(B) = 3.41. The odds of children on the Picture-book task providing an explanation that was future-oriented over one that was not were 3.41 times greater than on the Spoon task. This pattern of results was consistent when each Picture-book location was compared to the Spoon task separately to predict temporal focus, *ps* < .001.

Episodicity

Next, we ran a logistic regression with task type (Spoon and Picture-book) as a within-subjects predictor of episodicity of children's explanations (*episodic* or *non-episodic*). We found that task type did not predict the episodicity of children's explanations, *Wald* $\chi^2(1) = 1.18$, $p = .28$, Exp(B) = 0.80.

However, when the Spoon task was compared to each Picture-book location separately, task type emerged as a significant predictor of episodicity for the waterfall, *Wald* $\chi^2(1) = 5.31$, *p*

= .02, Exp(*B*) = 1.59, and stream locations, *Wald* $\chi^2(1) = 8.24$, $p = .004$, Exp(*B*) = 1.73, such that children were only more apt to provide episodic versus non-episodic explanations on the waterfall and stream locations of the Picture-book than on the Spoon task.

Pronoun Use

Finally, using paired-samples t-tests, we compared the number of first-person personal (e.g., "I", "we" etc.) and other (e.g., "you", "they") pronouns in children's explanations on the Spoon and Picture-book task (averaged across the four locations). We found that children used significantly more first-person personal pronouns in their Picture-book task explanations (M = 0.80, SD = 0.78) compared to their Spoon task explanations (M = 0.49, SD = 0.62), $t(157) = 4.73$, $p < .001$. The pattern of results for first-person personal pronoun use was consistent when the Spoon task was compared to each Picture-book location separately, $ps < .05$.

Children's use of other pronouns on the Picture-book (M = 0.54, SD = 0.66) and Spoon tasks (M = 0.56, SD = 0.71) did not significantly differ, $t(157) = .18$, $p = .86$. When the Spoon task was compared to each Picture-book location separately, we found that children used significantly fewer other pronouns on the Picture-book task mountain location (M = 0.39, SD = 0.79), compared to the Spoon task, $t(157) = 2.06$, $p = .04$.

Effect of Age, Conflict, and Item Choice Performance

Next, we conducted logistic regressions to investigate predictors of temporal focus and episodicity separately for the Spoon and Picture-book tasks (see the Appendix B for a summary of significant predictors of episodicity and temporal focus across tasks). When reporting the effects of the individual predictors or interactions, all other variables in the model were held constant. Taking a hypothesis-based approach to our analyses, we entered the predictors for which we hypothesized an effect on the temporal focus (i.e., *future*, *non-future)* or episodicity (i.e., *episodic, non-episodic*) of children's explanations simultaneously into block 1 of the regression: age in months (centred at the mean), conflict condition (high versus low), item choice performance (whether children selected the "correct" or "incorrect" item to take with them to a future location; see Atance et al., 2021) and the two-way interaction between age and conflict. The other two-way (age by choice, choice by conflict) and three-way interactions (age by choice by conflict) for which we did not predict an effect on temporal focus or episodicity were entered stepwise as predictors in block 2. For the Picture-book task, each location was analyzed separately so item choice performance reflected performance on the individual location trial only. Only significant results are reported.

Spoon Task

Temporal Focus. On the Spoon task, only children's age significantly predicted their temporal focus. For every one-month increase in children's age, the odds of providing a *future*-oriented explanation increased by 6%, *Wald* $\chi^2(1) = 4.66$, $p = .03$, Exp(B) = 1.06.

Episodicity. Item choice performance was a significant predictor of the episodicity of children's explanations. The odds of children who selected the correct item providing an *episodic* explanation was 23.94 times greater than children who selected the incorrect item, *Wald* $\chi^2(1) = 34.73$, $p < .001$, Exp(B) = 23.94.

Picture-book Task

First, we examined whether coding proportions differed across the four locations on the Picture-book task. Temporal focus coding categories (*future* vs. *non-future*), $\chi^2\,(3) = 11.29$, $p = .01$, and episodicity coding categories (*episodic* vs. *non-episodic*), $\chi^2\,(3) = 12.56$, $p = .006$, significantly differed by location. Thus, we ran our analyses for the Picture-book task separately for each location.

Temporal Focus. Children's age in months significantly predicted the temporal focus of their explanations across all locations, except for the waterfall location. For every one-month increase in age, the odds of children providing a *future*-oriented explanation increased by 6% for the dirt road location, *Wald* $\chi^2(1) = 4.86$, $p = .03$, Exp(B) = 1.06, 14% for the mountain location, *Wald* $\chi^2(1) = 16.40$, $p < .001$, Exp(B) = 1.14, and 8% for the stream location, *Wald* $\chi^2(1) = 4.70$, $p = .03$, Exp(B) = 1.08. Item choice performance was also a significant predictor of temporal focus for all locations. The odds of children who selected the correct item providing a *future*-oriented explanation was 4.12 times greater for the dirt road location, *Wald* $\chi^2(1) = 10.81$, $p = .001$, Exp(B) = 4.12, 3.90 times greater for the mountain location, *Wald* $\chi^2(1) = 5.81$, $p = .02$, Exp(B) = 3.90, 4.13 times greater for the waterfall location, *Wald* $\chi^2(1) = 11.55$, $p < .001$, Exp(B) = 4.13, and 6.51 times greater for the stream location, *Wald* $\chi^2(1) = 17.58$, $p < .001$, Exp(B) = 6.51, compared to children who selected the incorrect response. The interaction between age and conflict condition was also significant for the waterfall location, *Wald* $\chi^2(1) = 4.95$, $p = .03$, Exp(B) = 1.11. Thus, as age increased, the odds of children in the high conflict condition providing a *future*-oriented explanation increased by 11% compared to children in the low conflict condition.

Episodicity. Children's age significantly predicted the episodicity of their explanations for the stream location. For every one-month increase in children's age, the odds of providing an e*pisodic* explanation increased by 10% for the stream location, *Wald* $\chi^2(1) = 8.51$, $p = .004$, Exp(B) = 1.10. Item choice performance was also a significant predictor of episodicity for the waterfall and stream locations. The odds of children who selected the correct item providing an *episodic* explanation was 19.91 times greater for the waterfall location, *Wald* $\chi^2(1) = 36.68$, $p < .001$, Exp(B) = 19.91, and 8.58 times greater for the stream location, *Wald* $\chi^2(1) = 23.61$, $p <$

.001, Exp(*B*) = 8.58, compared to children who selected the incorrect item. For the dirt road location, conflict was also a significant predictor of episodicity; the odds of children in the high conflict condition providing an episodic explanation decreased by 89% compared to children in the low conflict condition, *Wald* $\chi^2(1) = 5.83$, $p = .02$, Exp(*B*) = 0.11. This effect was qualified by an interaction between item choice performance and conflict for the dirt road location, *Wald* $\chi^2(1) = 8.24$, $p = .004$, Exp(*B*) = 19.16. Thus, as conflict increased, the odds of children who chose the correct item providing an *episodic* explanation was 19.16 times greater compared to children who provided an incorrect response. Probing this interaction further, in the low conflict condition, children produced similar rates of episodic explanations regardless of item choice, $\chi^2(1) = 1.25$, $p = .26$, but in the high conflict condition children who answered correctly produced more episodic explanations than those who answered incorrectly, $\chi^2(1) = 28.44$, $p < .001$.

Finally, we explored the effect of age and conflict on the temporal focus and episodicity of children's explanations, but only for children who selected the correct item on the Spoon or Picture-book task trials. To do so, we entered age in months (centred at the mean), conflict (high versus low), and the interaction between age and conflict into our model. Overall, we found that for children who provided the correct item choice, conflict and the age x conflict interaction remained non-significant predictors of temporal focus and episodicity in children's Spoon and Picture-book task explanations. Additionally, age continued to significantly predict the temporal focus of children's explanations for the dirt road, *Wald* $\chi^2(1) = 4.91$, $p = .03$, Exp(*B*) = 1.07, and mountain locations, *Wald* $\chi^2(1) = 17.00$, $p < .001$, Exp(*B*) = 1.16, and the episodicity of children's explanations for the mountain, *Wald* $\chi^2(1) = 4.63$, $p = .03$, Exp(*B*) = 1.06, and stream, *Wald* $\chi^2(1) = 6.69$, $p = .01$, Exp(*B*) = 1.11, locations.

Discussion

The overall goal of the current study was to systematically compare children's verbal explanations on two commonly used episodic foresight tasks (i.e., Spoon and Picture-book) to determine whether these tap into episodic processes and future self-projection. In contrast to our prediction that children's explanations would be more future-oriented and self-focused on the Spoon task, we found that children were more apt to provide a future-oriented explanation and used more first-person personal pronouns on the Picture-book task. Episodicity and other pronoun use did not differ between the tasks. On the Spoon and Picture-book tasks (across most locations), age significantly predicted temporal focus, such that children provided more future-oriented than non-future-oriented explanations with increasing age. Further, across most locations on the Picture-book task, children who made a correct item choice tended to provide a future-oriented explanation. A different pattern of findings emerged for the episodicity of children's explanations. On the Spoon task and two locations on the Picture-book task, children who made the correct item choice provided episodic (versus non-episodic) explanations. Yet, age largely did not predict the episodicity of children's explanations on either task. Together, these findings suggest an association between the item choice and verbal components on these tasks.

Comparing the Picture-book and Spoon Tasks

One of the main goals of the current study was to use children's explanations to determine whether the Picture-book or Spoon task may differentially engage future-oriented and episodic processes. Previous literature has argued that children may perform well on the Picture-book task by relying on semantic knowledge without projecting oneself in the future, unlike the Spoon task, which is thought to better engage episodic future thinking (e.g., Suddendorf et al., 2011). According to the constructive episodic simulation hypothesis (Schacter & Addis, 2007), episodic memory allows one to recall past events and use them to build novel representations of episodic future events. However, the semantic scaffolding hypothesis (Irish & Piguet, 2013) also proposes the importance of semantic memory in scaffolding future thinking. Overall, our results showed that children were more likely to provide future-oriented explanations and use more first-person pronouns for their item choices on the Picture-book task than on the Spoon task.

While item-choice tasks, like the Picture-book task, have been criticized for the lack of future projection required during the task and the possibility that children are relying on learned associations (e.g., Martin-Ordas et al., 2014; Suddendorf et al., 2011), our findings suggest that children are referring to the future and referencing themselves in this imagined future. Previous research has also suggested that the abstract nature of the Picture-book task, which requires children to imagine a distant and novel future scenario, may evoke greater reliance on future projection compared to thinking about a more immediate and real future event that has previously occurred, much like on the Spoon task (Atance & Sommerville, 2014; McColgan & McCormack, 2008). It is also possible that the specific future event children were projecting into was more ambiguous on the Spoon task compared to the Picture-book task resulting in fewer future-oriented explanations. For example, we found that children referred to the future event of unlocking the box (45%) or other, unrelated or unclear events (44%) at similar rates on the Spoon task. Finally, we also found that children's use of episodic versus non-episodic details (i.e., semantic or other details combined) did not differ across both tasks, which may support the important role of both episodic and semantic memory in generating future events or scenarios. Thus, episodicity and future orientation may each provide unique insight into children's future reasoning across different EpF tasks.

However, differences in episodicity did emerge between specific Picture-book locations and the Spoon task, such that children were more likely to provide episodic explanations for the waterfall and stream locations compared to the Spoon task. In adult samples, Wang et al. (2016) found that imagining novel future events evoked more semantic memory than episodic memory, while the opposite was true for familiar events. Accordingly, when there is little personal experience from the past to draw on individuals may rely on semantic memory to construct the novel future event (Wang et al., 2016). In the case of the stream and waterfall locations, children may have been able to draw on experience visiting a lake or stream, allowing them to generate more episodic details for their explanations compared to the more novel experience of selecting an object to unlock a box on the Spoon task. Overall, our findings from children's explanations indicate that the Picture-book task aligns with Hudson et al.'s (2011) EpF criteria, which includes the consideration of the self in a specific future event and at a specific moment in time and may better engage EpF processes than previously assumed.

Development of Temporal Focus and Episodicity

Age-related development in children's future talk has been reported in several studies, suggesting that children talk about the future or use future temporal terms in the early preschool years, and do so increasingly as they get older (e.g., Atance & O'Neill, 2005; Busby & Suddendorf, 2005; Grant, & Suddendorf, 2011; Hayne et al., 2011; Mazachowsky et al., 2020). We similarly found that older children referenced the future in their explanations more frequently than younger children on the Spoon and Picture-book tasks. Descriptively, our findings also suggest that preschool-aged children frequently explain their item choices using temporally focused references (i.e., children's explanations were most frequently initially categorized as "future" or "present"). Further, the impact of age on the temporal focus of children's explanations was consistent across Picture-book task locations (except for the waterfall location where age interacted with conflict). Other research using the Picture-book task (or an earlier version: The Trip task) has reported differences in children's use of future references across different locations or after the selection of certain items (e.g., Atance & O'Neill, 2005; Atance & Meltzoff, 2005). For example, Atance and O'Neill (2005) found that children most often referred to future uncertainty (e.g., "*in case* somebody has an owie") when discussing the use of a Band-Aid on a trip (i.e., to avoid injury) and less so when discussing the future use of a teddy bear (i.e., to provide comfort). The salience or novelty of certain situations may also elicit more hypothetical future talk than more familiar situations (Atance & O'Neill, 2005), but future research should continue to examine why certain locations or item choices may prompt greater focus on the future or present.

In contrast to our prediction, the episodicity of children's explanations in the Spoon task and Picture-book task was not largely predicted by children's age (except for the stream location of the Picture-book task). These results are somewhat contradictory with previous work showing that children use more episodic details in their narratives or verbal explanations across childhood (e.g., Coughlin et al., 2014; Mazachowsky et al., 2020). Yet, these findings align with other research suggesting that both episodic and semantic memory may play a role in future thinking (e.g., Irish & Piguet, 2013). As with temporal focus, the extent to which a child may episodically project into an event may be dependent on the context or the type of event. Indeed, in the current study, for the stream location of the Picture-book task, older children provided more episodic than non-episodic explanations. Research has suggested that factors such as the level of control a child has over an event (e.g., little control like going grocery shopping vs. more control over their breakfast) may impact their episodic memory and episodic future thinking (Quon & Atance, 2010). Overall, our results indicate that in the early preschool years children rely on both episodic and semantic processes to justify their future choices but may use more future orientation as they get older depending on the task, or scenario presented within the task.

Item Choice Performance

As expected, item choice performance predicted the temporal focus and episodicity of children's explanations on the Picture-book task (across most, but not all locations). These findings support the correspondence between children's ability to select an appropriate item for the future and their ability to project into the future and draw on episodic processes to explain their choice. However, for the Spoon task, children's item choice performance only predicted the episodicity (not temporal focus) of their explanations. Our Spoon task finding contrasts with Suddendorf et al. (2011) who reported a relation between correct tool selection and reference to the future utility of the tool in 3-and 4-year-olds' explanations for their tool selection. There are several possibilities for the lack of correspondence between item choice performance and temporal focus of children's explanations on the Spoon task. First, our finding could be due to a lack of variability in children's item choice performance, since children were performing close to ceiling, particularly in the low-conflict condition (Atance et al., 2021). Second, children could select the appropriate item on the Spoon task by drawing on their memory for the past event, rather than relying on EpF, resulting in children referencing the future infrequently. Indeed, research has shown that: (1) performance on the Spoon task is worse after longer delays between the past event and item selection (i.e., finding a locked treasure chest and selecting an item to solve the problem 24 hours later vs. 15 minutes later; Scarf et al., 2013) and (2) after controlling for memory for the past event, age no longer predicts item choice performance on the Spoon task (Atance & Sommerville, 2014). Together, these findings support the idea that the Spoon task may rely more on memory as opposed to EpF. Thus, although the Spoon task may engage children's episodic abilities, it may not engage their future projection in the way we expect and to the same degree as the Picture-book task.

Conflict

Contrary to our prediction, conflict generally did not impact children's tendency to provide future-oriented and episodic explanations on the Picture-book or Spoon task. This is interesting in light of Atance et al.'s (2021) finding that children performed more poorly on the item choice component of the Spoon and Picture-book tasks in the high compared to low conflict condition. One possible reason why conflict seemed to affect children's non-verbal item choices but not their verbal explanations is executive functioning abilities. Specifically, selecting the correct item may recruit children's executive functioning, particularly when children must decide between a currently desirable option or one with future utility (e.g., Kramer et al., 2017; Atance et al., 2021). For example, Atance et al. (2021) found that inhibitory control was related to children's item choice performance on the Picture-book task in the high-conflict condition. However, once children have made their choice, their ability to generate future-oriented explanations may not rely as heavily on these executive processes and instead place more demand on children's language, narrative ability, or ability to use temporal terms (Atance & Jackson, 2009; Coughlin et al., 2019; Hanson et al., 2014). Together, this pattern of findings suggests that although current-future conflict may play a role in children's EpF, it might only affect children's item choices (e.g., Bélanger et al., 2014; Atance and Meltzoff, 2006) and not their verbal explanations.

Limitations and Future Directions

Studies using verbal measures of future thinking in the preschool-age group have proposed that children's responses may be limited by their vocabulary or verbal ability and understanding of temporal terms (e.g., Hudson et al., 2011). For example, Grant and Suddendorf (2011) found that 3- to 5-year-olds gradually produce and begin to correctly utilize temporal terms, with some terms (e.g., later, soon) emerging earlier than others (e.g., yesterday, tomorrow). Accordingly, future research should administer a measure of verbal and narrative ability alongside EpF measures to account for differences in children's explanations (but see Atance & O'Neill, 2005, and Hayne et al., 2011, who found no relation between children's general language ability and their ability to talk about the future). Similarly, future research should examine alternative ways of determining children's self-projection in their explanations. For example, we cannot determine whether children who used multiple first-person personal pronouns in their explanations were indeed engaging in greater self-projection than children who used only one. Additionally, it should be noted that significant effects of the age and conflict, and item choice and conflict interactions in our study were infrequent and specific to the dirt road and waterfall locations only, thus, these findings may not be robust and cannot be broadly interpreted. Finally, despite our finding that children may better engage episodic and future-oriented thinking during the Picture-book compared to the Spoon task, it is not clear whether this finding only applies to children's verbal explanations or item choices as well. It may be the case that children use semantic knowledge to select the appropriate item on the Picture-book task but then use future-oriented and episodic processes when generating their explanations for their choice.

Conclusion

Our results show that verbal explanations are an important component of EpF tasks that may complement information gleaned from children's item choices and offer unique insight into children's engagement in future thinking and episodic processes. While we also examined the dimension of conflict, our findings suggest that conflict does not impact children's explanations for their item selection but may initially challenge children's selection of an appropriate item for the future (Atance et al., 2021). Instead, children's ability to explain the future need for an item using episodic and future-oriented references relies more on age-related development and whether the item selected was the correct choice to fulfill the future need in the first place. Overall, we can draw several important conclusions from our in-depth examination of children's explanations: (1) the Picture-book task appears to capture episodic and future-oriented processes and may do so to varying degrees across trials and (2) on both the Picture-book and Spoon tasks, there is convergence between the item choice and the verbal components. Future research should continue to determine the degree to which the various EpF tasks used in early childhood require projection of the self into a future time, as well as their reliance on other abilities such as script knowledge, semantic associations, and memory.

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Appendix B

Logistic Regression Summary Tables

Significant predictors of temporal focus (future vs. non-future) for the Picture-book (by locations) and Spoon tasks using logistic regression

Task	Age	Conflict	IC	Age x Conflict	Age x IC	Conflict x IC	Age x Conflict x IC
Picture-book							
Dirt Road	*		*				
Mountain	*		*				
Waterfall			*	*			
Stream	*		*				
Spoon	*						

Note. * Designates significant predictor at $p < .05$. IC = Item choice.

Significant predictors of episodicity (episodic vs. non-episodic) for the Picture-book (by locations) and Spoon tasks using logistic regression

Task	Age	Conflict	IC	Age x Conflict	Age x IC	Conflict x IC	Age x Conflict x IC
Picture-book							
Dirt Road		*				*	
Mountain							
Waterfall			*				
Stream	*		*				
Spoon			*				

Note. * Designates significant predictor at $p < .05$. IC = Item choice.

CHAPTER 5

General Discussion

In everyday life, children rely on their future thinking to make optimal decisions and predictions for a later time. When deciding between 5 minutes on the iPad before their homework or 30 minutes after completing their homework, children must weigh future gains over present ones. Similarly, considering what one might do at school tomorrow informs their present planning to pack gym clothes. Over the past decade, many advancements have been made in determining the developmental trajectory of young children's future thinking across a variety of domains including saving, prospective memory, planning, delay of gratification, and episodic foresight. Generally, research suggests that future-oriented cognition improves substantially across the preschool years (e.g., Atance & Jackson, 2009; Atance & Meltzoff, 2005; Bélanger et al., 2014; Suddendorf & Busby, 2005). Typically, future thinking has been measured using performance-based indicators from behavioural measures administered in the laboratory. However, innovation and improvements in methodology can help to better identify the developmental course of future thinking and how future thinking is reflected in more naturalistic daily contexts. In fact, behavioural methods have been criticized by researchers for their lack of coherence (e.g., Atance & Jackson, 2009) and ability to capture future-oriented thinking versus other cognitive or related abilities, such as more general memory abilities (e.g., Atance & Sommerville, 2014; Atance et al., 2015; Hudson et al., 2011; Martin-Ordas et al., 2014). The current studies in my dissertation explored alternative measurement of children's future thinking including the use of parent report, open-ended questioning, and children's explanation to better capture the development of children's episodic foresight.

Most studies in the field have previously relied on behavioural methods to assess children's future-oriented cognition; however, these methods often determine children's abilities from their performance at a single point in time (e.g., one day in the lab) and on one or a few measures in an artificial context (e.g., laboratory). Further, the motivational demands (e.g., remembering to retrieve a sticker after a certain event; Guajardo & Best, 2000) or the repercussions of failure on future thinking tasks conducted in a laboratory are relatively low (e.g., remembering to place cards in a basket to assist a fictional character; Kvavilashvili et al., 2001). Comparatively, poor future thinking in daily life can have a wider range of consequences, in more severe cases jeopardizing personal safety (e.g., forgetting to take medication at the appropriate time; Zogg et al., 2012) or academic achievement (e.g., Mazzetti et al., 2020). Some research has examined future thinking via parent-report measures, but these tended to assess only one specific future thinking ability (e.g., prospective memory; Kliegel & Jäger, 2007) and did not have well-established validity (e.g., Smith et al., 2018). Study 1 in my dissertation was the earliest research to establish a broad parent report of future thinking and to explore the reliability and validity of the newly established measure (Mazachowsky & Mahy, 2020). The 44-item parent report was administered to 101 parents of children 3 to 7 years old in the laboratory. After parents completed the CFTQ, children completed a set of behavioural tasks that corresponded to each of the five domains measured on the CFTQ (i.e., saving, episodic foresight, prospective memory, planning, and delay of gratification). We found that each subscale and the full scale was positively correlated with children's age suggesting that the scale is useful for detecting development in children's future thinking abilities. In terms of the psychometric properties of the CFTQ, each of the five subscales and the full scale showed good reliability. There was also evidence for the validity of the measure; parents' ratings of their children's future thinking abilities in each domain (except for the PM subscale) corresponded to their children's performance on the corresponding behavioural measure. Overall, the CFTQ is the first parent-report measure to broadly capture children's future thinking evaluated across multiple contexts (e.g., home, school, extracurricular activities) in their daily life and can be used to complement behavioural findings to contribute to the understanding of the development of children's future thinking.

Whereas Study 1 sought to establish an alternative parent-report measure to behavioural tasks, Study 2 adapted a behavioural measure in one domain of future thinking, episodic foresight, to address novel questions pertaining to the development of children's episodic foresight. Although forced-choice tasks (i.e., tasks where children select the correct response from a limited number of provided options) are widely used to assess young children's episodic foresight, research has suggested that children may succeed on these tasks without reliance on future thinking (e.g., Atance & Sommerville, 2014; Martin-Ordas et al., 2012). Further, forced-choice tasks do not allow for measurement of children's independent future thinking given that children may be "cued" by the presence of the correct response (Atance et al., 2019). Performance on these tasks can often reach ceiling, especially in older preschoolers, thereby limiting variability in response (e.g., Atance et al. 2019; Atance et al., 2021; Atance & Meltzoff, 2005). Importantly, recent research suggests that even children as young as 3 years old are capable of spontaneous and generative future thinking (e.g., Caza & Atance, 2019; Atance et al., 2019). Thus, in Study 2, 48 3-to 5-year-olds independently generated solutions to future problems on an adapted version of the Picture-book task (Atance & Meltzoff, 2005). On this adapted version, children were not provided with item choices, but rather asked an open-ended item-choice question (i.e., "What would you bring with you to this place?") and asked to provide an explanation for their choice. Children's explanations were also systematically examined for temporal focus (e.g., present-oriented, future-oriented) and episodicity (e.g., episodic, semantic). We found that children were successfully able to generate items that would be useful in a future location using the open-ended version of the Picture-book task and that their ability to do so improved with age. Analysis of children's explanations revealed that they were mostly present-oriented and included similar rates of episodic and semantic details making it difficult to determine whether children were using future projection to succeed on the Picture-book task.

To further investigate children's use of future self-projection and the role of episodic and semantic processes, in Study 3, I compared future-orientation, episodicity, and pronoun use on two commonly used episodic foresight tasks, the Picture-book task (Atance and Meltzoff, 2005) and the Spoon task (Suddendorf et al., 2011). Researchers have outlined a set of criteria that are argued to engage children's episodic foresight capacities and have suggested that the Spoon task adheres to these criteria (e.g., Suddendorf et al., 2011). Yet, it is unclear whether children's explanations accompanying their item choices could be used to determine the degree to which children are engaging in future self-projection on these tasks. In Study 3, 158 3-to 5-year-olds completed the Spoon and Picture-book tasks where they selected items to fulfill a future need or solve a future problem and provided an explanation for their choice. The two episodic foresight tasks were adapted such that item choices were manipulated to elicit high or low conflict between current and future choices. Thus, children completed either high or low conflict versions of the tasks. Children's explanations were coded for temporal focus (i.e., present vs. future-oriented), episodicity (i.e., episodic vs. semantic) and pronoun use (i.e., first-person personal vs. other pronouns). On the Picture-book task, children provided more future-oriented explanations and used more first-person personal pronouns compared to the Spoon task. No differences were found between tasks in children's use of episodicity or frequency of other pronoun use in their explanations. Further, item choice performance (only for the Picture-book task) and age, but not conflict, predicted whether children provided future-oriented or episodic explanations. Generally, older children and children who made the correct item choice provided more future-oriented explanations. Overall, the results of this study suggest that the Picture-book task may indeed draw on future thinking capacities more than previously assumed.

Taken together these studies suggest: (1) parents can reliably report on their children's future thinking and, across most domains, it aligns with children's performance on behavioural measures, and (2) children's open-ended responses can provide unique insight into children's episodic foresight development (i.e., through an open-ended version of the Picture-book task in Study 2) and the degree to which children may be thinking about the future (i.e., through analysis of children's explanations in Study 2 and Study 3). Methodological adaptations and advancement in the field of future thinking can enhance our understanding of young children's future-oriented capabilities and development across contexts (e.g., naturalistic, everyday environments) and under different conditions (e.g., open-ended vs. forced-choice responses).

Development of Children's Future Thinking Abilities

Each of the three studies contributed to the understanding of the development of future thinking abilities across early childhood using parent-report and behavioural measures. In Study 1, the CFTQ broadly captured future thinking development across five domains, suggesting that, in daily life, older children's future thinking is more well-developed than younger children. Other parent reports that have examined individual domains of future thinking, specifically prospective memory, have also found age-related advancements in future thinking from 3 to 11 years (e.g., Mazachowsky et al., 2021; Kliegel and Jäger, 2007). Together, these findings suggest that parent-report measures may be valuable in understanding age-related changes in future thinking. Also in Study 1, we found age-related improvements in performance on behavioural measures of future thinking, which is in line with the larger literature using behavioural tasks (e.g., Atance & Jackson, 2009; Bélanger et al., 2014). For example, Atance and Jackson (2009) administered a battery of future thinking tasks including measures of planning, mental time travel, delay of gratification, and prospective memory to 3-to 5-year-old children. Across all tasks, older children outperformed younger children supporting improvements in future thinking across the preschool years.

Recent research, including my current work, has also aimed to investigate the development of children's more independent and spontaneous future thought. This research suggests that young children are capable of spontaneously generating a solution to a future problem and are generally better able to do so with age (Atance et al., 2019; Moffett et al., 2018). In Atance et al.'s (2019) study examining spontaneous episodic foresight, 3-to 5-year-olds were assigned to a forced-choice condition (where they selected one of three fruits to bring back to a room with a hungry toy animal) or a category cue condition (where they were broadly asked which fruit they should bring back to the other room). Overall, age differences were found between these two conditions such that older children had less difficulty generating an object to bring with them to address a future need compared to younger children. However, regardless of age, all children performed better in the forced-choice compared to the category cue condition. I similarly found that children's ability to generate useful items for future scenarios improved across ages 3 to 5.

Using alternate indicators beyond performance, I found that development of future thinking can also be gleaned from children's verbal explanations. In Study 2, older children used more future-orientation and episodic references in their Picture-book task explanations compared to younger children. Similarly, in Study 3, older children made more reference to the future in their explanations on episodic foresight tasks compared to younger children, but use of episodic references was largely not predicted by children's age. Indeed, as children get older, they begin to discuss the future and use temporal terms to describe past and future events (e.g., Atance & O'Neill, 2005; Busby & Suddendorf, 2005; Grant & Suddendorf, 2011; Hayne et al., 2011; Hudson et al., 1995, Mazachowsky et al., 2020). Research has also suggested that children initially rely on semantic memory when thinking about the past and future, which then supports the later development of episodic memory (Gott & Lah, 2014; Picard et al., 2009; Willoughby et al., 2012). In support of this idea, young children have been found to provide more semantic details when discussing future events compared to episodic details (Hudson et al., 1995; Martin-Ordas et al., 2014). Hudson et al. (1995) examined 3-to 4-year-olds' verbal event scripts (e.g., "what happens when going grocery shopping?") and more specific plans for future events (e.g., "tell me a plan for going grocery shopping"). The researchers found that 3-year-olds relied more on scripts and general knowledge (e.g., drive there, buy food, drive home), even in the planning condition, when describing future events compared to older children. Thus, scripts may rely more on semantic memory, while plans that involve the construction of a future event constrained by present circumstances (e.g., take a nap before you go) may rely more on episodic memory (Atance et al., 2008; Hudson et al., 1995; Marin-Ordas et al., 2014). My two studies examining children's explanations show that use of future orientation and reference to the future increase across early childhood, but whether older children use more episodic references than younger children is less clear. In line with the semantic scaffolding hypothesis (Irish & Piguet, 2013), it may be the case that across the preschool years episodic and semantic processes both facilitate children's episodic future thinking. Overall, these studies expand on our understanding of the development of future thinking using various, novel methodological approaches.

Theoretical Perspectives on Future Thinking

The current studies also inform theoretical issues in the future thinking literature. Study 2 and Study 3 suggest that both episodic and semantic details are recruited by children in episodic future thinking tasks. Episodic (i.e., personally experienced past events) and semantic (i.e., definitions, general knowledge, factual information about the world) memory processes are thought to support the recollection of autobiographic past events and the projection of the self into possible future ones (e.g., Conway et al., 2004; Irish & Piguet, 2013; Martin-Ordas et al., 2014; Spreng et al., 2009). The processes required to engage in episodic foresight have been theorized by the Scene Construction Hypothesis and the Constructive Episodic Simulation Hypothesis. According to the Scene Construction Hypothesis (Hassabis & Maguire, 2007), imagining the self in a future time and remembering the self in a past one requires constructive processes that allow one to generate a complex scene and hold a scene in mind. By this view, when an experience is recalled, it is likely to occur alongside mental imagery of the experience (Rubin et al., 2003). Whereas Schacter and Addis' (2007) Constructive Episodic Simulation Hypothesis claims that when constructing a possible future scenario, one must bring episodic details from the past to mind, which allows one to flexibly recombine these elements to imagine a novel future event. However, research with children with bilateral damage to the hippocampus showed that they were still able to construct novel future scenes despite deficits in the area of the brain which supports episodic memory (Cooper et al., 2011). Thus, Irish and Piguet (2013) more recently implicated the involvement of semantic processes in supporting the integration of episodic details into an abstract representation of the future (i.e., the Semantic Scaffolding

Hypothesis). Based on these theoretical perspectives, Study 2 and 3 investigated children's use of episodic and semantic details in their explanations provided on episodic foresight tasks. In Study 2, children's explanations showed approximately equal use of episodic and semantic information on the Picture-book task. Further, children's use of semantic and episodic references in Study 3 were not differentially engaged when comparing episodic foresight tasks, specifically the Picture-book and Spoon tasks. Thus, our results suggest that children rely on both episodic and semantic memory processes when considering novel future scenarios.

Nevertheless, in Study 3, I did find subtle differences in the proportion of episodic versus non-episodic information provided by children on the Spoon task compared to certain locations (e.g., waterfall and stream) on the Picture-book task. It has been suggested that semantic knowledge may be especially important to recruit when no prior personal experience can be drawn upon to construct a novel future event (Irish & Piguet, 2013). Wang et al. (2016) also found that in adult samples familiar future events required more episodic memory compared to novel future events, while novel future events required more semantic memory compared to familiar future events. Yet, overall episodic foresight involved greater episodic memory compared to semantic memory. Beyond the impact of familiarity, developmental considerations must also be made in determining children's use of episodic versus semantic details given the advancements in children's memory abilities across childhood (e.g., Ghetti & Lee, 2011; Sipe & Pathman, 2020).

In addition to the role of episodic and semantic memory in episodic foresight, researchers have disputed the degree to which future orientation is needed to solve future thinking tasks. Tulving (2002) outlined the self as a traveller through time as a key element in mental time travel. Notably, the self is also a core component of episodic future thinking (e.g., Hassabis &

Maguire, 2007). For example, Szpunar et al. (2007) showed greater activation in brain regions associated with past and future thought when individuals imagined themselves in a future or past event (e.g., imagine your birthday next year) compared to imagining an experience of someone else without a specific temporal marker (e.g., imagine your friend at their birthday). Despite these claims that self-projection defines episodic future thinking, it is not always the case that future thinking tasks require projection of the self into the future to succeed (e.g., Atance & Sommerville, 2014; Hudson et al., 2011; Martin-Ordas et al., 2012; Russell et al., 2010). For example, it is possible that individuals may rely on script-based knowledge (e.g., thinking about going grocery shopping more generally; Hudson et al., 2011) or imagining another person in the future (e.g., a friend versus yourself walking along a beach tomorrow; Vito et al., 2012) when performing future thinking tasks. In fact, certain episodic foresight tasks are thought to better engage self-projection over others. Suddendorf et al. (2011) suggested that the Spoon task meets the criteria for an episodic foresight task, which should consist of single trials and present novel and diverse problems across varied temporal and spatial contexts.

One way to determine whether children are engaging in future thinking and self-projection is through their explanations for their future choices on episodic foresight tasks. I found that children primarily referred to the present in their explanations, with less than half of children referring to the future when explaining their future choices. This finding suggests that children may not always engage in future thinking when making decisions for the future. Comparing the degree to which episodic foresight tasks require use of future projection of the self, in Study 3, I found that children used more first-person personal pronouns and made more references to the future on the Picture-book task compared to the Spoon task. Further, children's selection of the appropriate item for the future on the Picture-book task predicted their use of future orientation in their explanation suggesting a correspondence between better episodic foresight performance and use of future orientation on certain episodic foresight tasks. Overall, it seems that children may not always use future self-projection on episodic foresight tasks and the degree to which they do so may vary based on task-specific properties, and in some cases correspond to children's episodic foresight performance.

Methodological Limitations

Despite the methodological advances in the present studies, it is likely that no single measure can perfectly capture the development of children's future thinking. As proposed in Study 1, a composite of behavioural measures and observer reports may provide the most comprehensive picture of children's future thinking abilities. The development of novel measures and approaches in the current studies were intended to address some of the limitations associated with behavioural measures including the artificial nature of laboratory tasks, the lack of attention to varied contexts and motivational conditions under which children carry out future thinking tasks, the lack of variability in response options on some behavioural measures (e.g., forced-choice tasks), and the degree to which behavioural measures draw upon children's future-oriented abilities versus other cognitive abilities (e.g., retrospective memory, semantic associations). Despite these advancements, even the methods used in the current study had important limitations.

Primarily, as a parent-report measure, the CFTQ is subject to biases in responding. Parents' ratings of their child's future thinking abilities are subjective and likely to reflect their own perspective of their child's abilities. Nonetheless, the fact that parent reports have been used to reliability and accurately assess children's cognitive abilities (e.g., theory of mind, Tahiroglu et al., 2014; executive function; Gioia et al., 2003), and that ratings on most CFTQ subscales corresponded to children's performance on behavioural measures in Study 1, provides confidence that parents may be able to accurately assess their child's future thinking. Notably, in Study 1, parents' ratings of their child's prospective memory were unrelated to children's performance in the lab on a prospective memory task. It is possible that parents may not be able to accurately assess their child's abilities in the prospective memory domain or, alternatively, they have difficulty separating component abilities involved in daily prospective tasks. For example, parents may be unable to separate the prospective component of prospective memory tasks (e.g., remembering to carry out the intention at the appropriate time) versus the retrospective component (e.g., recalling what you were supposed to do; Einstein & McDaniel, 1996). In support of this idea, Kliegel and Jäger (2007) found that both the retrospective and prospective scales of the Prospective and Retrospective Memory Questionnaire were significantly related to children's performance on the prospective memory task, even when removing children who failed to retrospectively recall what they were supposed to do. Nevertheless, even using behavioural measures these PM components are also difficult to isolate (e.g., Graft & Uttl, 2001).

Adaptations to episodic foresight tasks in Study 2 and Study 3 (i.e., examining more generative future thinking and future reasoning using verbal explanations) were intended to better equate to future thinking tasks that children may encounter in daily life, yet still, these tasks were limited by a lack of ecological validity. Across future thinking domains, lab tasks vary in how closely they resemble future thinking in daily life. For example, board games, such as the virtual week (a measure of prospective memory; Rendell & Craik, 2000), the economic game (a measure of saving; Otto et al., 2006), and the saving board game used in Study 1 attempt to replicate real-life situations where future-oriented thinking is employed (e.g., remembering to give schoolwork to your teacher, depositing money in a bank, choosing to purchase items).

Further, how closely performance on future thinking tasks relates across naturalistic and laboratory settings may depend on the specific domain of future-oriented cognition being examined. Prospective memory is a particularly interesting case since it was the only CFTQ subscale where parents' ratings of their children's abilities in Study 1 did not relate to the corresponding behavioural measure of prospective memory in the lab. Yet, the prospective memory subscale of the CFTQ was significantly associated with prospective items on the BRIEF-P and has been found to relate to more naturalistic tasks in the laboratory (e.g., remembering to ask the experimenter for a sticker at the end of a task; Mazachowsky & Mahy, 2020). In the domain of prospective memory, research has compared adults' prospective memory performance in the lab to their prospective memory abilities in their daily life (e.g., Kim & Mayhorn, 2008). Kim and Mayhorn (2008) found that adults performed similarly on event (e.g., circle trivia questions related to telephones) and activity-based prospective memory (e.g., write your name at the end of each question block) tasks across lab and naturalistic contexts but had more trouble remembering to carry out time-based intentions in the laboratory (e.g., write your initials on the paper every 3 minutes) compared to daily life (e.g., remembering to meet someone at 2 p.m.). Personal relevance of prospective memory tasks may also determine the frequency with which they are carried out. Sommerville et al. (1983) reported that 2-year-olds were more successful at remembering to remind their caregivers to complete tasks when they were more relevant to the child (e.g., buy candy at the store) versus less relevant (e.g., bring in the laundry). Continuing to better equate laboratory tasks to future thinking tasks performed in daily life is essential for understanding children's capabilities and how they may differ across real-life demands, particularly in domains like prospective memory where there may be less correspondence between ability displayed in-lab and daily life. It is important to note that in Study 1, performance in naturalistic contexts related to in-lab performance across the four other future thinking domains (i.e., saving, episodic foresight, planning, and delay of gratification). One promising approach to target more naturalistic future thinking in-lab is through spontaneous episodic foresight. In Study 2, I identified that children can generate their own items for future use, which likely better reflects the demands of daily life (e.g., children might be asked what they would like to bring to grandmas when visiting the next day versus being provided with specific items to choose from).

Despite recent attention to children's spontaneous future thinking capabilities (e.g., Atance et al., 2019; Caza & Atance, 2019; Moffett et al., 2018), there are limitations associated with open-ended forms of responding. Mainly, children's explanations for their future choices rely heavily on their verbal capabilities, which may be limited in young children. It has been proposed that one of the reasons young children perform poorly on verbal measures is due to a lack of understanding of temporal terms (e.g., Busby & Suddendorf, 2005). During childhood, children gradually produce and accurately use temporal terms (e.g., starting with broad terms like "later" and "soon") and make temporal judgements (e.g., temporally locating events in the past and future and judging temporal distance; Busby Grant & Suddendorf, 2009; Hudson & Mayhew, 2011), and begin to use more specific time markers (e.g., weeks, months) to temporally situate events (e.g., Friedman, 1978). Hudson and Mayhew (2011) also found an association between children's understanding of temporal terms and their ability to judge temporal distance of events likely to occur in their personal futures (e.g., an event taking place tomorrow vs. next week). Conceivably, these factors may impact the degree to which children use future orientation and episodicity in their explanations for their future choices. However, some research also suggests that children's general language abilities are not related to their tendency to reference the future in verbal explanations (Atance & O'Neill, 2005; Hayne et al., 2011). Thus, evaluating children's engagement in future thinking via verbal explanations should be situated in context with child's understanding and ability to use temporal terms.

Future Directions

Based on the current studies, there are many fruitful directions for future research. First, as a newly developed measure, establishing the inter-rater reliability of the CFTQ would be an important next step. The CFTQ could be adapted for teacher report, which could be used to corroborate parent reports of children's future thinking abilities. Other questionnaire measures of children's cognitive abilities, such as the Behaviour Rating Inventory of Children's Executive Function- Preschool (BRIEF-P), find low to moderate associations between parent and teacher reports (Duku & Vaillancourt; Gioia et al. 2003). However, researchers note that these discrepancies between raters could partially be due to differences in behavioural expression and demands across environments (e.g., Isquith et al., 2014). Thus, comparing parent and teacher reports could be helpful in determining whether children's future thinking in everyday life is impacted by contextual factors (e.g., comparing performance in home vs. school settings). Interrater reliability could also be determined by looking at agreement between parents when evaluating their same child's future thinking. Parent reports evaluating children's social understanding have found moderate agreement between maternal and paternal ratings (e.g., Gluck et al., 2020), which suggests that parents may have similar insights on their child's social development. It is unclear whether this would be the case for children's future thinking as well, but future research should examine the interrater reliability of the CFTQ and seek to adapt the measure for teacher report.

Second, future research should attempt to identify the underlying processes involved in future thinking. Various theories propose different mechanisms that support future thinking: (1) constructive processes (e.g., Hassabis & Maguire, 2007; Shacter & Addis, 2007) that allow one to retrieve information from past events (e.g., sensory information, people appearing in past scenes) and recombine it into future representations, (2) executive processes (e.g., working memory; Suddendorf & Corballis, 1997) that provides the space where imagined future events can be stored while being manipulated or maintained, or (3) self-projection that allows one to move attention from the present and travel forward in time to imagine the self from a first or third person perspective (Buckner & Carroll, 2007). D'Argembeau et al. (2010) reported that executive and visual-spatial processes, as well as future-orientation, all contributed to adults' representation of future events in an autobiographical memory task. In Study 3, I used pronoun use to explore the degree to which children were considering their personal futures during episodic future thinking, but future research could more systematically test various accounts and component processes involved in future self-projection in children.

Third, across all studies in my dissertation the sample was quite homogenous (i.e., primarily Caucasian, middle-class, Canadian families), and thus, the results may not be generalizable across social classes or cultures (or even to diverse groups within cultures). Examining social class, Vásquez-Echeverría et al. (2019) found that children's episodic foresight ability predicted their membership in the medium-high or low socioeconomic status (SES) groups such that those in the medium-high SES group performed better on episodic foresight tasks compared to those in the low-SES group. In adult samples, research has also found that a high level of education was associated with greater future time perspective (e.g., Guthrie et al., 2009). Some research also suggests that future thinking varies across cultures, although this research is primarily with adult samples (e.g., Gao, 2016; Wang et al., 2011). For example, Wang et al. (2011) found that American adults solicited more specific episodic details when asked to imagine future events compared to Chinese adults. Gao (2016) also suggests that temporal orientation differs between North Americans and East Asians in several ways: (1) North Americans tend to focus more on the present, while East Asians tend to focus more on the past; (2) East Asians perceive the distant future as temporally closer than North Americans; and (3) East Asians tend to discount the future less (e.g., save more for the future, engage in healthy behaviours) compared to Westerners. While this work is primarily in adult samples, future thinking may be more valued or encouraged in some cultures or social classes over others which may contribute to different profiles of future-oriented cognitive development in children. The CFTQ has already been translated into other languages (e.g., Persian; Sadeghi et al., 2021) and could be used to explore cross-cultural variation in children's future thinking.

Fourth, motivational contexts impacting future thinking could be further explored. Exploring the impact of conflict on children's episodic foresight, Atance et al. (2021) presented children with items (e.g., present, ball) that were highly desirable to their current-self compared to the correct choice (e.g., water) to fulfil a future need (high conflict), or items (e.g., card, shampoo) that were less desirable to their current-self compared to the correct item (e.g., water; low conflict). The researchers found that children had more difficulty selecting the correct item in the high conflict compared to low conflict condition. In Study 3, however, I found that psychological conflict did not impact children's use of future orientation or episodicity in their explanations. Thus, presenting children with motivating options can inhibit performance, but does not seem to prevent children from reasoning about the future utility of that item. Interestingly, research has found that presenting children with a motivating food item (e.g., cupcake) is effective in helping children overcome a current physiological state (e.g., thirst) and the bias of that state on future reasoning (Mahy et al., 2020). Thus, in some cases, highly desirable future choices may “pull” children away from optimal future choices but in other cases could also be used to improve performance. Future research should continue to investigate under what motivational conditions children’s verbal reasoning and engagement in future orientation are impacted. A benefit of the CFTQ is that it considers children’s future-orientated abilities across many different motivational contexts (e.g., daily circumstances that vary in conflict, rewards, intrinsic motivation etc.).

Fifth, the current study only explored children’s future thinking and reasoning for their future-self, but research shows that across multiple future thinking domains, making predictions and decisions for another person in the future (i.e., psychological distancing) can aid children in making more rational future choices (e.g., Bélanger et al., 2014; Lee & Atance, 2016; Mazachowsky et al., 2019; Prencipe & Zelazo, 2005). In the domain of delay of gratification, Prencipe and Zelazo (2005) found that 3-year-olds chose to delay rewards for an adult experimenter more often compared to 3-year-olds who made the choice for themselves. Bélanger et al. (2014) also found that 3-to-5-year-olds were worse at predicting how their own future preferences would change over time (e.g., preference for Kool-Aid as a child, but coffee as an adult) compared to how another child’s preferences would change. More recently, Atance et al. (2021) reported no effect of psychological distance on children’s performance on the Spoon or Picture-book tasks, suggesting that an other-over-self-advantage may be task-specific. Future research should continue to investigate how future thinking could be improved and targeted for intervention in children with low future thinking capacities or in domains where children tend to struggle. For example, preschool children have trouble saving for the future, but performance improves when they are prompted to save (Atance et al., 2017) or when forming a budget (e.g., Kamawar et al., 2018). Accordingly, comparing various strategies to improve children's saving would be a fruitful endeavour given the serious impact of poor saving practices in adulthood, such as increased debt, or lack of savings for retirement.

Conclusions

Future thinking is an essential cognitive ability that shows substantial development across early childhood. Using methodological advancements, this research highlights that the development of children's future thinking can be captured by parents across many contexts in the child's daily life and through open-ended forms of questioning or children's explanations. Further, this research begins to untangle the processes involved in children's future thinking through their verbal explanations and supports theoretical perspectives (e.g., the Semantic Scaffolding Hypothesis; Irish & Piguet, 2013) that suggest a contribution of semantic and episodic memory in episodic foresight. One particularly novel finding of the current work is that children's use of episodicity and future orientation differ between episodic foresight tasks and relies on age-related development and children's ability to determine what is needed to fulfill the future need. Overall, future research should continue to advance current methodology and determine ways to better capture the development of future thinking across the preschool years in addition to developing future thinking tasks that better engage children's future self-projection.

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Appendix C

Ethics Approvals

Chapter 2

Cross-validation of a parent questionnaire on children's thinking [file: 16-319-MAHY]

Brock University
Research Ethics Office
Tel: 905-688-5550 ext. 3035
Email: reb@brocku.ca

Social Science Research Ethics Board

Certificate of Ethics Clearance for Human Participant Research

DATE: 6/1/2018

PRINCIPAL INVESTIGATOR: MAHY, Caitlin - Psychology

FILE: 16-319 - MAHY

TYPE: Faculty Research   STUDENT: Tessa Mazachowsky
SUPERVISOR: Caitlin Mahy

TITLE: Cross-Validation of a Parent Questionnaire on Children's Thinking

ETHICS CLEARANCE GRANTED
Type of Clearance: RENEWAL

Initial Clearance Date: 6/29/2017
Expiry Date: 6/1/2019

The Brock University Social Science Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement.

Renewed certificate valid from **6/1/2018 to 6/1/2019**.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before **6/1/2019**. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Research Ethics web page at http://www.brocku.ca/research/policies-and-forms/research-forms.

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;
c) New information that may adversely affect the safety of the participants or the conduct of the study;
d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved:

Ann-Marie DiBiase, Chair
Social Science Research Ethics Board

Note: Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.

Chapter 3

The development of spontaneous episodic future thinking [file: 14-183-ATANCE]

Brock University
Research Ethics Office
Tel: 905-688-5550 ext. 3035
Email: reb@brocku.ca

Social Science Research Ethics Board

Certificate of Ethics Clearance for Human Participant Research

DATE:	1/20/2015
PRINCIPAL INVESTIGATOR:	ATANCE, Cristina - Psychology
CO-INVESTIGATOR:	MAHY, Caitlin
STUDENT:	Seyda Nur Celebi and Sarah Mitchison
FILE:	14-183 - ATANCE
TYPE:	Faculty Research

TITLE: The development of spontaneous episodic future thinking

ETHICS CLEARANCE GRANTED

Type of Clearance: NEW Expiry Date: 1/29/2016

The Brock University Social Science Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement. Clearance granted from 1/20/2015 to 1/29/2016.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before 1/29/2016. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Research Ethics web page at http://www.brocku.ca/research/policies-and-forms/research-forms.

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;
c) New information that may adversely affect the safety of the participants or the conduct of the study;
d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved: J. Frijt

Jan Frijters, Chair
Social Science Research Ethics Board

Note: Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.

File Number: H12-14-05 **Date (mm/dd/yyyy):** 01/18/2018

Université d'Ottawa University of Ottawa
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Cristina	Atance	Social Sciences / Psychology	Principal Investigator
Caitlin	Mahy	Social Sciences / Psychology	Co-investigator
Seyda Nur	Celebi	Social Sciences / Psychology	Research Assistant

File Number: H12-14-05

Type of Project: Professor

Title: The development of spontaneous episodic future thinking

Renewal Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
01/14/2018	01/13/2019	Renewal

Special Conditions / Comments:
N/A

550, rue Cumberland, pièce 154 550 Cumberland Street, room 154
Ottawa (Ontario) K1N 6N5 Canada Ottawa, Ontario K1N 6N5 Canada
(613) 562-5387 • Téléc./Fax (613) 562-5338
www.recherche.uottawa.ca/deontologie/ www.research.uottawa.ca/ethics/

File Number: H12-14-05 **Date (mm/dd/yyyy):** 01/18/2018

Université d'Ottawa
Bureau d'éthique et d'intégrité de la recherche

University of Ottawa
Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement (2010) and other applicable laws and regulations in Ontario, has examined and approved the ethics application for the above named research project. Ethics approval is valid for the period indicated above and subject to the conditions listed in the section entitled "Special Conditions / Comments".

During the course of the project, the protocol may not be modified without prior written approval from the REB except when necessary to remove participants from immediate endangerment or when the modification(s) pertain to only administrative or logistical components of the project (e.g., change of telephone number). Investigators must also promptly alert the REB of any changes which increase the risk to participant(s), any changes which considerably affect the conduct of the project, all unanticipated and harmful events that occur, and new information that may negatively affect the conduct of the project and safety of the participant(s). Modifications to the project, including consent and recruitment documentation, should be submitted to the Ethics Office for approval using the "Modification to research project" form available at: https://research.uottawa.ca/ethics/forms.

Please submit an annual report to the Ethics Office four weeks before the above-referenced expiry date to request a renewal of this ethics approval. To close the file, a final report must be submitted. These documents can be found at: https://research.uottawa.ca/ethics/forms.

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5387 or by e-mail at: ethics@uOttawa.ca.

Signature:

Mélanie Rioux

Mélanie Rioux
Ethics Coordinator
For Catherine Paquet, Director of the Office of Research Ethics and Integrity

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Chapter 4

How do perspective and social distance affect young children's future-oriented thinking? [file: 17-223-ATANCE]

Brock University
Research Ethics Office
Tel: 905-688-5550 ext. 3035
Email: reb@brocku.ca

Social Science Research Ethics Board

Certificate of Ethics Clearance for Human Participant Research

DATE:	2/16/2018		
PRINCIPAL INVESTIGATOR:	ATANCE, Cristina - Psychology		
CO-INVESTIGATOR(S):	Caitlin Mahy (caitlin.mahy@brocku.ca)		
FILE:	17-223 - ATANCE		
TYPE:	Faculty Research	STUDENT: SUPERVISOR:	

TITLE: How do perspective and social distance affect young children's future-oriented thinking?

ETHICS CLEARANCE GRANTED

Type of Clearance: NEW Expiry Date: 2/1/2019

The Brock University Social Science Research Ethics Board has reviewed the above named research proposal and considers the procedures, as described by the applicant, to conform to the University's ethical standards and the Tri-Council Policy Statement. Clearance granted from 2/16/2018 to 2/1/2019.

The Tri-Council Policy Statement requires that ongoing research be monitored by, at a minimum, an annual report. Should your project extend beyond the expiry date, you are required to submit a Renewal form before 2/1/2019. Continued clearance is contingent on timely submission of reports.

To comply with the Tri-Council Policy Statement, you must also submit a final report upon completion of your project. All report forms can be found on the Research Ethics web page at http://www.brocku.ca/research/policies-and-forms/research-forms.

In addition, throughout your research, you must report promptly to the REB:

a) Changes increasing the risk to the participant(s) and/or affecting significantly the conduct of the study;
b) All adverse and/or unanticipated experiences or events that may have real or potential unfavourable implications for participants;
c) New information that may adversely affect the safety of the participants or the conduct of the study;
d) Any changes in your source of funding or new funding to a previously unfunded project.

We wish you success with your research.

Approved: [signature]

____
Ann-Marie DiBiase, Chair
Social Science Research Ethics Board

Note: Brock University is accountable for the research carried out in its own jurisdiction or under its auspices and may refuse certain research even though the REB has found it ethically acceptable.

If research participants are in the care of a health facility, at a school, or other institution or community organization, it is the responsibility of the Principal Investigator to ensure that the ethical guidelines and clearance of those facilities or institutions are obtained and filed with the REB prior to the initiation of research at that site.

File Number: H05-17-10 **Date (mm/dd/yyyy):** 06/01/2017

Université d'Ottawa University of Ottawa
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

Ethics Approval Notice

Health Sciences and Science REB

Principal Investigator / Supervisor / Co-investigator(s) / Student(s)

First Name	Last Name	Affiliation	Role
Cristina	Atance	Social Sciences / Psychology	Principal Investigator
Caitlin	Mahy	Social Sciences / Psychology	Co-investigator

File Number: H05-17-10

Type of Project: Professor

Title: How do perspective and social distance affect young children's future-oriented thinking?

Approval Date (mm/dd/yyyy)	Expiry Date (mm/dd/yyyy)	Approval Type
06/01/2017	05/31/2018	Approval

Special Conditions / Comments:
N/A

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File Number: H05-17-10 **Date (mm/dd/yyyy):** 06/01/2017

Université d'Ottawa University of Ottawa
Bureau d'éthique et d'intégrité de la recherche Office of Research Ethics and Integrity

This is to confirm that the University of Ottawa Research Ethics Board identified above, which operates in accordance with the Tri-Council Policy Statement (2010) and other applicable laws and regulations in Ontario, has examined and approved the ethics application for the above named research project. Ethics approval is valid for the period indicated above and subject to the conditions listed in the section entitled "Special Conditions / Comments".

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Please submit an annual report to the Ethics Office four weeks before the above-referenced expiry date to request a renewal of this ethics approval. To close the file, a final report must be submitted. These documents can be found at: http://research.uottawa.ca/ethics/submissions-and-reviews.

If you have any questions, please do not hesitate to contact the Ethics Office at extension 5387 or by e-mail at: ethics@uOttawa.ca.

Signature:

Riana Marcotte
Protocol Officer for Ethics in Research
For Daniel Lagarec, Chair of the Health Sciences and Sciences REB

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