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

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Abstract

Future-oriented cognition (planning, prospective memory, episodic foresight, saving, and delay of gratification) involves a critical set of skills that children must develop for successful daily functioning. The current study developed the Children's Future Thinking Questionnaire (CFTQ), a parent-report on 3- to 7-year-olds' future-oriented cognition. The CFTQ showed high internal consistency and detected development of future-oriented cognition (Study 1; N = 145). Study 2 (N = 255) showed high internal consistency reliability and preliminary validity of the CFTQ. Study 3 (N = 101) confirmed strong reliability and validity of the CFTQ. Study 4 (N = 105) revealed excellent test-retest reliability of the CFTQ. Thus, the CFTQ is the first reliable and valid parent-report measure of children's developing future-oriented cognitive abilities.

Keywords: children's future-oriented cognition, parent-report, reliability and validity

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

The ability to anticipate future states and needs (Bélanger, Atance, Varghese, Nguyen, & Vendetti, 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, Moses, & Kliegel, 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, Mischel, & Peake, 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.

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, Renaud, & Van Der Linden, 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, Garton, Ballard, Samanez-Larkin, and Knutson (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, Gross, McNamee, Fitzgibbon, & Tustin, 2011), by five or six 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, Connolly, Astle-Ragim, Smygwaty, & Vendetti, 2018: Metcalf & Atance, 2011). In contrast, when children were explicitly told about the opportunity to save marbles during the marble game, Atance, Metcalf, and Thiessen (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, Schots, Westerman, & Webley, 2006 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, Ebdon, & Messer, 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 (Kvavilashvili, Kyle, & Messer, 2008; Kvavilashvili, Messer, & Ebdon, 2001; Kliegel & Jager, 2007; 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 (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, Nielsen, & von Gehlen, 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, Shapiro, & Sosa, 1995). On tower tasks, children's ability to plan the movement sequence of items generally increases with age (e.g., Kaller, Rahm, Spreer, Mader, & Unterrainer, 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 three 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, Shoda, & Rodriguez, 1989). Though delay of gratification has been measured using the classic marshmallow task (e.g., Mischel, Ebbesen, & Raskoff Zeiss, 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, Ahadi, Hershey, & Fisher, 2001; Children’s Social Understanding Scale (CSUS); Tahiroglu, Moses, Carlson, Mahy, Olofson, & Sabbagh, 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, avoid placing high verbal demands on children, include questions that vary in context to improve ecological validity, include a more diverse economic and ethnic sample and allowing for more efficient data collection, and include 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, Atance, & Moses, 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, Atance, & Moses, 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, twenty-one (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, rs (143) ranged from .25 to .30, ps < .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, prs (140) ranged from .55 to .78, ps < .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 years 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) in order 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 in order 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 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 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 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 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 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, Isquith, Guy, & Kenworthy, 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 in order 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, 23th, 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, κ = .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 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 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 finds age-related improvements in performance across childhood (e.g., Atance & Jackson, 2009; Belanger et al., 2014; Otto et al., 2006).

Correlations between behavioural task and subscale ratings. See Figure 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 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, *p*s > .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)[1] a

[1] 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)

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 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. Results showed that the planning/organization subscale of the BRIEF-P was significantly correlated with all the CFTQ subscales, rs (81) = -.37 to -.48, p < .002. 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 were 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 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 Thinking Questionnaire. 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 saving of 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, Spreng, & Schacter, 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, Brewer, and Spillers (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 & Jager, 2007; Mahy, Moses, & Kliegel, 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[2]. 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 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 absent minded failures. Importantly, although prospective memory

[2] 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.

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, Williams, Bölte, & Kliegel, 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.

References

Addis, D. R., & Schacter, D. L. (2008). Constructive episodic simulation: Temporal distance and detail of past and future events modulate hippocampal engagement. *Hippocampus*, *18*, 227-237. doi: 10.1002/hipo.20405

Altgassen, M., Williams, T. I., Bölte, S., & Kliegel, M. (2009). Time-based prospective memory in children with autism spectrum disorder. *Brain Impairment*, *10*, 52-58. doi: 10.1375/brim.10.1.52

Atance, C. M., & Jackson, L. K. (2009). The development and coherence of future-oriented behaviors during the preschool years. *Journal of Experimental Child Psychology*, *102*, 379-391. doi: 10.1016/j.jecp.2009.01.001

Atance, C. M., & Meltzoff, A. N. (2005). My future self: Young children's ability to anticipate and explain future states. *Cognitive Development*, *20*, 341-361. doi: 10.1016/j.cogdev.2005.05.001

Atance, C. M., Metcalf, J. L., & Thiessen, A. J. (2017). How can we help children save? Tell them they can (if they want to). *Cognitive Development*, *43*, 67-79. doi: 10.1016/j.cogdev.2017.02.009

Atance, C. M., & O'Neill, D. K. (2001). Episodic future thinking. *Trends in Cognitive Sciences*, *5*, 533-539. doi: 10.1016/S1364-6613(00)01804-0

Atance, C. M., & O'Neill, D. K. (2005). The emergence of episodic future thinking in humans. *Learning and Motivation*, *36*, 126-144. doi: 10.1016/j.lmot.2005.02.003

Bélanger, M. J., Atance, C. M., Varghese, A. L., Nguyen, V., & Vendetti, C. (2014). What will I like best when I'm all grown up? Preschoolers' understanding of future preferences. *Child Development*, *85*, 2419-2431. doi: 10.1111/cdev.12282

Buckner, R. L., & Carroll, D. C. (2007). Self-projection and the brain. *Trends in Cognitive Sciences*, *11*, 49-57. doi: 10.1016/j.tics.2006.11.004

Busby, J., & Suddendorf, T. (2005). Recalling yesterday and predicting tomorrow. *Cognitive Development*, *20*, 362-372. doi: 10.1016/j.cogdev.2005.05.002

Carlson, S. M., Moses, L. J., & Claxton, L. J. (2004). Individual differences in executive functioning and theory of mind: An investigation of inhibitory control and planning ability. *Journal of Experimental Child Psychology*, *87*, 299-319. doi: 10.1016/j.jecp.2004.01.002

D'Argembeau, A., Renaud, O., & Van der Linden, M. (2011). Frequency, characteristics and functions of future-oriented thoughts in daily life. *Applied Cognitive Psychology*, *25*, 96-103. doi: 10.1002/acp.1647

Dunn, D. M., & Dunn, L. M. (2007). *Peabody picture vocabulary test: Manual*. Pearson.

Ersner-Hershfield, H., Garton, M. T., Ballard, K., Samanez-Larkin, G. R., & Knutson, B. (2009). Don't stop thinking about tomorrow: Individual differences in future self-continuity account for saving. *Judgment and Decision Making*, *4*, 280-286.

Gioia, G. A., Isquith, P. K., Guy, S. C., & Kenworthy, L. (2000). Test review behavior rating inventory of executive function. *Child Neuropsychology*, *6*, 235-238. doi: 10.1076/chin.6.3.235.3152

Guajardo, N. R., & Best, D. L. (2000). Do preschoolers remember what to do? Incentive and external cues in prospective memory. *Cognitive Development*, *15*(1), 75-97. doi: 10.1016/S0885-2014(00)00016-2

Harner, L. (1981). Children talk about the time and aspect of actions. *Child development*, 498-506.

Hayne, H., Gross, J., McNamee, S., Fitzgibbon, O., & Tustin, K. (2011). Episodic memory and episodic foresight in 3-and 5-year-old children. *Cognitive Development*, *26*, 343-355. doi: 10.1016/j.cogdev.2011.09.006

Hershfield, H. E., Goldstein, D. G., Sharpe, W. F., Fox, J., Yeykelis, L., Carstensen, L. L., & Bailenson, J. N. (2011). Increasing saving behavior through age-progressed renderings of the future self. *Journal of Marketing Research*, *48*, S23-S37. doi: 10.1509/jmkr.48.SPL.S23

Hudson, J. A., Shapiro, L. R., & Sosa, B. B. (1995). Planning in the real world: Preschool children's scripts and plans for familiar events. *Child Development*, *66*, 984-998. doi: 10.1111/j.1467-8624.1995.tb00917.x

Kaiser, H. F. (1974). An index of factorial simplicity. Psychometrika, 39, 31-36. doi: 10.1007/BF02291575

Kaller, C. P., Rahm, B., Spreer, J., Mader, I., & Unterrainer, J. M. (2008). Thinking around the corner: The development of planning abilities. *Brain and Cognition*, *67*, 360-370. doi: 10.1016/j.bandc.2008.02.003

Kamawar, D., Connolly, K., Astle-Rahim, A., Smygwaty, S., & Vendetti, C. (2018). Preschoolers' Saving Behavior: The Role of Planning and Self-Control. *Child Development*. doi: 10.1111/cdev.13037

Kerns, K. A. (2000). The CyberCruiser: An investigation of development of prospective memory in children. *Journal of the International Neuropsychological Society*, *6*, 62-70. doi: 10.1017/S1355617700611074

Kliegel, M., & Jäger, T. (2007). The effects of age and cue-action reminders on event-based prospective memory performance in preschoolers. *Cognitive Development*, *22*, 33-46. doi: 10.1016/j.cogdev.2006.08.003

Kvavilashvili, L., & Ford, R. M. (2014). Metamemory prediction accuracy for simple prospective and retrospective memory tasks in 5-year-old children. Journal of Experimental Child Psychology, 127, 65-81. doi: 10.1016/j.jecp.2014.01.014

Kvavilashvili, L., Messer, D. J., & Ebdon, P. (2001). Prospective memory in children: the effects of age and task interruption. *Developmental Psychology*, *37*, 418-430. doi: 10.1037/0012-1649.37.3.418

Kvavilashvili, L., Kyle, F., & Messer, D. J. (2008). The development of prospective memory in children: Methodological issues, empirical findings, and future directions. Prospective memory: Cognitive, neuroscience, developmental, and applied perspectives, 115-140.

Mahy, C. E. V., Atance, C. M., & Moses, L. J. (unpublished data). The children's thinking questionnaire.

Mahy, C. E., & Moses, L. J. (2011). Executive functioning and prospective memory in young children. *Cognitive Development*, *26*, 269-281. doi: 10.1016/j.cogdev.2011.06.002

Mahy, C. E., Moses, L. J., & Kliegel, M. (2014). The development of prospective memory in children: An executive framework. *Developmental Review*, *34*, 305-326. doi: 10.1016/j.dr.2014.08.001

Metcalf, J. L., & Atance, C. M. (2011). Do preschoolers save to benefit their future selves? *Cognitive Development, 26,* 371-382. doi: 10.1016/j.cogdev.2011.09.003

Mischel, W., Ebbesen, E. B., & Raskoff Zeiss, A. (1972). Cognitive and attentional mechanisms in delay of gratification. *Journal of Personality and Social Psychology*, *21*, 204-218. doi: 10.1037/h0032198

Mischel, W., Shoda, Y., & Rodriguez, M. I. (1989). Delay of gratification in children. *Science*, *244*, 933-938. doi: 10.1126/science.2658056

Miyake, A., Friedman, N. P., Emerson, M. J., Witzki, A. H., Howerter, A., & Wager, T. D. (2000). The unity and diversity of executive functions and their contributions to complex "frontal lobe" tasks: A latent variable analysis. *Cognitive Psychology*, *41*, 49-100. doi: 10.1006/cogp.1999.0734

Moffitt, T. E., Arseneault, L., Belsky, D., Dickson, N., Hancox, R. J., Harrington, H., ... & Sears, M. R. (2011). A gradient of childhood self-control predicts health, wealth, and public safety. *Proceedings of the National Academy of Sciences*, *108*, 2693-2698. doi: 10.1073/pnas.1010076108

National Institutes of Health. (2012). NIH Toolbox® for the assessment of neurological and behavioral function.

Østby, Y., Walhovd, K. B., Tamnes, C. K., Grydeland, H., Westlye, L. T., & Fjell, A. M. (2012). Mental time travel and default-mode network functional connectivity in the developing brain. *Proceedings of the National Academy of Sciences of the United States of America*, *109*, 16800-16804. doi: 10.1073/pnas.1210627109

Otto, A. M., Schots, P. A., Westerman, J. A., & Webley, P. (2006). Children's use of saving strategies: An experimental approach. *Journal of Economic Psychology*, *27*, 57-72. doi: 10.1016/j.joep.2005.06.013

Prencipe, A., & Zelazo, P. D. (2005). Development of Affective Decision Making for Self and Other Evidence for the Integration of First-and Third-Person Perspectives. *Psychological Science*, *16*, 501-505. doi: 10.1111/j.0956-7976.2005.01564.x

Rothbart, M. K., Ahadi, S. A., Hershey, K. L., & Fisher, P. (2001). Investigations of temperament at three to seven years: The Children's Behavior Questionnaire. *Child Development*, *72*, 1394-1408. doi: 10.1111/1467-8624.00355

Schacter, D. L., & Addis, D. R. (2007). The cognitive neuroscience of constructive memory: remembering the past and imagining the future. *Philosophical Transactions of the Royal Society B: Biological Sciences*, *362*, 773-786.

Shapiro, L. R., & Hudson, J. A. (2004). Effects of internal and external supports on preschool children's event planning. *Journal of Applied Developmental Psychology*, *25*, 49-73. doi: j.appdev.2003.11.004

Shoda, Y., Mischel, W., & Peake, P. K. (1990). Predicting adolescent cognitive and self-regulatory competencies from preschool delay of gratification: Identifying diagnostic conditions. *Developmental Psychology*, *26*, 978-986. doi: 10.1037/0012-1649.26.6.978

Ślusarczyk, E., & Niedźwieńska, A. (2013). A naturalistic study of prospective memory in preschoolers: the role of task interruption and motivation. *Cognitive Development*, *28*, 179-192.

Strommen, E. A. (1973). Verbal Self-Regulation in a Children's Game: Impulsive Errors on" Simon Says". *Child Development*, *44*, 849-853. doi:10.2307/1127737

Suddendorf, T., & Busby, J. (2005). Making decisions with the future in mind: Developmental and comparative identification of mental time travel. *Learning and Motivation*, *36*, 110-125. doi: 10.1016/j.lmot.2005.02.010

Suddendorf, T., & Corballis, M. C. (2007). The evolution of foresight: What is mental time travel, and is it unique to humans?. *Behavioral and Brain Sciences*, *30*, 299-313. doi: 10.1017/S0140525X07001975

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. doi: 10.1111/j.1467-7687.2010.00950.x

Szpunar, K. K., Spreng, R. N., & Schacter, D. L. (2014). A taxonomy of prospection: Introducing an organizational framework for future-oriented cognition. *Proceedings of the National Academy of Sciences*, *111*, 18414-18421. doi: 10.1073/pnas.1417144111

Tahiroglu, D., Moses, L. J., Carlson, S. M., Mahy, C. E., Olofson, E. L., & Sabbagh, M. A. (2014). The Children's Social Understanding Scale: Construction and validation of a parent-report measure for assessing individual differences in children's theories of mind. *Developmental Psychology*, *50*, 2485-2497. doi: 10.1037/a0037914

Unsworth, N., Brewer, G. A., & Spillers, G. J. (2012). Variation in cognitive failures: An individual differences investigation of everyday attention and memory failures. Journal of Memory and Language, 67, 1-16. doi: 10.1016/j.jml.2011.12.005

Zelazo, P. D., Anderson, J. E., Richler, J., Wallner-Allen, K., Beaumont, J. L., & Weintraub, S. (2013). II. NIH Toolbox Cognition Battery (CB): Measuring executive function and attention. *Monographs of the Society for Research in Child Development*, *78*, 16-33. doi: 10.1111/mono.12032

Zhang, M., & Hudson, J. A. (2018). Children's understanding of yesterday and tomorrow. *Journal of Experimental Child Psychology*, *170*, 107-133. doi: 10.1016/j.jecp.2018.01.010

Table 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 1

Correlations between behavioural tasks and corresponding CFTQ subscale from Study 2

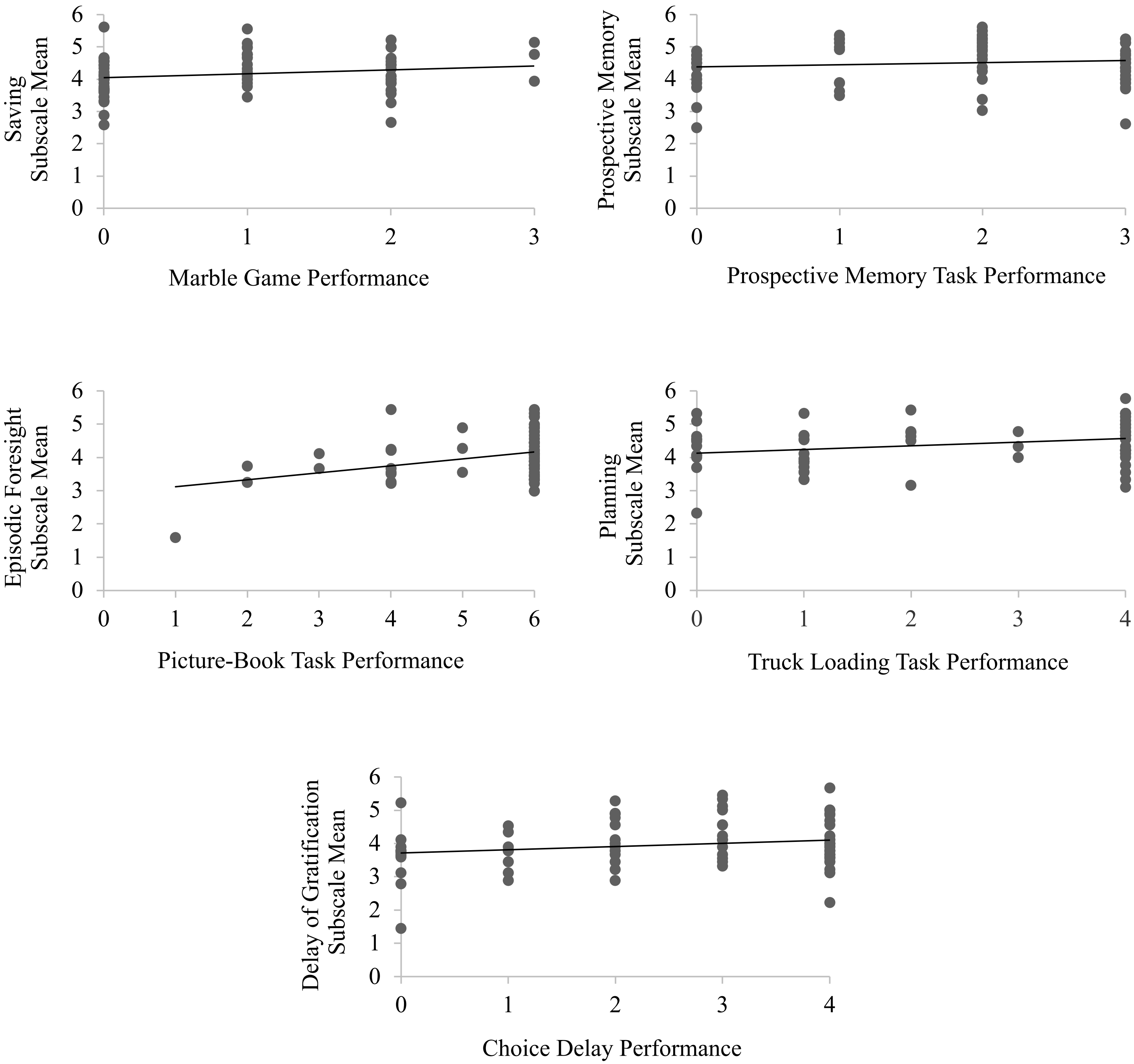
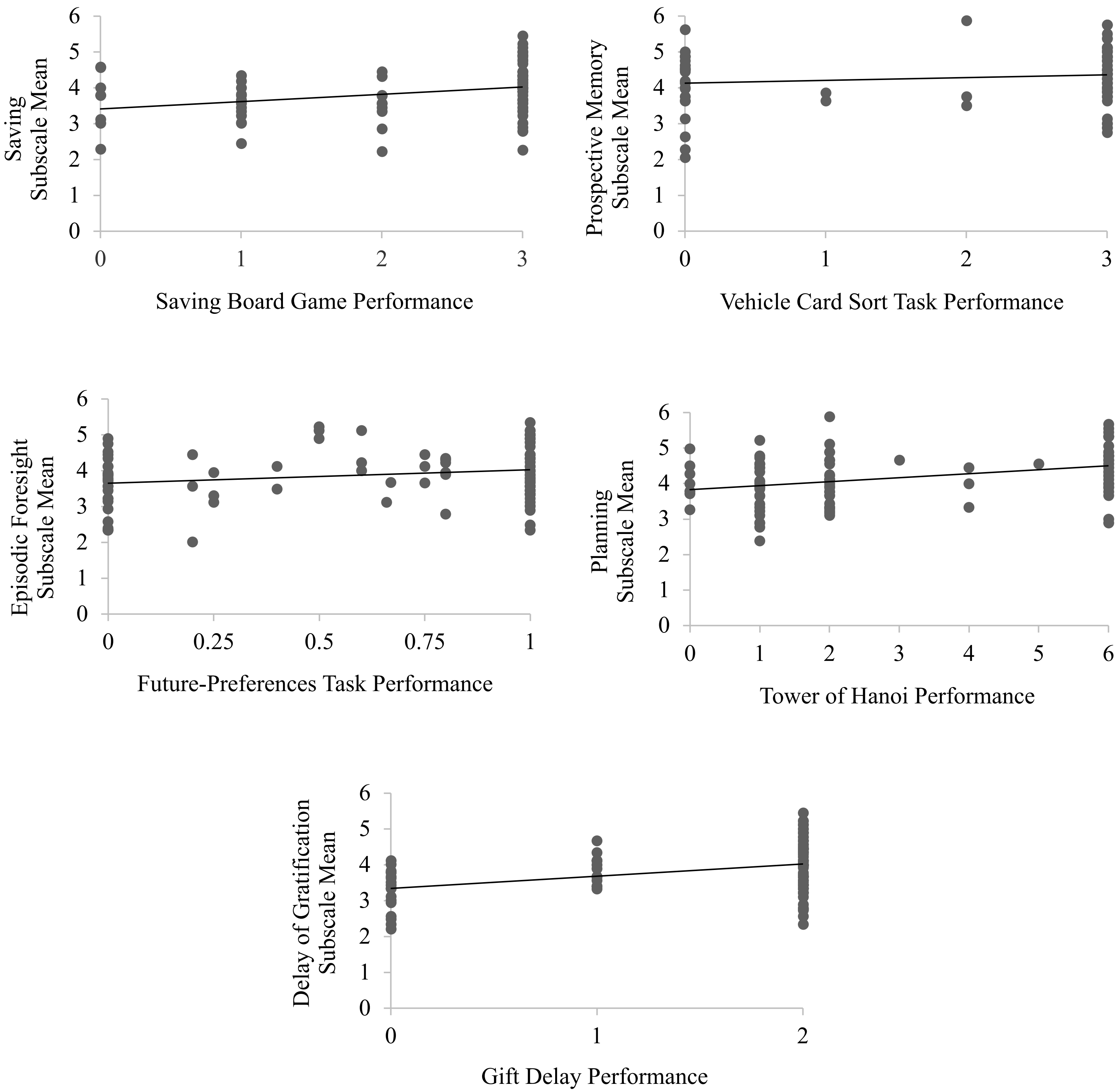


Figure 2

Correlations between behavioural tasks and corresponding CFTQ subscale from Study 3



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)**