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ABSTRACT

The development of children's future-oriented cognition has become a popular research topic in the past two decades. Much of this research focuses on the preschool and middle childhood years, but very little is known about the future-oriented cognitive abilities of toddlers and young preschoolers. The present study investigated the emergence of future-oriented cognition in toddlerhood and explored its relation with cognitive (i.e., executive function, episodic memory, and self-concept) and language abilities (i.e., expressive vocabulary, parent-child talk, temporal word use, and time metaphor use). Parents (N = 205) of 2- to 3-year-old children residing in the United States participated in an online study in which they completed the Children's Future Thinking Questionnaire (CFTQ) to assess their child's future-oriented cognition in five key domains. Also, parent-report measures of executive function, self-concept, episodic memory, expressive vocabulary, parent-child talk, child's temporal word use, and child's use of time metaphors were administered. Children as young as 2-years-old demonstrated future-oriented abilities. However, parents of 2-year-olds had substantial missing data (e.g., "*does not apply*"), especially in the planning and prospective memory subscales of the CFTQ. Three-year-olds were rated higher than 2-year-olds on the planning and prospective memory subscales, but there were no differences in ratings for 2- and 3-year-olds on the saving, episodic foresight, and delay of gratification subscales. Episodic memory and time metaphor use were significant independent predictors of future-oriented cognition and thus, both abilities may play a fundamental role in the emergence of future-oriented cognition in young children.

Future-oriented cognition, *the ability to anticipate future states and needs* (Bélanger, Atance, Varghese, Nguyen, & Vendetti, 2014), is an essential aspect of cognition and crucial for children's everyday activities. Maturation of children's future-oriented cognitive processes results in better decision-making (e.g., Lemmon & Moore, 2007), academic performance (e.g., Prabhakar, Coughlin, & Ghetti, 2016), and social skills (e.g., Mahy, Moses, & Kliegel, 2014). Although the past twenty years have seen an increase in research examining the development of future-oriented cognitive abilities (e.g., Atance & O'Neill, 2001; Hudson, Mayhew, & Prabhakar, 2011), relatively little is known about the early emergence of these abilities and which cognitive abilities support their emergence. Thus, the goal of the current

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study is to investigate the early emergence of key future-oriented cognitive abilities and to examine what domain-general cognitive abilities predict their emergence and development.

The development of future-oriented cognition

Future-oriented cognition involves a number of skills, including planning, delay of gratification, episodic foresight, prospective memory, and saving behavior. Children as young as 2 or 3 years old have some basic future-oriented capacities, and their competence increases during the preschool years (e.g., Atance & Meltzoff, 2005; Bauer, Schwade, Wewerka, & Delaney, 1999). In what follows, we review what is currently known about the development of these five key future-oriented cognitive abilities in very young children.

Planning

Planning, defined as the skill to construct plans and execute the action in order (Shapiro & Hudson, 2004), emerges in early childhood (e.g., Bauer et al., 1999). For example, Blankenship and Kibbe (2022) asked 2-year-old children to give toy animals their favorite beads (e.g., lion-red beads or monkey-yellow beads) in a planning game. Beads were stored in different drawers of a transparent box and each drawer could only be opened by completing specific actions. Thus, to accomplish this novel task, children first needed to remember how to open each of the drawers and then plan their actions (to give the correct bead to the right animal). Two-year-olds' planning performance was above chance, suggesting that children as young as 2-year-olds can engage in planning. However, increasing complexity in the plan (e.g., the number of actions needed to be executed) impairs children's performance. For example, Blankenship and Kibbe (2019) administered a similar planning game to 3- to 4-year-old children. As expected, 4-year-olds outperformed 3-year-olds in the planning game, suggesting an age-related improvement in planning ability. However, when the complexity increased in the game by adding additional steps to be planned, both age groups' performance decreased. Studies suggest that planning emerges and develops over early childhood, but young children still struggle to create plans that include multiple steps.

Delay of gratification

Young children can also delay gratification. For example, Garon, Longard, Bryson, and Moore (2012) provided 2- to 4-year-old children with two options (e.g., one sticker now vs. two stickers later) and asked them to choose one. Most 2-year-old children, like older children, chose the larger future reward. However, when they were asked to wait for the future reward, 3- and 4-year-old children waited longer than 2-year-olds (e.g., Steelandt, Thierry, Broihanne, & Dufour, 2012). These findings suggest that toddlers demonstrate future-oriented prudence for a larger reward, but they cannot delay gratification for as long as older children can.

Prospective memory

Prospective memory is defined as the ability to remember to carry out a future intention (Einstein & McDaniel, 1990). Young children struggle with prospective memory as it requires more complex aspects of cognition (e.g., retrospective memory; Mahy, 2022). For example, Kliegel and Jäger (2007) measured 2- to 6-year-old children's prospective memory in a card game in which they needed to remember to put an apple card in the box when it was presented. Two-year-olds showed floor levels of performance in the task because they could not recall the prospective memory instruction. However, 3-year-olds' performance was reliably greater than zero, suggesting that 3-year-old children can engage in prospective memory (Kliegel & Jäger, 2007). In another study examining young children's prospective memory (Ślusarczyk, Niedźwieńska, & Białecka-Pikul, 2018), two-thirds of 2-year-old children again failed to remember the content of their intention but the performance of the remaining children was reliably greater than zero, indicating that 2-year-old children who remembered their intention could successfully complete the prospective memory task. Thus, 2-year-old children's ability to remember to carry out future intentions is limited compared to older preschool children because of their poor memory capacities.

Episodic foresight

There is a lack of research on young children's episodic foresight (the ability to project the self into possible future scenarios; Atance & Mahy, 2016). Although cognitive abilities argued to support episodic develops during early childhood foresight (e.g., executive function; Carlson, 2005; Suddendorf & Corballis, 2007), young children's limited verbal and memory capacities impact their comprehension and performance on episodic foresight tasks (e.g., Atance & Mahy, 2016). Thus, the research investigating episodic foresight has mostly focused on preschool children (e.g., Ünal & Hohenberger, 2017). For example, Atance and Meltzoff (2005) asked 3- to 5-year-old children to pretend they were about to visit specific novel locations (e.g., a mountain trip) and to select an item (out of three-item options, e.g., lunch box, grass, ice) that would be needed in the location (e.g., lunch box). Three-year-old children chose the correct item 61% of the time. Further, children's success rate increased with age (75% and 92% in 4- and 5-year-old children, respectively). These findings suggest that preschool children can engage in episodic foresight, but little is known about very young children's episodic foresight ability.

Saving behavior

Saving behavior, defined as the postponement of the current consumption for future use (Metcalf & Atance, 2011), has been recently studied with preschool children (e.g., Atance, Metcalf, & Thiessen, 2017; Metcalf & Atance, 2011). In one of the earliest studies, Metcalf and Atance (2011) administered a marble game paradigm to assess 3- to 5-year-old children's saving behavior. In the game, children are given a chance to play with a small, boring marble run and then a bigger, exciting marble run with a limited number of marbles. Thus, children need to save some marbles (not using or "spending" the marbles on the small run) for the big run. Indeed, children, including 3-years-old, saved some marbles for the big run, but their savings (i.e., the number of marbles saved) did not increase with age (but see Atance et al., 2017 for an age-related improvement using the marble game). Toddlers may also engage in saving behavior in their everyday life (e.g., saving coins in a piggy bank). However, little is known about their saving.

In sum, these five future-oriented cognitive abilities show evidence of development between 2 and 4 years of age. In general, however, there is little work on 2-year-olds future oriented cognitive development especially in the domains of episodic foresight and saving. Further, most of the existing research relies on laboratory based behavioral tasks which might have limited ecological validity. Thus, we still know relatively little about the development of 2 and 3-year olds' future-oriented cognition in everyday life.

Parents' perception of their child's future-oriented cognition

To date, research on young children's future thinking has relied mainly on lab-based behavioral tasks such as those described above. However, behavioral measures often lack ecological validity (e.g., Doebel, 2020) and rely on other cognitive abilities that are utilized during the behavioral tasks but are not the focus of the task (e.g., verbal demands; Atance & Jackson, 2009). Thus, parents have been used as alternative informants to report on their children's future-oriented reasoning. Parent-report studies, like behavioral studies, show that future-oriented abilities emerge around the age of 2 and improve over the preschool years. For example, Benson (1994) asked parents of 9- to 36-months-old infants to report their child's everyday future-oriented behaviors (e.g., "*My child does things that show preparation for the future [e.g., My child gets a toy to take to Grandma's]*," Benson, 1994, p. 388). The results showed that children as young as the age of 2 could engage in future-oriented behaviors and their engagement in these behaviors increased as they aged. In addition, studies involving parents allow researchers to investigate children's future-oriented language in everyday contexts. For example, Grant and Suddendorf (2011) examined young children's production of temporal words in their daily talk and found that very broad temporal words (e.g., now, later, soon) are commonly and accurately used in 3-year-olds, whereas more specific temporal terms (e.g., days) were acquired later in the preschool years. In another study, Hudson (2006) investigated parent-child conversations and found that 2-year-old children contributed to the daily conversations about past and future events, and children's talk became more elaborated as they aged (e.g., using future tense).

In sum, naturalistic and behavioral data suggest that 2-year-old children have some ability to mentally simulate the future and engage in future-oriented conversations and behaviors in their daily life. Nevertheless, their prospective memory capabilities are limited, and little is known about their saving behavior and episodic foresight. Thus, the main goal of the current study is to examine the emergence of future-oriented abilities (i.e., saving, episodic foresight, delay of gratification, prospective memory, and planning) during toddlerhood.

The contribution of cognitive and language abilities to future-oriented cognition

Research has also highlighted mechanisms and characteristics of future-oriented cognition and has shown that several domain-general cognitive (e.g., self-concept, executive function, and episodic memory) and language abilities (e.g., expressive vocabulary, temporal word, time metaphor use, and daily talk) contribute to future-oriented cognition (e.g., Schacter, Benoit, & Szpunar, 2017; Ünal & Hohenberger, 2017). For example, developing inhibitory skills can suppress the current-state-driven responses in favor of future states and result in better future-oriented decision-making (Suddendorf & Corballis, 2007); or acquiring temporal tense/words support children in distinguishing between future time points in a more fine grained manner (e.g., tomorrow, next week; Hudson, 2002). We review each of these cognitive and language abilities in relation to the development of young children's future-oriented cognition.

Self-concept

In a seminal paper (Tulving, 1985, 2005), Tulving argued that the *self* travels between past and future to retrieve memories and pre-experience future events. Thus, self-concept,*the capacity to recognize self and distinguish self from others and the selves at different time points*, might be required in future thinking (e.g., D'Argembeau, Ortoleva, Jumentier, & Van der Linden, 2010). Self-concept emerges sequentially throughout childhood. First, babies begin to recognize themselves in a mirror around 18 months (e.g., Nielsen, Suddendorf, & Slaughter, 2006), and then they start to refer to themselves using terms such as "me" or "I" across the second year of life (Stipek, Gralinski, & Kopp, 1990). Children's developing self-concept, in turn, supports the emergence of autobiographical memory (e.g., Howe & Courage, 1997). As such, children's competency in self-recognition and self-description may support their ability to project themselves into future episodes, but little is known about the relation between self-concept and future-oriented cognition.

Executive function

Executive function (EF), defined as the set of cognitive processes involved in goal-directed behavior (Zelazo & Carlson, 2012), emerges in infancy and undergoes significant development over early childhood (e.g., Diamond, 2002). Maturation in EF supports future-oriented cognition, enabling children to *shift* their attention between current and future states, *inhibit* currently available information (e.g., physical states), and *manipulate* information to simulate an alternative future scene (e.g., Suddendorf & Corballis, 2007).

A robust relation between EF and future-oriented behaviors has been documented in preschool children. Delay of gratification shows a similar developmental trajectory to core EF skills (i.e., inhibitory control, working memory, shifting; Carlson, 2005) and is often conceptualized and described as a component of EF (e.g., "hot EF"; Zelazo & Carlson, 2012, "future-oriented self-control"; Mischel, Shoda, & Rodriguez, 1989). Similarly, inhibitory control has been suggested to drive developmental improvements in young children's planning ability (e.g., McCormack & Atance, 2011).

EF is also found to predict children's success in other future-oriented abilities. For example, preschool children with better executive skills tend to be better at remembering future intentions (e.g., Mahy & Moses, 2011) and demonstrate greater flexibility in their saving decisions (Lee & Carlson, 2015). Nevertheless, the role of EF in episodic foresight is less clear. Some studies suggest that EF is crucial for episodic foresight (e.g., Ünal & Hohenberger, 2017), but others have failed to find a relation during the preschool years (e.g., Hanson, Atance, & Paluck, 2014).

Episodic memory

Over the last two decades, a large body of research demonstrated that episodic memory and future thinking share similar developmental trajectories (e.g., Hayne, Gross, McNamee, Fitzgibbon, & Tustin, 2011) and underlying cognitive processes (e.g., Hassabis & Maguire, 2007). *The constructive episodic simulation hypothesis* argues that episodic memory might support future thinking in a process of recombining past details to create alternative future scenes (Schacter & Addis, 2007). Supporting the hypothesis, 5- to 9-year-old children's episodicity in past event narratives predicted their episodicity in future event narratives (e.g., Coughlin, Lyons, & Ghetti, 2014). Preschoolers also utilize their episodic memory to engage in future-oriented abilities, including episodic foresight (Atance & Sommerville, 2014), planning (Blankenship & Kibbe, 2022) and prospective memory (Somerville, Wellman, & Cultice, 1983). Thus, developmental gains in episodic memory may allow children to engage in future thinking and relatedly to develop future-oriented abilities during toddlerhood.

Language

Language develops rapidly during toddlerhood. Children show a steep acceleration in word learning between 16- to 18-months (e.g., Bloom, 2001) and begin to discuss past and future events during the second year of life (e.g., Hudson, 2002). For example, Hudson (2006) asked parents of 2.5- and 4-year-olds to initiate conversations about enjoyable future and past events with their children. The results showed that 2.5-year-old children could contribute to conversations, but their responses were significantly less elaborated than 4-year-olds.

Toddlers also begin to acquire verb tenses and develop a repertoire of temporal words. For example, children's use of past and future tense in speech increases between 2 to 6 years (e.g., Szagun, 1978), and they start to produce temporal adverbs, such as "*already*," by the age of two (Liang, Dandan, & Hui, 2019). More elaborate temporal words (e.g., specific timeframes, such as yesterday) show a gradual development during the preschool years (Grant & Suddendorf, 2011). In addition to temporal words, young children are also observed to use nontemporal concepts figuratively to refer to the past and future (Stites & Özçalişkan, 2013). For example, parents noted that their preschool children use "sleeps" instead of "days." Even some parents reported that their children tend to be better at understanding "three more sleeps" than "three days later" or "Wednesday" (Grant & Suddendorf, 2011). Time metaphor use might be another domain of language young children acquire across development.

Developmental gains in language might influence children's expression of future-oriented cognition. For example, Atance and Jackson (2009) showed that receptive vocabulary was positively correlated with episodic foresight, delay of gratification, and planning, indicating that language abilities may facilitate or limit how much children can express their future-oriented knowledge (an *expression* account). On the other hand, Hudson (2001) argued that children's past/future talk and acquisition of temporal tense/words enable them to develop temporal knowledge (e.g., differentiating points in time). Thus, developing language abilities might allow for the emergence of future-oriented cognition (an *emergence* account). In our study, we focus on four domains of language: (a) expressive vocabulary; (b) parent-child daily talk; (c) temporal word use; and (d) time metaphor use. Whether these language domains help children express their future-oriented cognition or whether they help future concepts emerge, we expect that they will predict young children's future-oriented cognition.

The current study

The current study investigated the emergence and development of future-oriented cognition in 2- to 3-year-old children using a parent-report questionnaire called Children's Future Thinking Questionnaire (CFTQ; Mazachowsky & Mahy, 2020). The CFTQ was developed to assess young children's future-oriented cognition into five domains of future thinking: saving, episodic foresight, prospective memory, delay of gratification, and planning. The CFTQ captures age-related increases in future-oriented abilities and shows high internal consistency and good validity with behavioral tasks, indicating that the CFTQ is a reliable and valid measurement of young children's future-oriented cognition (Mazachowsky & Mahy, 2020).

In line with previous studies (e.g., Blankenship & Kibbe, 2022), we expect that parents will report the emergence of future-oriented cognitive abilities in their 2-year-old children and that these abilities will improve between the second and third years of life. Parents' missing data in the CFTQ (e.g., leaving the item blank or selecting "don't know," "does not apply," or "prefer not to answer") will be examined as one indicator of children's difficulties with different aspects of future-oriented cognition. Finally, we also will examine which cognitive (i.e., self-concept, executive function, episodic memory) and language (i.e., expressive vocabulary, parent-child talk, temporal word use, time metaphor use) abilities independently contribute to children's early future-oriented cognition (Figure 1).

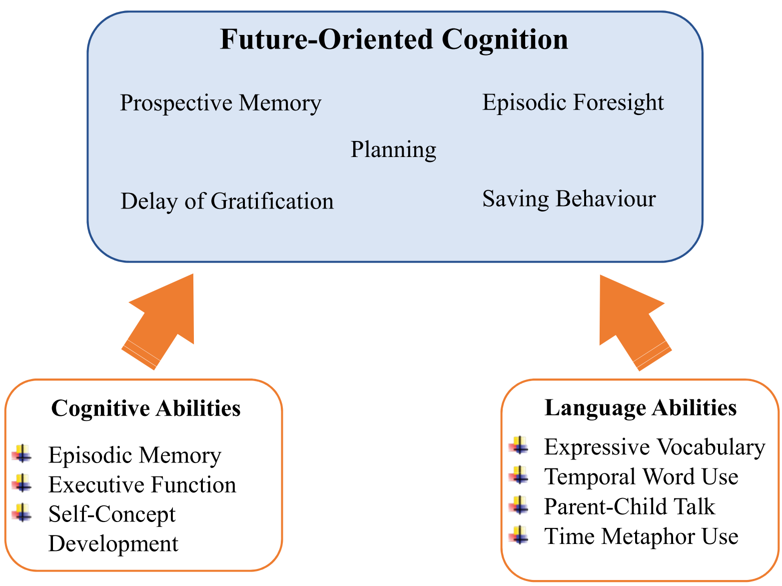

Figure 1. Future-oriented cognition and cognitive and language abilities supporting its development.

Method

Participants

An a priori power analysis in G*Power suggested that a sample size of 130 participants would be sufficient to detect a medium effect size for a linear multiple regression ($f^2 = 0.15$, power = .80, alpha = .05; Faul, Erdfelder, Lang, & Buchner, 2007). Our previous experiences in online parent studies suggest a data loss of around 30 to 50%. Thus, we collected data from 250 parents to ensure substantial power and compensate for expected data loss due to online study participation. Parents of 2- or 3-year-old children recruited from Prolific (www.prolific.co) participated in the study via a Qualtrics survey (www.qualtrics.com) in November 2021. Parents were residents of the United States. Forty-five participants were excluded for the following reasons: their child was outside of the 2- to 3-year-old age range ($n = 14$), their child was atypically developing ($n = 8$), they completed the study in less time than the fastest possible completion time of two research assistants (i.e., less than 11 minutes; $n = 1$), they completed the study slower than two standard deviations above mean completion time ($M = 29$ minutes, $SD = 13$ minutes, $n = 9$), they provided two dates of birth for their child that did not match ($n = 12$), or they failed at least four out of five attention check questions ($n = 1$).

The final sample consisted of 205 parents (141 mothers, 63 fathers, and 1 co-parent): 128 were parents of a 2-year-old (63 girls and 65 boys; $M_{age} = 28.73$ months, $SD = 3.55$, age-range = 24–35 months) and 77 were parents of a 3-year-old (38 girls and 39 boys; $M_{age} = 41.10$ months, $SD = 3.56$, age-range = 36–47 months). Participants were mostly White (81%; 7% were African American, 4% were Hispanic, 2% were Asian, and 6% were mixed-ethnicity) and from middle-class backgrounds (6% earning less than 25,000 USD, 16% earning between 25,000–40,000 USD, 27% earning between 40,000–75,000 USD, 20% earning between 75,000–100,000 USD, 30% earning more than 100,000 USD, and 1% undisclosed).

Measures

Children's Future Thinking Questionnaire (CFTQ)

The CFTQ (Mazachowsky & Mahy, 2020) was developed to measure children's future-oriented cognition in five key domains (i.e., planning, delay of gratification, saving, episodic foresight, and prospective memory). Parents were asked to rate 44 statements about their child's daily thinking and behaviors on a 6-point Likert scale ranging from "*Strongly Disagree*" to "*Strongly Agree*" with three other response options: "*Don't Know*," "*Does Not Apply*," and "*Prefer Not to Answer*." Example items include: "*Fails to understand that his/her activity preferences may change over time*." and "*Remembers what time he/she is supposed to be places*." Higher scores indicated better future thinking. The five subscales revealed acceptable internal consistencies: delay of gratification ($\alpha = .74$), prospective memory ($\alpha = .93$), saving ($\alpha = .76$), planning ($\alpha = .87$), and episodic foresight ($\alpha = .84$). The full scale had excellent internal consistency, $\alpha = .95$.

Behavior rating inventory of executive function – preschool version

The BRIEF-P was developed by Gioia, Espy, and Isquith (2003) to measure children's EF in five domains: working memory, inhibition, shifting, emotional control, and planning.

Parents rated 63 statements about how often each behavior had been a problem for their child in the last six months (e.g., "*Needs help from adult to stay on task*" and "*Becomes upset too easily*") on a 3-point scale: "*Never*," "*Sometimes*," or "*Often*." Higher scores represented greater EF impairment. The global executive composite (the sum of the five subscales) was used as our measure of EF and it showed excellent internal consistency, $\alpha = .96$.

Children's Memory Questionnaire-Revised (CMQ-R)

The CMQ-R (Hedges, Drysdale, & Levick, 2015) is a 36-item questionnaire assessing three aspects of children's memory (i.e., episodic memory, visual memory, and working memory and attention). Only the episodic memory subscale was administered. Parents rated their child's everyday episodic memory performance on 14 items (e.g., "*Forgets what she/he was told a few minutes ago*" and "*Loses things*") on a 5-point Likert scale ranging from "*Never or almost never happens*" to "*Happens more than once a day*." Higher scores represented greater impairment in episodic memory. The subscale revealed excellent internal consistency, $\alpha = .91$.

Self-Concept Development Questionnaire (SCDQ)

The SCDQ (Stipek et al., 1990) is a 25-item questionnaire measuring young children's self-concept in four areas: self-description and evaluation, self-recognition, emotional response to wrongdoing and self-regulation, and autonomy. The self-description and evaluation (12 items) and self-recognition (5 items) subscales were administered in this study. Parents were asked to rate statements (e.g., "*Use general evaluative terms about himself/herself*," or "*Recognize himself/herself in pictures*") about their child's self-concept development on a 3-point scale: "*Definitely has not manifested*," "*Sort of manifested*," and "*Definitely has manifested*." Higher scores indicated a stronger self-concept. The self-description ($\alpha = .90$) and self-recognition ($\alpha = .73$) subscales revealed acceptable internal consistencies.

Children's word use questionnaire

The Children's Word Use Questionnaire had three sections: temporal word use, time metaphor use, and child's daily talk. The temporal word use section was adapted from Grant and Suddendorf (2011) and assessed children's production of temporal terms. Parents were provided with a list of temporal words (e.g., "*yesterday*") and asked whether their child had used the term or not (yes or no). If they indicated that their child used the term, parents were asked to report how often their child used the word on a 5-point Likert scale ranging from "*Never*" to "*Always*." The original word list (Grant & Suddendorf, 2011) consisted of 18 terms. In this version, we added seven temporal terms (i.e., *times of day* [e.g., morning], *frequency adverbs* [e.g., never], *maybe, may/might, pretend, wish*, and *if*). Very few parents reported that their child used the terms "*in the future*" (1.95%) and "*in the past*" (0.98%) from the original list. Thus, these two items were excluded (see Grant & Suddendorf, 2011 for a similar exclusion). A mean frequency score was calculated, ranging from 1 to 5. Higher scores indicated children's more frequent use of temporal terms. The scale revealed excellent internal consistency, $\alpha = .95$.

In Grant and Suddendorf (2011), some parents also reported that their child used time metaphors to describe time (e.g., sleeps for days). Thus, we created three new questions to assess children's time metaphor use. Parents were asked to rate how often their child used routines, special events, and non-temporal phrases to refer to the future or past in their daily talk on a 5-point Likert scale ranging from "*Never*" to "*Always*." The questions were: a) routines ("*How often does your child use routines to refer to past or future events [e.g., after snack time]?*"), b) special events ("*How often does your child use memorable/special events to refer to past or future events [e.g., next Christmas]?*"), and c) non-temporal phrases ("*How often does your child use metaphors to refer to time [e.g., sleeps for days]?*"). Items were strongly correlated with each other (rs = .39 – .66, ps < .001). A composite mean score was calculated, ranging from 1 to 5. Higher scores indicated more frequent use of time metaphors. The scale revealed acceptable internal consistency, α = .76.

In the last section, we administered five questions assessing parent-child daily talk (adapted from Benson, 1994). Parents were first asked to indicate whether they discussed past and future with their child (yes vs. no). If they indicated yes, they were then asked to report the frequency on a 5-point Likert scale ranging from "*Never*" to "*Always*." The questions were: a) future events ("*How often do you ask your child questions about future events?*"), b) past events ("*How often do you ask your child questions about past events?*"), c) future possibility ("*How often do you talk about possible future events with your child?*"), d) future activities ("*How often do you talk about future activities with your child?*"), and e) future planning ("*How often do you plan events/activities with your child?*"). The items were strongly correlated with each other (rs = .46 - .67, ps < .001). A composite mean score was calculated, ranging from 1 to 5. Higher scores indicated more frequent parent-child talk. The scale revealed high internal consistency, α = 84.

MacArthur–bates short form vocabulary checklist – level II

This parent-report checklist was developed by Fenson et al. (2000) to assess children's expressive vocabulary skills. Parents were provided with a one-page list of words (e.g., mop, taste, star) and asked to indicate the words they had ever heard their child use. Children received 1 point for each selected word. Standardized percentile scores were used in the study.

Procedure

The procedure and analysis plan were pre-registered (https://osf.io/cgajy). After participant consent was obtained, parents completed several questionnaires assessing their child's future-oriented cognition, cognitive, and language abilities (Table 1). The questionnaires were presented to participants via Qualtrics in a randomized order. Each questionnaire (except for MacArthur-Bates Short Form Vocabulary Checklist) involved one attention check question (in total, five). Attention checks were randomly inserted into the questionnaires to ensure participants were paying attention throughout the study and they used the same response scale as the questionnaire they appeared in but instructed the participant to select a particular response (e.g., "Please select 'sometimes' for this question"). Parents also provided basic demographic information (e.g., annual income, education, or ethnicity) at the end of the study. Parents received 7 USD for their participation in the study. All study procedures were approved by the Research Ethics Board at Brock University.

Table 1. The variables and the questionnaires.

	Variable	Questionnaire
Future-Oriented Cognition	Saving Behavior	CFTQ Saving Subscale
	Episodic Foresight	CFTQ Episodic Foresight Subscale
	Prospective Memory	CFTQ Prospective Memory Subscale
	Delay of Gratification	CFTQ Delay of Gratification Subscale
	Planning	CFTQ Planning Subscale
	Full Scale	CFTQ Full Scale
Cognitive Abilities	Executive Function	BRIEF-P
	Episodic Memory	CMQ-R Episodic Memory Subscale
	Self-Description	SCDQ Self-Description Subscale
	Self-Recognition	SCDQ Self-Recognition Subscale
Language Abilities	Temporal Word Use	CWU Temporal Word Use Scale
	Time Metaphor Use	CWU Time Metaphor Use Scale
	Parent-Child Daily Talk	CWU Parent-Child Daily Talk Scale
	Expressive Vocabulary	MacArthur–Bates Short Form Vocabulary Checklist–II

CFTQ: Children's Future-Thinking Questionnaire; BRIEF-P: Behavior Rating Inventory of Executive Function – Preschool Version; CMQ-R: Children's Memory Questionnaire-Revised; SCDQ: Self Concept Development Questionnaire; CWU: Children's Word Use Questionnaire.

Results

Preliminary analysis

Estimation-maximization (EM) was used to impute missing data (https://osf.io/cgajy for data analysis plan). Four different responses were considered missing on the CFTQ: three optional response choices (i.e., "*don't know*," "*does not apply*," and "*prefer not to answer*") and blank items (i.e., no response selected). Preliminary analysis showed that 73 parents of 2- to 3-year-olds (34 girls and 39 boys; M_{age} = 30.59 months, SD = 5.77, age-range = 24–45 months) provided these missing responses to more than 20% of CFTQ. These parents were overwhelmingly parents of 2-year-olds (n = 57) and reported mostly "does not apply" (M = 71.82%, SD = 24.89) in their missing responses compared to "don't know" (M = 17.02%, SD = 15.33), "no response" (M = 10.95%, SD = 12.27), and "prefer not to answer" (M = 0.22%, SD = 1.31), ts > 11.85, ps < .001, ds = 1.39–2.89. Parents also reported more "does not apply" responses in the planning (M = 48.10%, SD = 29.11) and prospective memory (M = 54.62%, SD = 21.00) subscales than in the saving (M = 37.44%, SD = 25.49), episodic foresight (M = 21.00%, SD = 26.36), and delay of gratification subscales (M = 22.07%, SD = 23.46), ts > 7.16, ps < .001, ds = 0.84–1.52. These findings suggested that mostly parents of 2-year-olds provided missing data on the CFTQ, particularly "does not apply" responses in the planning and prospective memory subscales.

We decided to include these parents (n = 73) because their missing data might be meaningful in capturing the emergence of various future-oriented abilities.[1] Preliminary analysis also showed no relation between CFTQ (subscale and full scale scores), child's sex, and SES, so these variables were excluded from subsequent analyses. Descriptive statistics of all measures are presented in Table 2.

[1]We also replicated the analysis reported below, excluding these 73 parents. These analyses were performed based on the data of 132 parents (71 2-year-olds; Mage = 34.92 months, SD = 7.06). The results remained similar, except that parent-child talk was not a significant predictor of future-oriented cognition, and episodic memory did not predict the delay of gratification subscale.

Table 2. Descriptive statistics of all measures.

	2-year-olds				3-year-olds				Whole Sample			
	Min	*Max*	*M*	*SD*	*Min*	*Max*	*M*	*SD*	*Min*	*Max*	*M*	*SD*
Age (months)	24	35	28.73	3.55	36	47	41.10	3.36	24	47	33.38	6.93
CFTQ Saving	1.22	4.99	2.99	0.80	1.14	4.69	3.21	0.72	1.14	4.99	3.08	0.77
CFTQ PM	1	5.75	2.97	1.10	1	5.25	3.30	.97	1	5.75	3.09	1.06
CFTQ EpF	1.44	5.78	3.07	0.89	1.22	5	3.20	0.80	1.22	5.78	3.12	0.86
CFTQ Planning	1	5.78	2.79	0.96	1.14	5	3.20	0.84	1	5.78	2.95	0.93
CFTQ DoG	1.33	5.79	3.19	0.80	1.58	4.56	3.34	0.67	1.33	5.79	3.25	0.75
CFTQ Full Scale	1.30	5.18	3.01	0.78	1.41	4.59	3.25	0.66	1.30	5.18	3.10	0.75
Expressive Vocab.	5	95	32.34	28.44	5	90	49.22	30.40	5	95	38.68	30.25
CMQ-R Episodic Memory	14	61	34.63	12.16	14	63	35.99	10.71	14	63	35.14	11.62
BRIEF-P Global Executive	65	172	101.5	21.67	65	164	104.7	20.42	65	172	102.75	21.22
SCDQ Self-Desc.	.001	2	1.29	0.55	0.33	2	1.68	0.37	.001	2	1.43	0.52
SCDQ Self-Recog.	0.20	2	1.76	0.34	0.80	2	1.90	0.24	0.20	2	1.81	0.31
Temporal Word Use	2	4.50	3.07	0.56	2.36	4.78	3.49	0.54	2	4.78	3.24	0.59
Time Metaphor Use	1	4.67	2.05	0.96	1	4.67	2.86	0.84	1	4.67	2.35	0.99
Parent-Child Talk	1	5	3.45	0.73	2	5	3.41	0.72	1	5	3.43	0.73

CFTQ: Children's Future Thinking Questionnaire; PM: Prospective Memory; EpF: Episodic Foresight; DoG: Delay of Gratification; Expressive Vocab: Expressive Vocabulary Skills; CMQ-R: Children's Memory Questionnaire-Revised; SCDQ: Self Concept Development Questionnaire. Self-Desc.: Self-Description; Self-Recog.: Self-Recognition.

The emergence and development of future-oriented abilities

As an exploratory, unregistered analysis, one-sample t-tests were performed to examine whether 2-year-olds' CFTQ ratings were above one (i.e., referring to "*never*" in the scale). The results revealed that 2-year-olds' future thinking scores (CFTQ subscale and full scale scores) were reliably above one, *t*s > 20.23, *p*s < .001, *d*s = 1.78–2.74, suggesting that parents perceived that their children as young as two engage in at least some future thinking in their daily lives.

Children's age (in months) was positively related to parent-report of future-thinking, indicating that parents perceived children tended to be better at future-thinking with age (CFTQ subscale and full scale scores; Table 3). To examine the development of future-oriented abilities between the ages of 2 and 3, 2- and 3-year-olds' CFTQ scores were compared. Parents of 3-year-olds' CFTQ full scale scores were (M = 3.25, SD = 0.66) higher than parents of 2-year-olds (M = 3.01, SD = 0.78), $t(203)$ = 2.25, p = .026, d = .32. However, there were different patterns across the CFTQ subscales. Although parents of 3-year-olds reported higher scores than parents of 2-year-olds on the prospective memory (t [203] = 2.16, p = .032, d = .31) and planning subscales (t[203] = 3.01, p = .003, d = .43), there was no significant difference between parents of 2-year-olds and 3-year-olds in the saving, episodic foresight, and delay of gratification subscales. To reflect on these different patterns, an exploratory, unregistered, one-way repeated measures analysis of variance (ANOVA) was performed to compare children's future-oriented abilities in each age group. In 2-year-old children, the CFTQ subscales differed from each other, F(4, 508) = 9.726, p < .001, η^2 = .071. Bonferroni-corrected post hoc analysis showed that their planning scores (M = 2.80, SD = .96) were significantly lower than their saving (M = 3.00, SD = 0.80), prospective memory (M = 2.97, SD = 1.10), episodic foresight (M = 3.07, SD = 0.89), and delay of gratification scores (M = 3.19, SD = 0.80), *p*s < .03. Although parents of 2-year-old children reported lower scores in the prospective memory subscale than in the saving, episodic foresight, delay of gratification subscales, the differences were not significant. In 3-year-old children, the subscales did not differ from each

Table 3. Correlations between future-oriented cognition, cognitive and language abilities.

	1	2	3	4	5	6	7	8	9	10	11	12	13	14
1.Age (months)														
2.Expressive Vocabulary	.29**													
3.CFTQ Saving	.20**	.34** (.30**)												
4.CFTQ PM	.23**	.42** (.38**)	.72** (.71**)											
5.CFTQ EpF	.18*	.37** (.34**)	.73** (.72**)	.73** (.72**)										
6.CFTQ Plan	.30**	.36** (.30**)	.75** (.74**)	.80** (.79**)	.79** (.79**)									
7.CFTQ DoG	.14*	.15* (.12)	.52** (.51**)	.43** (.41**)	.58** (.57**)	.51** (.49**)								
8.CFTQ Full Scale	.25**	.39** (.35**)	.87** (.87**)	.88** (.87**)	.90** (.90**)	.91** (.91**)	.69** (.69**)							
9.BRIEF-P Global	.03	−.14 (−.15)	−.29** (−.30**)	−.31** (−.32**)	−.35** (−.36**)	−.28** (−.30**)	−.30** (−.30**)	−.35** (−.37**)						
10. CMQ-R EM	−.02	−.05 (−.05)	−.38** (−.39**)	−.38** (−.39**)	−.39** (−.40**)	−.37** (−.38**)	−.35** (−.35**)	−.44** (−.45**)	.58** (.58**)					
11.SCDQ Self- Desc.	.50**	.59** (.54**)	.37** (.32**)	.41** (.35**)	.38** (.34**)	.38** (.27*)	.22** (.18*)	.41** (.35**)	−.16* (−.20*)	−.09 (−.09*)				
12.SCDQ Self-Recog.	.31**	.40** (.34**)	.32** (.27**)	.33** (.28**)	.30** (.26**)	.34** (.27**)	.21** (.18*)	.35** (.30**)	−.28** (−.31*)	−.23* (−.23*)	.64** (.59**)			
13.Temporal Word	.38**	.46** (.40**)	.32** (.26**)	.34** (.28**)	.29** (.24**)	.34** (.25**)	.13 (.09)	.34** (.27**)	−.02 (−.03)	−.13 (−.13)	.42** (.29**)	.24** (.14**)		
14.Metaphor Use	.49**	.58** (.52**)	.53** (.51**)	.53** (.50**)	.49** (.46**)	.55** (.49**)	.35** (.32**)	.58** (.54**)	−.20* (−.25**)	−.24** (−.26**)	.63** (.52**)	.42** (.33**)	.48** (.37**)	
15.Parent- Child Talk	.06	.28** (.27**)	.27** (.28**)	.30** (.29**)	.28** (.28**)	.29** (.29**)	.21* (.20*)	.32** (.31**)	−.23** (−.23**)	−.10 (−.14)	.34** (.36**)	.27** (.26**)	.29** (.29**)	.34** (.35**)

CFTQ: Children's Future Thinking Questionnaire; PM: Prospective Memory; EpF: Episodic Foresight; DoG: Delay of Gratification; CMQ-R EM: Children's Memory Questionnaire-Revised Episodic Memory; SCDQ: Self Concept Development Questionnaire; Self-Desc. Self-Description; Self-Recog.: Self-Recognition. * $p < .05$, ** $p < .01$.

other, $F(4, 304) = 1.245$, $p = .29$, $\eta^2 = .016$. These findings suggested that the emergence of prospective memory and planning might be protracted but they also improve more drastically between the ages of 2 and 3 compared to other future-oriented abilities.

The contribution of cognitive and language abilities on future-oriented cognition

After controlling for age, the CFTQ full scale was negatively correlated with the BRIEF-P global executive composite and the CMQ-R episodic memory subscale, indicating that EF and episodic memory deficits were related to lower levels of future thinking. The CFTQ full scale score was positively correlated with SCDQ self-description and self-recognition, such that children with stronger self-concept had higher CFTQ full scale scores. Finally, language (i.e., expressive vocabulary skills, parent-child talk, children's time metaphor, and temporal word use) were positively correlated with the CFTQ full scale score (Table 3).

The relations were examined for each of the five CFTQ subscales (i.e., saving, episodic foresight, prospective memory, planning, and delay of gratification) separately. There were large, positive correlations between the CFTQ subscales, indicating that parents who reported higher scores for their child in one of the future-thinking skills tended to report higher scores in other skills. Also, all of the CFTQ subscale scores were positively correlated with SCDQ self-description, SCDQ self-recognition, expressive vocabulary, temporal word use, time metaphor use, parent-child talk, and negatively correlated with BRIEF-P global executive composite and CMQ-R episodic memory subscale (Table 3). However, there was no correlation between temporal word use and the CFTQ delay of gratification (Table 3).

A linear regression was conducted to determine predictors of young children's future-oriented cognition. CFTQ full scale score was used as the outcome variable. On the first step, children's age (in months), expressive vocabulary, BRIEF-P global executive composite score, CMQ-R episodic memory, SCDQ self-description, SCDQ self-recognition, temporal word use, time metaphor use, and parent-child talk were included in the model as predictor variables. The interactions between all these predictors and age were included on the second step. The first step of the model explained 43.8% of the variance in CFTQ full scale score, $F(9, 171) = 14.81$, $p < .001$ (Table 4). Only episodic memory ($b = -.019$, 95% CI [−.029, −.009], $\beta = -.309$, $t = -4.17$, $p < .004$), time metaphor use ($b = .253$, 95% CI [.131, .375], $\beta = .329$, $t = 4.13$, $p < .001$), and parent child daily talk ($b = .149$, 95% CI [.015, .283], $\beta = .141$, $t = 2.21$, $p = .028$) were significant independent predictors of CFTQ full scale score.

Table 4. Predictors of children's future-oriented cognition (full scale CFTQ score).

			95% CI			
	b	*SE*	*LL*	*UL*	β	*p*
Child's Age (months)	.001	.007	−.013	.015	.012	.866
Expressive Vocabulary	.003	.002	−.001	.007	.103	.171
BRIEF-P Global Executive	−.002	.003	−.008	.004	−.055	.456
SCDQ Self-Description	−.059	.157	−.614	.255	−.032	.709
SCDQ Self-Recognition	.060	.214	−.368	.488	.020	.781
CMQ-R Episodic Memory	−.019	.005	−.019	−.010	−.309	<.001
Temporal Word Use	.070	.090	−.110	.250	.057	.437
Time Metaphor Use	.253	.061	.131	.375	.329	<.001
Parent-Child Talk	.149	.067	.015	.283	.141	.028

CFTQ: Children's Future Thinking Questionnaire; SCDQ: Self Concept Development Questionnaire; CMQ-R EM: Children's Memory Questionnaire-Revised Episodic Memory.

The second step of the model did not increase the variance explained, and none of the interactions were significant.

Time metaphor use was revealed as a strong predictor of future-oriented cognition. However, it also shared variance with other language abilities (e.g., expressive vocabulary, temporal word use, and parent-child talk). Thus, as an exploratory, unregistered analysis, the same regression model was tested again but this time we did not include the time metaphor use to explore whether other language abilities would predict future-oriented cognition in the absence of time metaphor use. The model was significant but only explained 38.2% of the variance, $F(8, 172) = 13.30$, $p < .001$. Episodic memory ($b = -.023$, 95% CI [−.033, −.013], $\beta = -.373, t = -4.93$, $p < .001$), and parent-child talk ($b = .184$, 95% CI [.044, .324], $\beta = .175, t = 2.64$, $p = .009$) were again significant predictors of future-oriented cognition. Additionally, there was a small predictive effect of expressive vocabulary, $b = .005$, 95% CI [.001, .009], $\beta = .187, t = 2.47$, $p = .014$. The other cognitive and language abilities did not predict children's future-oriented cognition. Thus, time metaphor use may play a distinct role in future-oriented cognition independent of parent-child talk and temporal word use.

As an exploratory, unregistered analysis, the predictive role of cognitive and language abilities was tested for each subscale of the CFTQ (i.e., saving, episodic foresight, prospective memory, planning, and delay of gratification). Again, children's age (in months), expressive vocabulary skills, BRIEF-P global executive composite score, CMQ-R episodic memory subscale, SCDQ self-description, SCDQ self-recognition scores, temporal word use, time metaphor use, and parent-child talk were included on the first step. Their interactions with age were included on the second step. Episodic memory and children's time metaphor use were significant predictors of each future-oriented skill. Also, none of the interactions with age were significant. However, a different pattern was observed for parent-child daily talk and expressive vocabulary. The parent-child daily talk was a significant predictor of the CFTQ prospective memory ($b = .232$, 95% CI [.030, .433], $t = 2.29$, $p = .023$) and planning subscales ($b = .210$, 95% CI [.032, .388], $t = 2.37$, $p = .019$). However, it was not a significant predictor of the CFTQ saving, episodic foresight, and delay of gratification. Expressive vocabulary was a significant predictor only in the model for the CFTQ prospective subscale, $b = .006$, 95% CI [.012, .001], $t = 2.28$, $p = .024$.

Discussion

The purpose of the current study was to explore the emergence and development of future-oriented cognition in toddlerhood and how cognitive and language abilities contribute to early future-oriented cognition. The results showed that: (1) American toddlers can engage in future-oriented cognition, (2) some of their future-oriented abilities improve between 2 and 3 years of age, and (3) episodic memory and time metaphor use were independent predictors of young children's future-oriented cognition.

The emergence and development of future-oriented cognition in toddlerhood

Parents reported that their 2- to 3-year-old children could engage in five domains of future-oriented cognition in their daily life (i.e., saving behavior, episodic foresight, delay of gratification, prospective memory, and planning). This finding aligns with the previous studies showing 2-year-old children's successful engagements in planning (Blakenship & Kibbe, 2022) and delay of gratification (Garon et al., 2012). Also, the present study contributes to the knowledge of future-oriented cognition, particularly by examining the understudied areas such as toddlers' saving behavior and episodic foresight.

We observed different age trends in future-oriented abilities according to parent-report: children's prospective memory and planning abilities improved with age, but episodic foresight, saving behavior, and delay of gratification did not differ between 2- and 3-year-old children. Moreover, 2-year-olds' episodic foresight, saving behavior, and delay of gratification scores were higher than their prospective memory and planning scores. Two-year-old children might show earlier competence in these abilities compared to planning and prospective memory, and they may undergo a marked improvement later in development (e.g., during the preschool years; Atance & Jackson, 2009).

On the other hand, the planning and prospective memory domains increased between 2 and 3 years of age. These abilities were also rated with lower scores in 2-year-olds compared to the other future-oriented abilities. Thus, the emergence of these abilities might be protracted compared to other future-oriented abilities. One reason for this delayed emergence could be children's developing cognitive abilities. Both planning and prospective memory require complex cognitive abilities. For example, to successfully plan, children need to hold information about different actions and execute them in a specific order. To successfully engage in prospective memory, children need to recall and execute their future intentions at the appropriate time. Children may need to first demonstrate matured EF skills, memory capacity, and temporal representation skills to engage in prospective memory and planning (e.g., McCormack & Atance, 2011). Thus, parents of 2-year-old children may have reported greater amounts of missing data in these domains, and their children had lower scores in these domains than 3-year-olds. Past research has also shown floor-level performance of young children in these domains. For example, 2-year-old children failed to engage in prospective memory in a lab-based behavioral task because of their limitations in retrospective memory (e.g., Kliegel & Jäger, 2007). Also, 2-year-olds only successfully planned when the goal state information was provided for them (Bauer et al., 1999). These findings may suggest that prospective memory and planning might be a later emerging future-oriented cognitive abilities because of higher reliance on more complex cognitive abilities.

Nevertheless, 2-year-olds' poor prospective memory and planning might not only be related to their developing cognitive abilities. Parents mostly rely on their child's verbal output to keep track of their success or failure in prospective memory and planning. For example, parents may not know whether their child forgot to remember an intention (prospective memory) or execute a plan (planning) unless the child expresses it verbally. However, parents may observe their child's performance in other future thinking domains without depending on any verbalization from their child. For example, a child putting money in the piggy bank (saving), waiting patiently for snack time to have a cookie (delay of gratification), or taking an umbrella to school on a cloudy day (episodic foresight) are signs of future-oriented thinking skills that do not require any verbal output from a child. Therefore, parents may have struggled to report on their child's prospective memory and planning skills even though their child may demonstrate these skills in everyday life, which might explain the greater amount of missing in these domains and age-related improvement only in these two domains.

Additionally, the items assessing prospective memory and planning abilities might be less appropriate for 2-year-old children. In the CFTQ, parents were asked to report to what extent their child plans/remember important tasks (e.g., "*Remembers what time he/she is supposed to be places*" or "*Involves him/herself in the planning of his/her personal space*"). However, parents of a 2-year-old might not ask their child to do such tasks or might do it for them. Young children might be asked to practice their prospective memory and planning in simpler tasks. For example, Sommerville et al. (1983) instructed parents of 2- to 4-year-old children to ask their children to remind them to do simple everyday tasks (e.g., "*remind me to get milk at the store.*"). Children in all age groups were successful in this naturalistic design, and further, 2-year-olds' success rate increased up to 80% if the task was of high interest (e.g., reminding parents to buy candy). Thus, naturalistic studies with more age-appropriate questionnaire items may allow us to explore whether young children's poor prospective memory and planning were related to the specific questionnaire items or their lack of ability in the domain.

Overall, our study showed two developmental trajectories for future-oriented abilities in early childhood: (a) an early competence-stable trend; and (b) a later competence-increasing trend. Saving, episodic foresight, and delay of gratification showed an early-competence-stable trend as parents of young children reported higher ratings for their children in these domains but these scores did not differ between 2 and 3 years of age. On the other hand, prospective memory and planning show a later competence-increasing trend. Parents of young children reported lower scores in these domains compared to saving, episodic foresight, and delay of gratification, but their scores increased with age.

Cognitive and language abilities supporting future-oriented cognition

Another important contribution of the study was the investigation of cognitive and language abilities underlying future-oriented cognition in early childhood. The study assessed 2- and 3-year olds' cognitive (i.e., EF, episodic memory, and self-concept) and language abilities (i.e., expressive vocabulary, temporal word use, time metaphor use, and parent-child daily talk) via parent reports. We found that only episodic memory, parent-child daily talk, and time metaphor use predicted 2- to 3-year-old children's future-oriented cognition. Moreover, the predictive effects of episodic memory and time metaphor use were significant for every future-oriented ability. However, there was no predictive effect of EF or self-concept. This might be unexpected considering the theoretical role of self-concept (e.g., Suddendorf & Corballis, 2007) and self-regulation (e.g., Atance & Jackson, 2009) in future thinking. However, a growing number of studies have revealed no relations between future-oriented abilities, EF, and theory of mind (an ability related to self-concept) in young children (e.g., Atance et al., 2017; Hanson et al., 2014). In early childhood, future-oriented abilities may rely on children's language development and episodic memory instead of their self-concept and EF.

The role of episodic memory

The constructive episodic simulation hypothesis holds that episodic memory is responsible for retrieving past events and constructing future events (Schacter & Addis, 2007). Indeed, previous research revealed a close link between young children's episodic foresight and episodic memory (e.g., Hayne et al., 2011). However, less research has been conducted on the relation between episodic memory and other future-oriented abilities, such as saving behavior. The present study showed a key role of episodic memory in the emergence of future-oriented abilities. Episodic memory might be a prerequisite for these future-oriented abilities, and children's developing episodic memory may allow them to think of themselves in future scenarios and engage in future-oriented behaviors. Past research also showed a facilitative effect of episodic memory on young children's future-oriented decisions. For example, Metcalf and Atance (2011) found that 3- to 5-year-old children increased their savings when they had a chance to play the saving game again, suggesting that young children may draw on their recent past episodic experience (i.e., the first attempt in the game) while deciding to save/spend in their second attempt.

The role of parent-child daily talk

Parent-child daily talk predicted children's future-oriented cognition, indicating that children who engaged in conversations about past and future events with their parents frequently in their daily talk may develop better future-thinking skills compared to other children. This finding aligns with previous research showing a positive link between children's daily talk and their future-thinking (Benson, 1994; Hudson, 2006). Further, we found that parent-child talk only predicted parents' ratings in the prospective memory and planning subscales but not the delay of gratification, saving behavior, and episodic foresight subscales. Although this result further suggests a differentiating role of daily talk in future-thinking skills, the parent-report-based design of the study may have driven this relation. As discussed above, parents may rely on their child's verbal expression when rating their prospective memory and planning. Children who engage in more daily talk with their parents more often may have provided more data for their parents to reflect on their future-thinking skills. Therefore, parent-child talk was a significant predictor of prospective memory and planning, but not other future-oriented abilities.

The role of time metaphor use

Time metaphor use predicted 2- to 3-year-old children's future-oriented abilities. To our knowledge, the present study was the first study to assess young children's time metaphor use. We measured children's time metaphor use based on the production of special events, routines, and phrases in their daily talk. The scale showed high internal consistency and was positively correlated with other language abilities (i.e., expressive vocabulary, parent-child talk, and temporal word use). Thus, the time metaphor scale seemed to be a reliable method to capture children's metaphor use in their daily language.

Two- to 3-year-old children's time metaphor use explained individual differences in their future-oriented abilities even after controlling for other cognitive and language abilities. Time metaphor use might represent children's flexibility in future talk. Using various phrases to refer to a specific timeframe (e.g., "tomorrow," "when I wake up," or "school time") may show children's competency in future-oriented conversations. These children might also express their future-oriented knowledge better in their everyday lives, leading parents to give them higher scores on the CFTQ. Therefore, the role of time metaphor use in future-oriented cognition may support the expression account, which holds that language abilities facilitate children's expression of future-oriented behaviors. Also, children's time metaphor use might show sophistication in temporal sequencing rather than just the production of temporal terms. For example, when children produce the term "after school" instead of "tomorrow," they can describe the event relative to other events in an extended timeline. Thus, children who frequently used time metaphors may also have greater temporal understanding and knowledge, which may support children in developing future-oriented abilities (the emergence account). If this was the case, we would also expect to find a link between children's temporal word use and future thinking as well. However, children's temporal word use was still not a predictor even after excluding time metaphor use. Children's expressive vocabulary had a small predictive effect on future-oriented cognition, supporting the expression account that frequent time metaphor use and better expressive vocabulary might predict children's better expression of future events.

Limitations and future directions

The current study has some limitations. First, no behavioral data were collected for the current study due to the limitations of the COVID-19 pandemic. Thus, our analysis relied only on parents as informants. Although the scales used in the study were reliable and valid measures (e.g., Gioia et al., 2003; Mazachowsky & Mahy, 2020), future studies may test the relations using behavioral measures in addition to parent-report.

Second, children were born between 2017 to 2019; thus, children had different exposure levels to the COVID-19 pandemic. Younger children of the sample were newborns, whereas older children were around 1-year-old when lockdowns occurred in the United States. Individual variance in the exposure level to the pandemic and restrictions might have impacted the results as the closure of child-care facilities and limited social interactions likely influenced children's cognitive and language development.

Also, the present study examined different facets of language development in relation to the emergence of future-oriented cognition. Our interest was expressive vocabulary, parent-child talk, temporal word use, and time metaphor use. Future studies might explore different facets that explain variance in future-oriented cognition (e.g., receptive language; Atance & Jackson, 2009). More importantly, despite the extensive research on children's vocabulary skills and their production of temporal words, we showed that children's production of time metaphors might also be essential in driving children's future thinking. Future studies may consider assessing children's metaphor use in more naturalistic settings such as in everyday life parent-child talk. Indeed, Hudson (2006) recorded and coded children's daily talk at home and was able to analyze different aspects of this talk (e.g., temporal frame of reference or contextual statements). A similar method might be adopted in future studies to explore children's time metaphor use and its role in future-oriented cognition in greater detail (e.g., the expression vs. emergence accounts).

Conclusion

In sum, the current study found that 2- to 3-year-old children demonstrate future-oriented behaviors in their everyday lives. However, saving, episodic foresight, and delay of gratification seem to show earlier competence than planning and prospective memory, but 2- and 3-year-old children did not differ in these abilities. On the other hand, prospective memory and planning seem to show a protracted emergence in toddlerhood, but these abilities showed an age-related improvement, suggesting that a marked development might be observed in these abilities during toddlerhood years. Further, episodic memory and time metaphor use have independent roles in the emergence of future-oriented cognition. Future studies should continue to explore developing future-oriented cognition in young children and its relation to cognitive and language abilities to better understand how these abilities emerge and how their development can be fostered during the early years.

Disclosure statement

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Data availability

The data that support the findings of this study are openly available at the Open Science Framework at https://osf.io/cgajy

Open Scholarship

This article has earned the Center for Open Science badge for Preregistered. The materials are openly accessible at https://osf.io/cgajy.

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