Journal of Experimental Child Psychology 246 (2024) 105966

Contents lists available at ScienceDirect

Journal of Experimental Child Psychology

journal homepage: www.elsevier.com/locate/jecp

Imagining the future improves saving in preschoolers

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ARTICLE INFO

Article history:
Received 2 December 2023
Revised 24 April 2024

Keywords:
Self-control
Future episodic thinking
Imagination
Saving
Decision making
Anticipated emotion

ABSTRACT

Preschoolers are notoriously poor at delaying gratification and saving limited resources, yet evidence-based methods of improving these behaviors are lacking. Using the marble game saving paradigm, we examined whether young children's saving behavior would increase as a result of engaging in future-oriented imagination using a storyboard. Participants were 115 typically developing 4-year-olds from a midwestern U.S. metropolitan area (M_{age} = 53.48 months, *SD* = 4.14, range = 47–60; 54.8% female; 84.5% White; 7.3% Hispanic/Latino ethnicity; median annual household income = $150,000–$174,999). Children were randomly assigned to one of four storyboard conditions prior to the marble game: Positive Future Simulation, Negative Future Simulation, Positive Routine, or Negative Routine. In each condition, children were asked to imagine how they would feel in the future situation using a smiley face rating scale. Results showed that children were significantly more likely to save (and to save more marbles) in the experimental conditions compared with the control conditions (medium effect sizes). Moreover, imagining saving for the future (and how good that would feel) was more effective at increasing saving behaviors than imagining not saving (and how bad that would feel). Emotion ratings were consistent with the assigned condition, but positive emotion alone did not account for these effects. Results held after accounting for game order and verbal IQ. Implications of temporal psychological distancing and emotion anticipation for children's future-oriented decision making are discussed.

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https://doi.org/10.1016/j.jecp.2024.105966

Introduction

It is argued that the ability to think about the future is one of the most powerful human capacities (Suddendorf et al., 2022). From the earliest years of preschool, children show an emerging ability to contemplate their future selves. They can make choices in the present that will allow them to solve a future problem (Suddendorf et al., 2011), they can talk about things that will happen in the future (e.g., Busby & Suddendorf, 2005), and they can make plans for the future (e.g., Payne et al., 2015), although their predictions about their future are sometimes inaccurate (e.g., predicting their adult selves would prefer juice boxes over coffee; Bélanger et al., 2014). Exploring these future-thinking abilities is a worthy endeavor because they signify the shift from merely responding to immediate circumstances to proactively adapting actions in consideration of one's future self.

Aspects of future-oriented behaviors such as the ability to delay gratification, often referred to as future-oriented self-control (Mischel et al., 1989), has been a subject of extensive research, particularly in young children. Children's ability to hold off the immediate consumption of rewards in exchange for larger future rewards likely draws on their self-control and executive function skills. Self-control refers to the ability to manage one's impulses, emotions, and behaviors to achieve long-term goals. It is relevant in many areas of life, including school, the workplace, and relationships. Self-control is an important aspect of executive function (EF), which includes neurocognitive skills such as remembering goals, controlling impulses, and thinking flexibly (Miyake et al., 2000). EF is positively correlated with intelligence and socioeconomic status (SES), yet children's EF has been linked to myriad long-term outcomes even after controlling for childhood IQ and SES, including greater physical health and wealth and a lower probability of divorce, drug abuse, and criminal conviction (Koepp et al., 2023; Moffitt et al., 2011). EF is likely to contribute to such outcomes because people make poor decisions when momentary impulses overpower their longer-term goals. EF development is protracted, and young children are notoriously poor at making prudent and virtuous decisions such as delaying gratification (Carlson et al., 2013). A classic delay of gratification (DoG) task using a delayed choice asks children to choose between a small, immediate reward or a larger delayed reward across a series of trials. Children's preference for delayed rewards tends to increase with age. For example, Lemmon and Moore (2007) reported that 3-year-olds preferred to wait for the larger later rewards 24% of the time, whereas 4-year-olds chose the delayed reward 48% of the time.

Another important aspect of future-oriented decision making is saving. Although similar to delay of gratification, saving is a distinct construct that involves forgoing immediate spending of limited resources in favor of a more enjoyable expenditure in the future. Surprisingly, empirical research fails to find consistent correlations between children's performance on saving tasks and children's EF and/or delay of gratification (see Atance et al., 2017; Kamawar et al., 2019; Lee & Carlson, 2015; Tsui & Atance, 2023). Thus, it is informative to study the development of saving in and of itself during childhood.

Saving is considered a wise and virtuous behavior, but one that is challenging even for adults (Vohs & Faber, 2007). Sonuga-Barke and Webley (1993) pioneered the study of saving behavior in children. Children aged 4 to 12 years played a board game where their goal was to save enough tokens to exchange for a toy. Whenever they passed a "robber" or a "sweet shop," they had the chance to put some tokens in the bank to avoid them being stolen or spent. Findings showed that the number of times children put tokens in the bank increased with age. Another study using the same approach found that children used different saving strategies depending on age; younger children (6 years) tended to spend in the beginning and then stop spending in an effort to save for the toy, whereas older children (9 and 12 years) tended to save at first and then spend toward the end when they had more than enough tokens to win the toy (Otto et al., 2006).

Few studies have explored saving behaviors in young children. The preschool years involve rapid growth in children's future thinking capacity and ability to delay gratification, which suggests that this developmental period may be particularly important for exploring emerging saving tendencies. In a seminal study, Metcalf and Atance (2011) used marble games to probe children's saving behavior. In this paradigm, 3-, 4-, and 5-year-olds were given three marbles and told that they would spend 3 min in each of two rooms. The first room contained a small marble game, and the second room contained a bigger, more attractive marble game. The games were specially designed such that marbles could not be retrieved once they were put down a chute (i.e., each marble could be used only once). Of interest was whether children saved any marbles for use in the bigger game. Results revealed that the rate of saving was low overall (only 39% of children saved one or more marbles), and older children did not save more marbles than younger children. Similar results were reported by Lee and Carlson (2015), who used the same procedure with 3-year-old children and found that only 26% saved at least one marble.

Given that preschoolers are so poor at saving for the future, it begs the question of what can bolster their ability to consider the future and lead them to make more prudent decisions. Strategies to improve saving behavior using the marble paradigm have been explored. Atance et al. (2017) found that simply prompting preschoolers with a choice ("You can use all of your marbles in the small marble game, or you can save some marbles for the big marble game") led them to save more marbles (M = 1.6 of 5) than children in the spontaneous condition (M = 0.67), and saving improved significantly with age. Planning ahead for their future actions also could help children to perform better on the saving task. Kamawar et al. (2019) found that 3- to 6-year-olds who used two bowls to budget their marbles before the game saved significantly more marbles than those in a control group who received the standard procedure. Within the budgeting group, the number of marbles saved was positively correlated with children's ability to plan ahead. It appears that budgeting allowed children to create and follow an explicit plan.

Research has also suggested that psychological distance—taking a mental step back from the exigencies of the current situation—helps young children to be more reflective and perform better on similar measures. For example, Prencipe and Zelazo (2004) reported that 3-year-old children were likely to suggest that the experimenter should wait for a larger delayed reward even while they themselves chose the smaller immediate reward. In subsequent research, psychological distancing was induced by having children use their own name (third person) or pretend to be someone else (e.g., Batman) while performing EF and emotion regulation tasks. The "Batman Effect" has been shown to improve cognitive flexibility (White & Carlson, 2016), to increase persistence in the face of distraction (White et al., 2017), and, among low-EF children, to regulate frustration when they could not find the key to open a prize box (Grenell et al., 2018). Together, these findings support the Vygotskian notion that children are "a head taller" in pretense by gaining psychological distance on a challenging task (Carlson & White, 2013). Jerome et al. (2023) further explored the extent to which budgeting and psychological distancing relate to 3- to 5-year-old children's saving of tokens for preferred prizes. When placed in either a self-budgeting or psychologically distanced budgeting (budgeting for another) condition, they showed more saving behavior compared with the control group, with no difference between the two budgeting conditions. The authors speculated that budgeting alone might be sufficient in this case and that the combined benefits of budgeting and psychological distancing might not be additive.

Whereas the Batman Effect refers to social distancing (adopting a less personal perspective), the verbal prompt and self-budgeting interventions mentioned above indirectly involve creating psychological distance from the present self and thinking about what one might do in the future, referred to as temporal distancing or mental time travel. The degree to which a person sees the current self as being connected to the future self is important in the context of saving behavior (Macrae et al., 2017). There is a robust adult literature showing that when people think about the future, they make more adaptive decisions than they would otherwise (e.g., Seligman et al., 2013). Bulley et al. (2016) outlined how imagining the future enhances intertemporal choice (e.g., taking $20 now or waiting a week to receive $100) by focusing on the long-term implications of one's decisions. When adults feel connected to their future selves, their actual savings tend to be greater (Ersner-Hershfield et al., 2009). Furthermore, when the future self was made more salient through experimental manipulation, such as having adults interact with a computer-generated image of themselves later in life (i.e., in their late 60 s), participants tended to allocate more money to a (fictitious) retirement savings account (Ersner-Hershfield et al., 2011). Consonant with these findings, at the neural level, imagining future outcomes increases activation in prefrontal–mediotemporal networks known to be essential for EF (Peters & Büchel, 2010). Thus, by making the future self more salient than one's current self, people adopt a more expansive construal of the situation at hand and tend to make more future-oriented decisions (Trope & Liberman, 2010).

This evidence is further supported by research on psychological distance more generally, which contends that it improves self-control by decreasing the salience of momentary distractions and increasing attention toward distal considerations such as goals (White et al., 2020; Fujita et al., 2006; Mischel & Rodriguez, 1993). By increasing perceived distance, children are better able to resist impulsive responses and maximize rewards. As a form of psychological distance, mental time travel might "cool down" the motivational demands of EF measures involving rewards, making it easier for children to make choices that benefit their future (Metcalfe & Mischel, 1999).

Research on temporal psychological distance in children is scarce. One study with overweight/obese children aged 9 to 14 years found that imagining their future selves (e.g., "In 2 weeks, I will be celebrating my birthday") increased delayed gratification for a monetary reward (Daniel et al., 2015). With respect to saving, another study found that priming 8- to 11-year-olds with videos related to a future perspective (encouraging them to think about what they would need to do to achieve their goals with real-life illustrations) resulted in children saving more money compared with those in the present perspective group (encouraging them to enjoy life right now) and the control group (videos of unrelated content) (Trzcińska et al., 2022). In both studies, the future self was primed but unrelated to the specific decision to delay or save. They also involved older children, which leaves open the question of whether future self reminders benefit delayed gratification among preschool children.

A few studies have explored the relation between episodic future thinking and future-oriented decision making. One study found that children's episodic future thinking ability was positively correlated with performance on a delayed choice task (Burns et al., 2021). However, when children were induced to engage in incidental episodic future thinking (such as what they would do tomorrow morning) before the delayed choice tasks, their performance actually worsened significantly compared with those in the control condition. This seemingly paradoxical finding, in our view, suggests the importance of task-relevant reflection for effective future simulation, at least in young children who might need additional scaffolding compared with older children. By preoccupying children with thoughts of unrelated future events, the manipulation might have distracted children from the current task and prevented them from reflecting deeply on their future selves in the context of the task. Two other studies on future thinking and DoG used similar methods of engaging in incidental episodic future thinking, and neither study found a significant effect (Chernyak et al., 2017; Leech et al., 2019). Canning et al. (2023) conducted a study in which children, in the context of DoG, were cued to imagine spending the larger delayed reward, cued to visiting a place, or received no cueing. They found that children in the Imagine Place group showed significantly fewer delayed choices than the other two groups, which did not differ from each other. This study adds to our understanding of episodic future cueing on decision making, suggesting that reward-related future cueing alone might not be effective at motivating behavior. With preschool children, it might be important to scaffold them through the pathway to future rewards, enabling them to establish a connection between their choices and future outcomes.

Given the well-established importance of EF and saving, supporting mental time travel in children could have widespread and substantial consequences. Lacking, however, is a method for inducing future simulation in young children and assessing its effect on saving. This gap may impede development of relevant and effective means of supporting EF during children's early years, when habits of mind are formed. Hence, the current study aimed to identify the promise of mental time travel as a strategy to improve saving in the context of affective decision making among 4-year-olds. Based on evidence in adults, the central hypothesis was that scaffolding children to imagine future outcomes would improve saving by reducing the pull of the present moment and highlighting the future.

Unlike previous studies on this topic with preschoolers, we also considered the role of emotion. A possible mechanism underlying the benefits of mental time travel is that anticipating future outcomes triggers a simulation of emotions likely to accompany that future state such as feeling good about receiving $100 as opposed to $20. Baumeister et al., (2007,2016) contended that as people learn to anticipate the consequences of their decisions, they alter their behavior to pursue the feelings they like, such as feeling happy, and avoid those they dislike, such as feeling sad or regretful. Although 4-year-olds are just beginning to reliably plan for the future (Atance, 2008), they might commonly fail to spontaneously simulate the future, specifically how they will feel in the future if they make certain decisions in the present. Based on existing research with adults, it is possible that if children were prompted explicitly to imagine how they would feel if they made one choice versus another, their decision making would improve.

We sought to investigate these possibilities using the saving paradigm of Metcalf and Atance (2011) to assess 4-year-old children's saving behavior. To help children imagine their future selves with a focus on anticipated emotions following their decisions, we modified priming methods used in previous research with young children. Research has shown that implicit priming was surprisingly more effective at influencing children's decisions to delay gratification than explicit instructions; preschool children were more likely to mirror the choice made by a peer protagonist in a story they heard rather than follow explicit instructions given by an adult (Kesek et al., 2011). Similarly, a storyboard has been proven successful at priming preschool children to think in a "pretend" frame of mind, which then improved 3-year-old children's performance on the Less-Is-More EF task (White & Carlson, 2021). The storyboard in the current study was lined with felt where children could "play out" the future of their options to save or not save marbles for the big marble game. Children in the simulated saving condition were encouraged to think they would feel happy for saving a marble, whereas those in the simulated nonsaving condition were encouraged to think they would feel sad for not saving any marbles. This method allowed us to explore the role of anticipated emotion in future simulation.

In addition, we included two control conditions in which children were instructed to imagine their bedtime routines. One condition was biased toward a positive consequence ("Imagine your parent reads you your favorite story before bed"), and the other was biased toward a negative consequence ("Imagine you really want to listen to another story, but your parent says no"). Control conditions were similar to the experimental conditions in that all of them involved imagination about a future real-world event and pretense, and all conditions were comparable in terms of interaction length and number of prompts. They differed in that the experimental conditions involved task-relevant future simulation, whereas the control conditions did not. The purpose of including both positive and negative control conditions was to rule out the effect of emotion alone on children's saving behavior.

We hypothesized that children in the future simulation conditions would be more likely to save than children in the control conditions due to temporal distancing that was specifically relevant to the upcoming task. We also explored whether positive or negative future simulation would be more effective. Evidence from adult research has shown that people tend to be positively biased when imagining their future (Newby-Clark & Ross, 2003), and such positive future anticipation could be beneficial for economic decision making (Idson et al., 2004). Similarly, children might find it easier to engage in positive simulations about their future, which helps them to better reflect on future emotions and consequences of their actions. Evidence from neuroscience also suggests that the "feel good" neurotransmitter dopamine is associated with decision making. Suppressed dopamine activity leads to poor emotion-based decision making characterized by shortsightedness, and thus difficulties resisting short-term rewards, despite long-term negative consequences (Sevy et al., 2006).

On the other hand, a body of research also supports a bias to attend to negative information (for review, see Baumeister et al., 2001). From a developmental perspective, when children are raised in environments where positive emotions and interactions are prevalent, occasional negative information would capture their attention (Vaish et al., 2008). Research on children's compliance also notes that "Don't" instructions (e.g., not to touch attractive toys placed on a low shelf) elicit more compliance from children (15–45 months) than "Do" instructions (e.g., asking the child to clean up toys) (Kochanska et al., 2003). It is possible that directing a child to perform a task requires the child to coordinate more behavioral elements compared with simply restraining from an activity (Thelen & Urich, 1991). Considering the competing evidence, our goal was to explore the most effective method of motivating future-oriented decision making by examining children's savings behaviors in the context of visualizing the positive feelings associated with saving versus the negative feelings connected to not saving.

We also collected measures of other cognitive abilities that develop during the preschool years, including EF, theory of mind, verbal IQ, and future episodic thinking. These skills have been documented to be relevant to self-control and saving in the developmental literature (Atance et al., 2017; Lee & Carlson, 2015) and thus potentially were necessary to consider in our analyses. We hypothesized that our experimental manipulation effects would hold over and above these covariates.

Methods

Participants

Typically developing 4-year-old children were recruited from April 2022 to December 2022 from a large midwestern U.S. city using a university-affiliated early childhood education center and a database of families interested in research. Screening criteria included full-term birth, English speaking, and the absence of serious medical conditions and developmental disorders (9 children were excluded). The final sample consisted of 115 4-year-old children (M = 53.48 months, SD = 4.14, range = 47–60; 54.8% female). Six parents did not complete the Family Information Questionnaire. According to parent reports of ethnicity, 7.3% identified as Hispanic/Latino (1 unreported). Regarding race, 84.5% of children were White, 4.6% White and Black/African American, 2.7% Asian, 5.5% were White and Asian, 0.9% Black/African American, 0.9% Native American/Alaskan and Asian, and 0.9% other/Mexican (1 unreported). All children were English speakers, and 12 children were also bilingual. Most families (96.4%) were two-caregiver households and 91.8% of primary caregivers reported attaining a bachelor's degree or higher (5 unreported). Median household income was $150,000 to $174,999 per year, with the modal income being $200,000 per year (2 unreported).

Procedure

Children were tested individually in a laboratory setting by two experimenters. Participants were randomly assigned to one of four conditions in a 2 (Content of Imagination: marble task or bedtime routine) × 2 (Emotional Valence: positive or negative) design. Children also completed a battery of cognitive tasks. Experimental manipulations were administered either prior to (n = 64) or after (n = 51) the administration of other tasks. Sessions were videotaped and lasted 40 min. Institutional review board approval was granted by the University of Minnesota.

Measures

Marble saving game

Two marble games differing in desirability were used to assess children's saving behavior (adapted from Metcalf & Atance, 2011). Children were brought to a research suite by Experimenter A and Experimenter B. Experimenter A showed children a small marble game consisting of one chute into which marbles could be dropped. She demonstrated that once she put a marble down the chute, the marble would be caught in an unremovable box at the end and could not be used again. Children were then brought into a second room with a bigger, more desirable marble game consisting of four chutes and were told the same rule. Then they returned to the first marble game room and were told they would stay there for 3 min and then go to the second room for another 3 min. Experimenter A showed children a clear bag with three marbles inside and told them that they could play with these marbles in the two games and that there were no other marbles available.

To ensure comprehension of the game rule, Experimenter A asked children to say or point to the game they were going to play first and second. Children were told the game sequence again if they did not answer or point correctly. Experimenter A then reminded children of the key rules in the game: "Remember, you only get three marbles today to use for *all* your marble games. So, you can use some marbles now for the small game. You can also save some marbles for later for the big game. But remember, once you put a marble down the hole, you can't use it again." Each marble game was then covered with a bedsheet. Experimenter A announced that she would leave the room to do some work, asking the participants to stay with Experimenter B for the subsequent storyboard activity.

Experimenter B entered the room with a felt storyboard, with the blank side of the board facing outward so that Experimenter A would remain blind to the condition. Children were randomly assigned to one of four storyboard conditions. In Positive Future Simulation, Experimenter B showed children felt images of a small marble game and a big marble game on the board as well as three felt marble cutouts: ‘‘On this board, we have the small marble game and the big marble game, just like the ones [Experimenter A] showed you. And let's pretend these are the marbles you will be using later in the game. Let's imagine you will use two marbles in the small marble game.'' She handed two felt marbles to the children and suggested that they place them on the small marble game image. She then asked, ‘‘Then how many marbles will you have to play in the big marble game?'' She corrected children if needed and then handed the felt marble to them and suggested that they put it on the big marble game image.

Experimenter B then asked, ‘‘How would you feel if you saved one marble to play in the big marble game? I think you would feel pretty happy, wouldn't you?'' She then placed a felt happy face and a felt sad face in front of the children, asking them whether they would feel happy or sad. Based on children's selection, she then placed a mildly happy face and a very happy face (or a mildly sad face and a very sad face) in front of the children asking whether they would be very happy (sad) or a little bit happy (sad), thereby yielding responses on a 4-point scale (1 = *very sad,* 4 = *very happy*). After children made their selection, Experimenter B suggested that they put the corresponding face cutout on the storyboard next to the big marble game. The goal of the emotion manipulation was to nudge children into imagining themselves as being happy for saving a marble for the future, but children were not corrected if their indicated emotion was different from the target emotion.

The Negative Future Simulation condition was identical, but instead of being prompted to imagine saving a marble for the big marble game, children were asked to imagine *not* saving for the future: ‘‘On this board, we have the small marble game and the big marble game, just like the ones [Experimenter A] showed you. And let's pretend these are the marbles you will be using later in the game. Let's imagine you will use all three marbles in the small marble game.'' Experimenter B handed three felt marbles to the children and suggested that they place them on the small marble game image. She then asked, ‘‘Then how many marbles will you have to play in the big marble game?'' She corrected children if the answer was not 0 by saying, ‘‘You will actually have no marbles to play in the big marble game.'' Experimenter B then asked, ‘‘How would you feel if you didn't save any marbles to play in the big marble game? I think you would feel pretty sad, wouldn't you?'' She then proceeded with the emotion rating scale as described above and suggested that the children put the selected face cutout on the storyboard next to the big marble game.

In the Positive Routine control condition, children were prompted to think about daily bedtime routines. A felt cutout of a child sleeping in a bed was placed on the storyboard, and three bedtime activity felt cutouts (brushing teeth, taking a bath, and storybook) were placed in front of the children. Children were asked to imagine that every night before bed, they brush their teeth first and take a bath second, and then their parent reads them their favorite bedtime story. They were encouraged to place the corresponding cutout as they were imagining the routine. Experimenter B then asked, ‘‘How would you feel if you got to listen to your favorite story before bed? I think you would feel pretty happy, wouldn't you?'' Children were then asked to select their emotions related to the imagined scenario, as in the simulation conditions.

In the Negative Routine control condition, children were also prompted to think about daily bedtime routines, but then to imagine their parent rejecting their request for more stories: ‘‘Imagine that your mom/dad [the parent who brought the children to the study] reads you your favorite story, you really want to listen to another story, but you can't, you have to go to bed now.'' Children were then asked, ‘‘How would you feel if you couldn't listen to more stories before bed? I think you would feel pretty sad, wouldn't you?'' Children were then asked to select their emotions related to the imagined scenarios, similar to the other conditions.

After the storyboard activity, Experimenter B exited the room (again with the blank side of the board facing out) and Experimenter A entered. She handed children the bag of marbles and told them they could play with the small marble game until the timer rang. A timer was set to 3 min. Experimenter A put on headphones and sat in a corner, pretending to do work while the children played with the marble game. After the timer went off, Experimenter A asked the children which game they would play next. Children were affirmed for answering the big marble game and corrected if they answered incorrectly. Children were escorted to the room with the big marble game and were invited to play until the timer rang while Experimenter A ostensibly worked in the corner with headphones on. If children attempted to talk to Experimenter A, she gently directed their attention back to the game by making neutral statements such as, ''Remember, I have some work to do now.''

When the timer rang, Experimenter A pretended to look for more marbles and found three more marbles in her pocket to her feigned surprise. All children were given the extra marbles to play at the end of the game regardless of their saving behavior. The main dependent variables of interest were whether children saved at all (scored as 0 or 1) and the number of marbles saved (0–3). A subset (30%) of the participants' videos were independently coded by a blinded research assistant, and no discrepancies were found on the main dependent variables.

Cognitive measures

Either before or after the marble game, children were administered a series of cognitive tasks by Experimenter B in the following order.

Short-term and working memory. We used Forward and Backward Word Span (Carlson et al., 2002) to measure children's short-term and working memory. In the Forward Word Span task, children were asked to repeat a list of single-syllable, non-semantically related words. Ernie (a puppet) demonstrated saying the words followed by a practice trial (corrected if necessary) and then the test trials. List size increased (two, three, four, and five words) with each successful trial. Backward Word Span was administered after the Forward Word Span task, keeping all procedures the same except asking children to repeat a list of words in reverse order. Scores were recorded as the highest number of words children could repeat successfully in each order (1, 2, 3, 4, or 5, where 1 denotes failure to repeat two words).

Executive function. Children's overall EF skills were assessed using the Minnesota Executive Function Scale (MEFS; Carlson & Zelazo, 2014), which has been validated for use with preschool children. In this touchscreen tablet task, children see two virtual boxes labeled with different images. They sort cards into boxes based on conflicting rules related to the size, color, or shape of the images. The task comprises seven increasingly challenging levels, with the starting point depending on age (Level 4 in this case), from which children move up or down to determine the highest level they can successfully complete. Total scores, which incorporate accuracy and reaction time, were used for analysis (possible range = 0–100).

Theory of mind. Children's understanding of mental states was assessed using the Contents False Belief task, following the procedure of Carlson et al. (2002). Children were shown a crayon box and asked what they thought was inside. After discovering the box actually contained Band-Aids, the lid was closed and children were asked about their own former false belief: ''When you first saw this box, before you opened it, what did you think was inside, crayons or Band-Aids?'' Next, they were told that Ernie (a puppet) had never looked inside the box before and were asked, ''What does Ernie think is inside, crayons or Band-Aids?'' Finally, they were asked the reality control question, ''What is really inside the box, crayons or Band-Aids?'' If the control question was not answered correctly, they received a score of 0. Hence, scores could range from 0 to 2.

Future thinking. Children's future episodic thinking was measured through the Future Preference Task (adapted from Bélanger et al., 2014). Children were presented with five trials regarding their future preferences. Each trial featured two identical exemplars of a child-preferable item and two identical exemplars of an adult-preferable item, including drinks (juice boxes and coffee cups), games (Play-Doh containers and crossword puzzles), television shows (cartoon shows and cooking videos), leisure activities (sticker books and magazines), and writing utensils (crayons and fountain pens). At the beginning of the task, children were asked, ''Right now, you're 4 years old. But one day, you're going to be all grown up. You're going to be as big as your daddy/mommy. I'm going to show you some things, and I want you to tell me the things you will like best when you're all grown up.'' Exemplars were photos printed in a booklet, and the adult/child item positions were alternated across trials. Children received points for selecting the adult-preferred items; scores could range from 0 to 5.

Verbal IQ. The Stanford–Binet Verbal Knowledge routing subtest was administered to provide an estimate of verbal intelligence (Roid, 2003). Children were shown figurines and pictures and were read words. Then, they were asked to name or describe what they saw or heard. Prescribed stopping rules were followed, and standardized scores were calculated based on age and the number of questions answered correctly.

While children were playing in the testing suite, parents were asked to wait in the seating area to complete a brief Family Information Questionnaire, which included basic demographic information about the children and their families.

Results

Descriptive and Preliminary Analyses

An alpha level of.05 was used for all statistical analyses. No statistical differences were found between children recruited through the university child care center ($n = 52$) and the participant database ($n = 63$) concerning any cognitive measures; therefore, the groups were combined. Three children did not complete the cognitive tasks due to scheduling issues. Of those who completed, four children did not complete the MEFS due to experimenter error ($n = 3$) or noncooperation ($n = 1$); One child did not complete Forward Word Span and one child did not complete Backward Word Span due to experimenter error. Descriptive statistics are shown in Table 1. One-way analyses of variance (ANOVAs) indicated no significant differences across experimental conditions in age, gender, race, family income, and cognitive measures, suggesting that random assignment created reasonably similar groups.

Table 2 shows zero-order correlations between key variables. Notably, game order was significantly correlated with both being a saver and the number of marbles saved; children who played the marble games before the cognitive activities were more likely to be savers and saved more marbles on average. In addition, verbal IQ was marginally positively correlated with both saving measures (number of marbles saved: $p = .09$; saver vs. spender: $p = .08$). Although the cognitive measures were related to one another in largely expected ways, only game order and verbal IQ (marginal) were related to saving behavior and thus were covaried in the main analyses.

Manipulation Check

To check whether our study manipulations were effective at eliciting the desired emotions, we conducted a series of *t* tests on the emotion rating (1–4, with 4 being the happiest) between groups of different valences (Fig. 1). Participants in the Positive Future Simulation condition reported significantly higher emotion ratings ($M = 3.53$, $SD = 0.82$) compared with participants in the Negative Future Simulation condition ($M = 1.71$, $SD = 1.12$), $t(56) = 7.1$, $p < .001$, Cohen's $d = 1.87$, and in the Negative Routine condition ($M = 2.19$, $SD = 1.27$), $t(47.6) = 4.81$, $p < .001$, Cohen's $d = 1.26$. Participants in the Negative Future Simulation condition also reported significantly lower emotion ratings than participants in the Positive Routine condition ($M = 3.79$, $SD = 0.63$), $t(42.6) = -8.55$, $p < .001$, Cohen's

Table 1
Descriptive statistics.

	N	Min	Max	*M*	*SD*
Age in months	115	47	60	53.48	4.139
Forward Word Span	111	2	5	3.68	0.738
Backward Word Span	111	1	4	1.90	0.873
MEFS total score	108	13	77	57.49	10.404
Theory of mind score	112	0	2	0.79	0.853
Future preference score	112	0	5	2.74	1.892
Verbal IQ (scaled)	112	5	19	10.80	2.313
Number of marbles saved	115	0	3	0.47	0.798
Saver (1) vs. spender (0)	115	0	1	0.31	0.466

Note. MEFS, Minnesota Executive Function Scale.

Table 2
Bivariate correlations among study variables.

	Age in months	Gender	Family income	Game order	Forward Word Span	Backward Word Span	MEFS	Theory of mind	Future preference	Verbal IQ (scaled)	Number of marbles saved	Saver (1) vs. spender (0)
Age in months	–											
Gender	−.056	–										
Family income	−.086	.019	–									
Game order	.053	−.108	−.062	–								
Forward Word Span	.112	.096	.204*	−.076	–							
Backward Word Span	.411**	−.039	.125	.061	.346**	–						
MEFS	.135	.179	.138	−.018	.045	.165	–					
Theory of mind	.153	.244**	.081	−.041	.169	.386**	.256**	–				
Future preference	.197*	.089	−.022	.036	.249**	.204*	.172	.172	–			
Verbal IQ (scaled)	−.166	.105	.165	.062	.220*	.286**	−.014	.193*	.171	–		
Number of marbles saved	−.008	−.101	.016	.241**	.100	.079	−.017	.010	.111	.161	–	
Saver (1) vs. spender (0)	.008	−.065	.018	.225*	.091	.097	.103	.052	.132	.166	.875**	–

Note. For gender, male was coded as 0 and female as 1. For game order, cognitive tasks first was coded as 0 and marble game first as 1. MEFS, Minnesota Executive Function Scale.
* Correlation significant at the.05 level (two-tailed).
** Correlation significant at the.01 level (two-tailed).

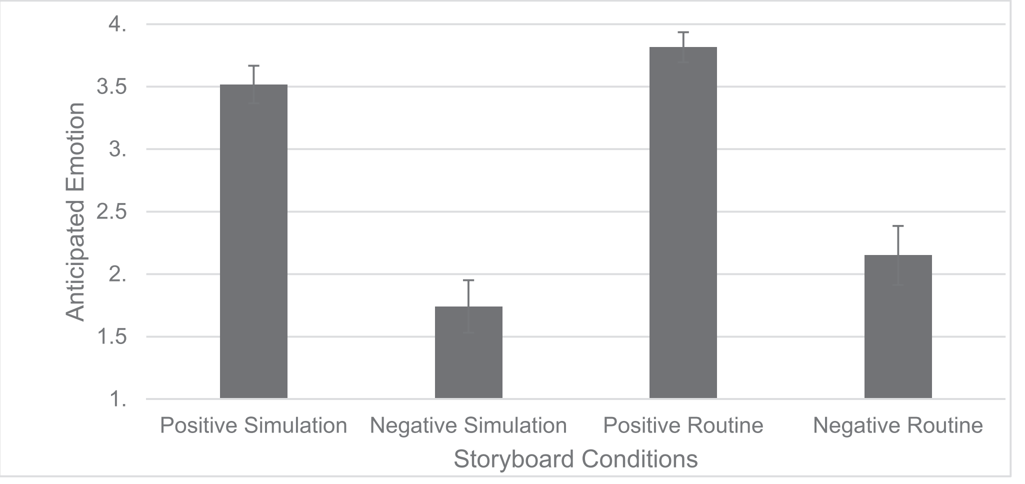

Fig. 1. Anticipated emotions by condition. Bars represent standard errors. Emotions range from 1 (*very sad*) to 4 (*very happy*).

$d = -2.28$. Participants' emotion ratings did not differ between the two positive groups ($p = .098$) and the two negative groups ($p = .070$), suggesting that the novelty of the marble game simulation did not generate more or less emotions compared with routine simulation. Hence, our emotion manipulations successfully led children to report anticipated feelings in the future based on the valence of the storyboard condition. Note that a minority of children endorsed different emotional valences than intended by the storyboards (4 in the Positive Future Simulation, 6 in the Negative Future Simulation, 1 in the Positive Routine condition, and 9 in the Negative Routine condition). Analyses excluding those cases corroborated the current results.

Main Analyses

To test our primary hypothesis of whether task-relevant future simulation (collapsing valence) predicts the odds of children saving at least one marble, we used logistic regression with storyboard condition (Future Simulation or Routine) as a between-participants factor and game order and verbal IQ as covariates. The overall model was found to be statistically significant, $\chi^2(3, N = 115) = 15.962$, $p = .001$, with Nagelkerke $R^2 = .116$. Future simulation significantly predicted the odds of saving, $\chi^2(1, N = 115) = 8.085$, $p = .004$, with children in the Future Simulation conditions being 3.54 times more likely than children in the Routine control conditions to save, confidence interval (CI) = 1.43–8.76. In terms of proportions, 56.9% of children in the Future Simulation groups saved at least one marble compared with 19.3% of children in the Routine control groups. Game order also significantly predicted saving; children who did the marble game first were 2.76 times more likely to save than those who did the cognitive tasks first, $\chi^2(1, N = 115) = 5.07$, $p = .024$, CI = 1.11–6.84.

We also examined saving behavior with the number of marbles saved (0–3) as the dependent variable using a general linear model (GLM). A significant effect was observed for the model, $F(3, 111) = 5.956$, $p < .001$, $\eta p^2 = .142$. The main effect of storyboard condition was again significant, $F(1, 111) = 8.556$, $p = .004$, $\eta p^2 = .073$. Children saved more marbles in the Future Simulation conditions ($M = 0.65$, $SD = 0.896$) than in the Routine conditions ($M = 0.24$, $SD = 0.543$). Game order also was a significant predictor of marbles saved; children who completed the marble games first saved more marbles, $F(1, 111) = 5.560$, $p = .020$, $\eta p^2 = .049$. Verbal IQ was not a significant predictor in either analysis (logistic regression: $p = .082$; GLM: $p = .106$).

To further explore our query of whether positive or negative future simulation is more effective at improving the odds of saving, we used logistic regression again with four storyboard conditions (Positive Future Simulation, Negative Future Simulation, Positive Control, and Negative Control) as a factor and game order and verbal IQ as covariates. The overall model was found to be statistically significant, $\chi^2(5, N = 115) = 20.456$, $p = .001$, with Nagelkerke $R^2 = .236$. Storyboard conditions significantly predicted the odds of saving, $\chi^2(3, N = 115) = 12.579$, $p = .006$. Specifically, children in the Positive Future Simulation condition were 4.74 times more likely than children in the Negative Routine condition (reference group) to save, $CI = 1.37–16.35$, $p = .014$, whereas the Negative Future Simulation ($p = .52$) and Positive Routine ($p = .48$) groups did not differ significantly from the reference group. In terms of the proportion of savers in each condition, 56.7% of children in the Positive Future Simulation condition saved at least one marble compared with 28.6% in the Negative Future Simulation group, 14.3% in the Positive Routine group, and 24.1% in the Negative Routine group. Game order also significantly predicted saving: Children who did the marble games first were 2.88 times more likely to save than those who did the cognitive tasks first, $\chi^2(1, N = 115) = 5.164$, $p = .023$, $CI = 1.12–7.39$.

To test whether this result replicates when using the number of marbles saved as a dependent variable, we used univariate GLM with storyboard condition as the factor and game order and verbal IQ as covariates. The overall model was significant, $F(5, 111) = 6.430$, $p < .001$, $\eta p^2 = .233$ (Fig. 2). The main effect of condition also was significant, $F(3, 111) = 7.310$, $p < .001$, $\eta p^2 = .17$. Children in the Positive Future Simulation condition saved the most marbles ($M = 0.97$, $SD = 1.052$), significantly more than those in the Negative Future Simulation condition ($M = 0.32$, $SD = 0.548$), Positive Routine condition ($M = 0.14$, $SD = 0.356$), and Negative Routine condition ($M = 0.33$, $SD = 0.679$). Notably, 4 children (13.8%) in the Positive Simulation group saved all three marbles, whereas 0 children in the other conditions did so. The main effect of game order also was significant: Children who completed the marble games first saved more marbles, $F(1, 111) = 5.918$, $p = .017$, $\eta p^2 = .053$. Verbal IQ was not a significant predictor in either analysis (logistic regression: $p = .136$; GLM: $p = .146$).

Finally, to rule out the alternative explanation that emotion alone would predict saving (i.e., children who imagined being happy saved more marbles), we conducted a third set of analyses with emotional valence (Positive or Negative, collapsing across the Simulation and Routine conditions) as the between-participants factor. No significant main effect of emotional valence was found for either saver versus spender or the number of marbles saved (logistic regression: $p = .47$; GLM: $p = .16$).

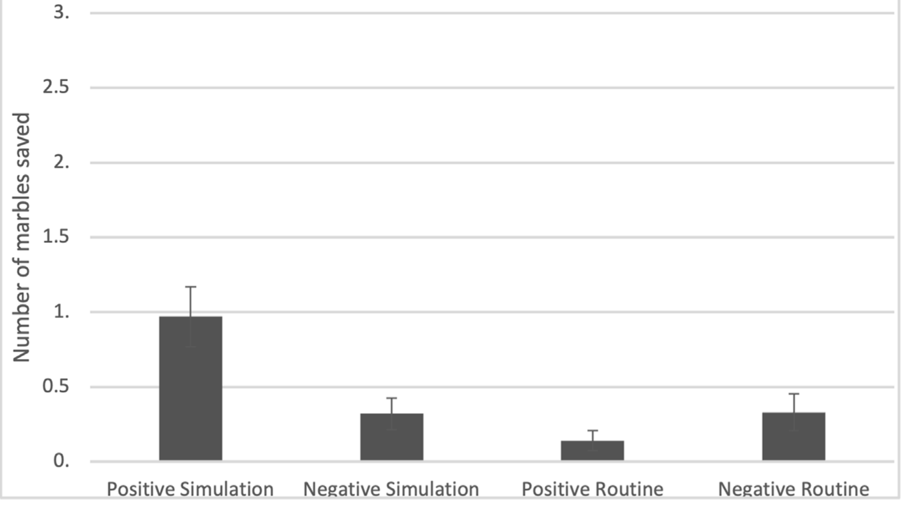

Fig. 2. Number of marbles saved by condition. Bars represent standard errors.

Discussion

The main goal of this study was to determine whether young children would save more resources when given the chance to imagine the future consequences and accompanying emotions of their decisions. We adapted Metcalf and Atance's (2011) marble saving paradigm to compare the saving behavior of 4-year-old children who imagined either saving or not saving in the future as compared with unrelated future imaginings about children's bedtime routines. We used the storyboard method to scaffold children to play out different marble game (or bedtime routine) scenarios and used emotion ratings to assess their anticipated feelings in those scenarios. A secondary goal was to determine whether simulating positive versus negative future outcomes and emotions resulted in different saving behavior. We controlled for game order and verbal ability based on preliminary analyses suggesting that they were related to saving.

It is important to note first that our study reinforced the common perception that 4-year-olds are very good at spending and very poor at saving: Only 19% of those in the control groups spontaneously saved at least one marble. The strong impulse to spend at this age makes it challenging to influence their behavior. Nevertheless, as we hypothesized, when children were scaffolded to imagine the future consequences of their decisions, they were far more likely to save (57%) and saved significantly more marbles. There could be several reasons why projecting the self into the future facilitated children's saving. First, by having children use the storyboard game, they were given the chance to reflect more deeply on the task ahead and the consequences of deciding to spend or save a marble. According to Zelazo's (2015) *iterative reprocessing* model, reflection, or the reflective reprocessing of information prior to responding, lays the foundation for EF skills, which include cognitive flexibility, working memory, and inhibitory control. Thus, it is possible that simply by giving children the time to stop and think about the future game, they made better decisions because they were able to deploy their EF skills more fully.

Second, we argue that this increased reflection was facilitated by psychological distance, which is known to promote EF and emotion regulation task performance (Carlson et al., 2005; Grenell et al., 2018; Gross & Thompson, 2007; Prencipe & Zelazo, 2004; White & Carlson, 2016, 2021; White et al., 2017). Research has shown that adults are more likely to make better decisions by imagining their future selves given that the pull of the present emotion and impulses are made less personal (Pronin et al., 2008). Creating psychological distance also helps to "cool" the hot EF demands of a task, making it easier for children to choose wisely without the salient motivational reminder of the present reward (Metcalfe & Mischel, 1999).

Third, going beyond previous experiments investigating future thinking in children, the current study used *task-relevant* future simulation. It is possible that children in the irrelevant control conditions were not cognitively engaged in the task-related reflective process and subsequently were more likely to make impulsive decisions that discounted the future. Our findings on the future routine control conditions align with previous research showing that merely thinking about the future was not sufficient to improve young children's decision making (Burns et al., 2021).

Fourth, we drew from theory and research on adults suggesting that anticipated emotion is an important driver of future-oriented decision making (Baumeister et al., 2007,2016). We nudged children to predict they would feel happy if they saved and would feel sad if they did not save. In combination with task-relevant future simulation (but not with irrelevant future imaginings), anticipating feelings might have amplified the effects. Importantly, our study also found that children assigned to imagine saving their marbles in the future (and how happy they would feel) were more likely to save and saved more marbles than children assigned to imagine that they did *not* save marbles in the future (and how sad they would feel).

There are several potential explanations for the finding that positive future simulation was most beneficial. First, a closer examination of the research on positive and negative bias during childhood found that negative bias is usually relevant in remembering events in the past, whereas positive bias occurs when children are asked to spontaneously generate predictions about the future (Boseovski, 2010). In the current study, children were asked to imagine their future and predict future emotions; thus, they might have been biased to attend more closely to the positive prospect of saving than the negative consequences of spending. At a neurochemical level, dopamine plays a major role in emotion-based decision making (Sevy et al., 2006). Imagining positive future experiences might increase dopamine levels, possibly enhancing children's prudent decision making. Yet, positive emotion (and its presumptive dopaminergic effects) was not sufficient on its own to increase children's saving on this task, as shown by the Positive Routine control condition; it might be essential to consider the temporal focus and relevance to the task.

Studies with adults also support this positive bias in future thinking; people spontaneously imagine more positive events than negative events when asked to think about their future (Newby-Clark & Ross, 2003). One purported function of this bias is to regulate emotion and decrease worry (e.g., Schacter et al., 2008; Taylor, 1989). Adult research also has shown that future-oriented positive affect (i.e., hopefulness) helps people to consume less unhealthy foods and have lower preferences for unhealthy snacks than those in a past- or present-focused positive emotional state (i.e., pride, happiness) (Winterich & Haws, 2011). Of note, the same study also demonstrated that saving did not arise from future-focused negative emotions (i.e., fear) as they did from future-focused positive emotions like in our study with 4-year-olds.

Taken together, these findings suggest that children might find it easier to imagine and thus more deeply reflect on the image and emotions of their future selves in which they reap the rewards of saving than if they had imagined not having them. Consistent with this claim, research showed limited effectiveness of experiencing negative consequences of decisions to delay and save in preschoolers (Lee & Carlson, 2015). It is noteworthy that our results might be in direct conflict with many parents' and teachers' intuitions about how best to motivate young children (e.g., to encourage sharing by saying, "How would you feel if your friend didn't share with you?"). In early childhood education, it is often suggested to use positive language and encourage good behavior instead of the opposite. Negative language is more cognitively and linguistically demanding for children to capture the speaker's intention because it is vague and does not provide direction on what to do instead (Lentini et al., 2009).

Although our pattern of results is consistent with psychological distancing and positive emotion accounts, it also raises an alternative interpretation, namely priming. Previous research with preschoolers has shown improved delay of gratification and saving when children are exposed to a model or prompted about their options (Atance et al., 2017; Kesek et al., 2011). Our results, however, cannot be explained by priming alone. First, all children (including the control groups) were reminded that they could save a marble for the bigger game, as in Atance et al. (2017). Furthermore, if children were merely following the scenarios created by the experimenter and viewed them as prescriptive, we would expect those in the negative simulation condition to save *less* than children in the control groups, yet they performed similarly. As we noted, however, children saved at a low rate overall, so there was not much room to observe even lower performance compared with the control conditions. Accordingly, priming remains a viable interpretation, although not mutually exclusive with the aforementioned explanations of psychological distancing and anticipated emotion. Future research could include a condition where children are explicitly instructed to follow saving rules (but not exposed to future simulation) to disentangle these interpretations.

We observed that game order was associated with children's saving behavior in the marble game. Children who completed the marble game first were more likely to save and saved more marbles than children who completed the marble game after the battery of cognitive tasks. This finding was somewhat surprising given that Atance et al. (2017) did not find that game order significantly affected children's saving behavior. We speculate that the order effect might be due to fatigue or self-control depletion experienced by children who completed the marble game after cognitive tasks. Although the robustness of ego depletion in adults has been challenged by multi-site studies (Hagger et al., 2016; Vohs et al., 2021), such an effect has been observed in preschoolers; prior engagement of EF tasks decreased subsequent performance on delayed gratification, Go/No-go, and false belief tasks in 4- and 5-year-olds (Powell & Carey, 2017). The battery of cognitive measures in our study consisted of six tasks, many of which required children to exercise EF abilities (working memory, cognitive flexibility, following directions, etc.). It is possible that children who completed the marble game second were ego-depleted or simply fatigued. It would be necessary to include a comparison group receiving a battery of noncognitive measures such as physical activity for the same period of time as the cognitive battery to disentangle these possibilities. Nevertheless, our results held up while controlling for game order in addition to verbal ability.

This study is the first to explore the role of anticipated emotion and task-relevant future simulation in preschoolers' decision making, with limitations that would need to be considered when designing future studies on this topic. First, like other lab-based manipulations, our study is subject to the concern of generalizability. It invites questions as to whether we would observe such effects outside of the laboratory setting and for how long they would last. Our sample also consisted of children from predominantly White, highly educated, and upper-middle-class families from the midwestern United States. It is uncertain whether our results would replicate in a more diverse sample with respect to race, ethnicity, SES, and cultural practices or whether they are moderated by these factors. Follow-up studies also can explore whether this method of inducing future-oriented imagination benefits older children as being able to consider the future and make prudent decisions in risky situations become increasingly important as children transition to adolescence. Another limitation of the study is the difference in future timing between the experimental and control groups. The storyboard in the future simulation groups pertained to a near-term future, whereas the bedtime routine pertained to a more distant future (later that day). Investigating task-relevant outcomes in both near and distant futures (e.g., playing the marble game immediately after the simulation vs. the end of the session vs. tomorrow) would further elucidate the effect of temporal distancing on children's decisions to save. In addition, although our analysis demonstrated that emotion alone did not affect saving, future research could disentangle the effect of future simulation and emotion on saving by including an experimental group that contains only saving simulations without emotions. Furthermore, differentiating different kinds of positive emotions (e.g., pride vs. happiness) as well as the source of anticipated emotions (self vs. other) in our manipulation could also aid in our understanding of the nuanced effects of emotions on motivation (Shimoni et al., 2022).

Future research also could expand the range of outcomes studied. Most research on children's self-control examines decisions that are good for oneself, but children often make decisions that involve pitting self-interests against others such as sharing and helping. Adult research has shown that briefly engaging in episodic future thinking can increase helping behavior (Cernadas Curotto et al., 2022). It may be fruitful to see whether engaging in episodic future thinking about sharing would improve children's tendency to share with others. It would also be of interest to compare temporal distance (imagining one's future self) with other distancing practices known to facilitate EF such as social distance (imagining how a character would act) and physical distance (physically standing farther from the reward) to see whether one intervention is more effective than others and when during development. Lastly, the storyboard method could be adapted to use in school or clinical settings to engage children with EF challenges in future-oriented imaginative play by scaffolding children to predict what happens next and consider their emotions, thereby enhancing reflection on the real-world task at hand.

In conclusion, this study investigated the influence of future-oriented imagination on prudent decision making among 4-year-olds. Specifically, we found that children who imagined themselves saving limited resources for the future reported feeling happy about their choice and were more likely to save, and to save more, than those who imagined not saving or imagined irrelevant routine events. This research adds new evidence supporting psychological distancing as an effective strategy to improve saving and make decisions for adaptive long-term goals.

CRediT authorship contribution statement

Jinyi Zhang: Writing – original draft, Visualization, Resources, Project administration, Methodology, Investigation, Formal analysis, Data curation, Conceptualization. **Kathleen D. Vohs:** Writing – review & editing, Conceptualization. **Stephanie M. Carlson:** Writing – review & editing, Supervision, Resources, Funding acquisition, Conceptualization.

Data availability

Data will be made available on request.

Acknowledgment

This research is supported by University of Minnesota Grant in Aid #550181 to Stephanie M. Carlson.

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