Future-Oriented Thinking: Saving, Prospective Memory, and Planning in Young Children

by

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Abstract

Saving is an important future-oriented thinking skill to acquire but little is known about how its early development relates to other future-oriented thinking abilities. The present study would have examined whether saving ability is related to prospective memory (PM) and planning, two other aspects of future-oriented thinking, during the preschool years, as little is known about the relation between saving and PM. Due to the SARS-CoV-2 pandemic, data collection could not occur. However, approximately 80 participants would have been recruited from daycares in Moncton, New Brunswick and the surrounding area. Four- and five-year-old children would have completed a token and sticker saving task, a card-sorting and naturalistic PM task, and the Tower of Hanoi and Truck Loading planning task, as well as a vocabulary measure (abbreviated PPVT-V). Potential results are discussed regarding what may have been found should data collection have been able to occur.

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Introduction

In order to be successful in everyday life, one must be able to consider the future and make decisions that benefit oneself over time. For example, we think about the future when we save money for a trip, make a note to return something to a friend, or make a grocery list for the week ahead. The ability to consider our future selves is important for a variety of reasons, from simple everyday tasks, such as buying food to make dinner, to more complex long-term goals, such as retirement. These abilities are relevant for adults, but as children develop, it is important that they begin to consider the future as well (Atance & Jackson, 2009). Children must be able to progress from the mindset that only the present is relevant in order to think about the future and contemplate the possibilities of what could occur, and how they might prepare for what is to come. For example, children need to consider that their current actions (such as eating all their vegetables) may impact their future selves (that they would be allowed to have dessert). Additionally, the ability to expect how one might feel in a future situation, such as being sad about not having dessert, can allow them to prepare adequately so that they are better able to handle the immediate situation (Atance & Meltzoff, 2005).

The ability to consider what may occur in the future is often referred to as future-oriented thinking (e.g., Atance & Jackson, 2009; Atance & Meltzoff, 2005; Metcalf & Atance, 2011). Future-oriented thinking refers to a wide range of abilities that encompass many aspects of everyday life. In this context, the term *prospection* has been used to refer to how one considers their future self in a hypothetical, imagined event (McCormack & Atance, 2011). For example, children might think about how they might feel happy when they go to school the next day because they get to see their best friend. Relatedly, *mental time travel* (Tulving, 1985) and

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episodic foresight (Metcalf & Atance, 2011) have been proposed to be relevant abilities. Tulving (1985) proposed the term mental time travel, which is defined as the ability to imagine oneself in the future, and in the past, by thinking about past and future events in reference to oneself.

Episodic foresight refers to envisioning oneself in the future regarding something that will occur by pre-experiencing an event (Metcalf & Atance, 2011). Both mental time travel and episodic foresight have been used in literature to describe how one might consider their future selves by thinking about oneself in a future situation.

Atance and Mahy (2016) suggest that most future-oriented thinking abilities likely develop after the age of two years, as the construct of the self in young children is not complete enough to consider one's future self until then. Future-oriented thinking relies heavily on the ability to reference the self; therefore, it is important for the construct of the self to be developed before one can accurately consider the future. The development of future-oriented thinking is typically studied in children between the ages of three- and five-years-old, although it has been suggested that even children as young as two-years-old may be able to think about the future in events typical of everyday life (Somerville et al., 1983). Preschool-aged children have been shown to be able to discuss their past and future selves, suggesting that in verbal tasks, children as young as four years of age are able to engage in mental time travel. In an experiment conducted by Busby and Suddendorf (2005), three-, four-, and five-year-olds were asked questions about what they did and did not do the day before (recalling the past) and something that they will and will not do next day (considering the future). The older children were better able to accurately discuss what they might do in the future compared to the three-year-olds, which suggests that four- and five-year-olds are better able to engage in mental time travel.

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There are several types of future-oriented thinking that have been investigated by researchers. Saving is an example of one of these abilities. Saving is defined as the ability to avoid the immediate consumption of a resource so that it can be used in the future (Metcalf and Atance, 2011). In adults, saving can be seen when one decides not to go out for an expensive meal in order to be able to afford groceries. Young children are also faced with the need to save, such as saving allowance money to buy a toy the next time they go to the toy store instead of spending it on a more immediate, readily available reward such as candy at the grocery store. Prospective memory is another example a future-oriented thinking ability. Prospective memory refers to remembering to do something in the future (Einstein & McDaniel, 1990). For example, adults might need to remember to give their friend a book back the next time they see them. Young children may also require prospective memory when they have to remember to ask their parents to sign a permission slip when they get home from daycare. Another example of a future-oriented thinking ability is planning, which refers to using strategies in order to prepare for a future goal (Gauvain & Rogoff, 1989). In adults, planning is used when preparing for the day ahead or for an upcoming trip. Young children may also need to plan when choosing a jacket appropriate for the weather for the day.

Another example of a future-oriented thinking ability is delay of gratification (DoG). DoG refers to choosing between an immediate smaller reward or waiting for a larger, more desirable reward (Mischel & Metzner, 1962). In children, one might be given the option to have one treat right now or wait to have more treats in a few minutes (e.g., as in the classic marshmallow task). What each of these examples of future-oriented thinking abilities have in common is that they require the ability to consider a later point in time.

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It is important to note that while they are similar, saving and DoG are distinct skills. Before reviewing saving and the related research in depth, it is important to make clear the distinction between saving and DoG. DoG tasks involve choosing between an immediate smaller reward, or waiting in order to get that smaller reward along with more (i.e., a larger reward). For example, a DoG task might first give participants the option of having one marshmallow right away or waiting a few minutes to get that marshmallow plus an additional one later (e.g., Mischel & Metzner, 1962). Saving is different than DoG because the immediate reward is not obtained in addition to the later reward (as in typical DoG tasks), but instead it is forfeited in order to obtain the later reward, which may or may not be more desirable (Atance et al., 2017). For example, in a typical DoG marshmallow task, in which participants can choose between one marshmallow now or two marshmallows later (e.g., Mischel & Metzner, 1962), saving would require participants to forfeit the first marshmallow in order to obtain the second. However, in DoG tasks, participants would get both the first marshmallow and the second marshmallow after waiting for the delay. Despite how intuitively these skills appear to be similar, previous research has not reported a relation between these abilities in preschoolers (Kamawar et al., 2019; Lee & Carlson, 2015). However, DoG and saving are similar in that both of these skills require the ability to consider oneself in the future in order to see the benefit of waiting for the reward.

Preschoolers' saving ability has been a growing area of research in recent years, however there is little information about the relation between this ability and other types of future-oriented thinking abilities, and how they may be related. The present study will begin to address this gap by focusing on saving, prospective memory, and planning, as each of these skills require the consideration for the future. More specifically, the relations among saving, prospective memory, and planning is of interest. Previous research has suggested that saving and planning are related

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(Kamawar et al., 2019) and that prospective memory and planning are related (e.g., Mahy & Moses, 2015; Causey & Bjorkland, 2014), but little is known about the relation between saving and prospective memory or how these three future-oriented thinking skills are related to each other. Therefore, the main goal of this study is to determine if saving is related to these other more established future-oriented thinking skills (prospective memory and planning).

Before describing the planned study in more detail, I will begin by describing young children's future-oriented thinking more generally. Then, I will provide an overview of the current literature on young children's saving, prospective memory, and planning ability. Further, I will describe how planning has been shown to be related to saving and prospective memory performance. Finally, I will discuss the hypotheses and planned analyses for the present study.

Before describing the specific aspects of future-oriented thinking that will be a focus of the present study, it is important to describe how future-oriented thinking has been studied in young children more generally, as it has been studied in a variety of ways. For example, researchers have assessed young children's future-oriented thinking using what are known as 'the spoon task' (Tulving, 2005) and 'the room task' (Suddendorf & Busby, 2005). Both tasks require children to make a decision in the present to help them in the future, using information that they have learned in the past. The spoon task (Tulving, 2005) references a story in which a child is faced with the challenge of not having brought a spoon to a party and is therefore unable to eat their favourite dessert. In order to be able to have this dessert at the next party, the child must reference their past self in recalling how they felt when they did not have a spoon, consider the future event, and recognize the need to bring a spoon for the next party so they can have the dessert. Thus, success on this task is interpreted to mean that the child has considered their future

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selves and pre-experienced an event in order to anticipate the need for the spoon, and then planned accordingly in the moment (Tulving, 2005).

Suddendorf and Busby (2005) developed a room task similar to that of Tulving's (2005) spoon test, but with a more practical design. In this task, participants are shown a room that contains a puzzle board but no puzzle pieces, or anything else with which to play. After spending a couple of minutes in this room, participants are then placed in another room for five minutes, where there are lots of other things to play with, including pieces for the puzzle board. Next, they are instructed that they are going to go back to the first room, but they are allowed to bring one item with them. They are given a choice of items, of which three are distractor items and the target items are the puzzle pieces that would fit into the puzzle board from the previous room. As in the spoon task (Tulving, 2005), to succeed, participants need to reference the past (the first, primarily empty room), their boredom from that room, and anticipate how they might counter that boredom if they were to bring the puzzle pieces in to play with. Suddendorf and Busby (2005) found that four- and five-year-olds were more likely to choose the puzzle pieces than the decoy items; however, the three-year-olds were not more likely to choose the puzzle pieces relative to the distractor items. This finding suggests that by four years of age, children are able to consider their past selves and effectively plan for their future selves. Other research has found similar age trends for this type of task (e.g., Suddendorf et al., 2010; Scarf, Gross, Colombo, & Hayne, 2011), thereby demonstrating that the emergence of this skill takes place during the preschool years.

Other studies have employed different measures of future-oriented thinking, such as being able plan and prepare for a hypothetical future event in which one's physiological state differs from the current one (Atance and Meltzoff, 2005). For example, Atance and Meltzoff

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(2006) conducted a study in which preschoolers were given the choice between pretzels or water, both in the moment and for the next day. They were given this choice again after having eaten salty pretzels, as the researchers expected that this would make the children feel thirsty (i.e., changed physiological state). The researchers found that children were more likely to choose water for the next day after having eaten the pretzels, even though they had previously indicated that they prefer pretzels over water. Thus, Atance and Meltzoff (2006) conclude that current state and current desires affect the decisions we make for our future selves, but that children become better able to understand that their physiological state may change in the future they get older. Results from these types of studies indicate that even children as young as three years old are able to demonstrate that they can consider their future selves.

Relatedly, Leech et al. (2019) studied how talking about oneself in the future would impact prospective abilities. Three- to five-year-old participants were assigned to a future self, present self, future other, or present other condition in which they read a story corresponding to their condition. These stories made reference to different time points, according to the condition. For example, children in the future self condition were told “The next morning, you wake up. ‘I will go to the doctor soon. But wait! What if the doctor will give me a shot?’” and were asked “What else will you do before you go to the doctor?” (Leech et al., 2019, p.114). They also completed a series of future-oriented tasks, including a prospective memory task (adapted from the Guajardo and Best, 2000) study described below; the Atance and Meltzoff (2005) future-oriented decision making task (described above), and a DoG task. Leech et al. (2019) found that those in the future-self condition were more successful on the prospective memory, future-oriented decision making, and DoG tasks than those in the other conditions, suggesting that talking about one’s self in the future is beneficial to future-oriented cognition. Leech et al. (2019)

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also found that prospective memory and DoG were marginally related; however, only one prospective memory task was used and it may not entirely represent prospective memory ability as there may have been other factors that affected success on the task (e.g., retrospective memory ability, visible prospective memory cue). Finally, Leech et al. (2019) also found a significant positive correlation between prospective memory and the future-oriented decision-making task, suggesting that these abilities are also related. Overall, the results suggest that there is evidence to support the benefits of talking about oneself in the future for future-oriented tasks and that these future-oriented tasks are related to one another in preschool aged participants.

Given that a focus of this proposal is preschoolers' ability to save, I will now turn to reviewing the development of this skill in more detail, including reviewing factors that have been found to affect preschoolers' saving behaviour. This review will include a critical evaluation of the studies and the methods they have employed. Finally, I will discuss the specific saving tasks that will be used in the present proposed study and the reasons they were chosen.

Saving

Recall that saving refers to avoiding the immediate consumption of a resource in the present so that it can be used in the future (Metcalf and Atance, 2011). Though quite limited in number, studies employing a variety of saving measures have shown that children under the age of five are able to save in some capacity (e.g., Atance et al., 2017; Kamawar et al., 2019; Lee & Carlson, 2015; Mazachowsky & Mahy, 2020; Metcalf & Atance, 2011). The research that currently exists in this area now be discussed.

In some of the earliest work in this area, Sonuga-Barke and Webley (1993) studied saving and economic development in children using a complex play economy. Children aged four-, six-, nine-, and twelve-years were shown a board game which depicted all of the items in

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the room they were in, including a lever pressing machine, a 'bank', a 'toy shop' and a 'sweet shop'. They were instructed that the lever pressing machine would give them tokens, and they could spend these tokens at either the sweet shop or the toy shop, or they could choose to save the tokens at the bank. The bank was divided into four boxes. The boxes were either clear (so they could see inside) or solid wood (so that they could not see inside). They were further divided in a way that allowed for the participants to remove the tokens either more or less often (i.e., something akin to shorter- and longer-term savings). Participants began by playing on the board game, and when they landed on a square, they were able to use the item in that 'room'. The goal of the game was to be able buy a toy with the tokens they earned, with the better prizes being more expensive (i.e., require more tokens).

Sonuga-Barke and Webley (1993) found that younger children were more likely to spend their tokens on sweets throughout the game and less likely to save their tokens compared to the older children, suggesting that there are age-related differences in terms of saving. However, this task is made up of many complex rules and many parts, therefore it might be possible that the younger children did not do as well as the older children due to the potentially overwhelming nature of the task. Although the younger children were more likely to spend their tokens on the sweets as they played the board game and they were less likely to save, it may not reflect that they were unable to save, but it may have been due to misunderstanding the instructions, preferring the sweets over the toys at the end, or simply getting bored as the game was played and losing interest in the toys at the end. This task, although representative of what might occur in a more typical, real-life event (where the tokens represent money and the sweets represent something small that might affect the ability to save for something larger), the complexity of the task may not have been suitable for younger children, thereby underestimating their saving

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abilities. Thus, more recently, a paradigm suitable for three- to five-year-olds was created by Metcalf and Atance (2011).

Metcalf and Atance (2011) developed a more age-appropriate saving task, one in which children did not have to save a symbol of the resource (such as a token), but instead had to save the limited, to be ‘consumed’ resource itself. Further, the rules were significantly simpler and therefore more likely to be understood by young participants. In their marble run task, children between the ages of three- and five-years of age were introduced to two rooms, which each contained a different marble run (a device that allowed for marbles to be placed at the top and dropped down). One of the marble runs was larger and more interesting than the other (and therefore presumably more desirable), and the other one was smaller with fewer details (and therefore presumably less desirable). Children were given three marbles and told that once a marble is used (i.e., ‘spent’), it cannot be used again. Children then spent three minutes in each room. In one condition, they began with the room that contained the smaller marble run (more-rewarding-future), and in the other condition, the one with the larger marble run (more-rewarding-present). The experimenter worked silently in the room while the child either used or saved their marbles. This was repeated over two trials and the researchers tracked the number of marbles children saved for the second room in each trial.

Interestingly, Metcalf and Atance (2011) found that preschoolers were, in fact, able to save using this age-appropriate task. In the more-rewarding-future condition, 39% of children in trial one, and 58% of children in trial two, saved at least one marble for the second room. In the more-rewarding-present condition, 29% of children in trial one, and 34% of children in trial two, saved at least one marble for the second room. Further, they found that participants waited longer to use their marbles on the second trial compared to the first trial. This finding suggests

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that participants are able to learn from the first trial in order to better benefit their future selves in the second trial (i.e., in the second trial they were able to reference their past self's disappointment from not having saved enough marbles, thus learning from their past experiences). Further, they found that the children who went to the room with the more desirable run second saved more marbles than those who saw the more desirable marble run first, which suggests that participants recognized that waiting for the more desirable marble run was of greater value than simply using them all on the first marble run. Additionally, they found that although some participants did not spend their marbles in the first room, they also did not spend them in the second room, suggesting that they were saving them for after they left the lab (which was not what the researchers expected). Finally, no age differences were found between how many marbles were saved, and no age differences were found in regard to how long participants waited to use their marbles. Metcalf and Atance (2011) suggest that age differences may not have been observable due to individual differences in saving ability, even at a young age. Further, they suggest that perhaps age differences were not observed because children at such a young age are not able to save their marbles spontaneously without prompts and that prompting saving behaviour is an important aspect of why children may save. The researchers suggest that this may have caused all participants to perform equally poorly so that no age differences could be observed, and this limitation was addressed in a follow-up study, which will be discussed.

Overall, Metcalf and Atance (2011) demonstrated that the marble run saving paradigm allows for the measurement of saving in preschoolers. Thus, this type of task is suitable to investigate young children's emerging ability to save. However, it is important to note that saving marbles is not the same as saving in a real-life scenario (e.g., saving money) or perhaps motivating enough to be an adequate measure of a typical saving behaviour. For example, a task

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might be more representative of a real-life scenario if it required saving a resource, similar to money, that could be used to obtain a reward. Further, something that is more motivating, such as toys, might be a better indicator of how a child might save in real life for something that they really want. More recent research addresses these concerns and will be discussed shortly.

In a follow-up to the first marble run study, Atance et al. (2017) used a modified version of the marble run task with three-, four-, and five- year-old participants. This study was similar to that of Metcalf and Atance (2011), but with the addition of a baseline condition in which both marble runs were presented at the same time and a condition in which children received a verbal prompt to save. The purpose of presenting both marble runs at once to some of the participants was to test whether participants did in fact prefer the larger marble run, and the prompt condition was designed to test whether suggesting that participants save their marbles might improve their likelihood to do so.

The researchers found that participants were more likely to choose the big marble run when both were presented at the same time. They also found that giving preschoolers a prompt to save did in fact increase the likelihood that they would save more marbles for the more desirable marble run relative to not receiving such a prompt. Additionally, the relations between saving and other cognitive abilities, such as working memory (defined as the ability to hold and manage information in one's mind; Baddeley 2003), and inhibitory control (defined as inhibiting an initial response; Miyake & Friedman, 2012), were examined. However, neither of these skills were found to be significantly related to saving performance after controlling for age. Atance et al. (2017) suggest that their task may not have relied on inhibitory control, which was consistent with findings from other studies (e.g., Lee and Carlson, 2015), and that working memory was not related to saving.

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More recently, Kamawar et al. (2019) included the opportunity for some of their three- to five-year-old participants to develop a spending plan (i.e., create a budget) before engaging in their marble savings task (based very closely on Metcalf & Atance, 2011). It was expected that participants who were given the option to plan their spending and saving (i.e., budget) before the task began would be more likely to save more marbles for their preferred marble run. After participants were introduced to the two marble runs, but before they entered the room with the first marble run (whichever marble run they indicated as preferring less), about half of the participants were introduced to the budgeting option. Participants were given two bowls, one for each marble run. They were then allowed to allocate their marbles for both marble runs represented by the bowls, with both bowls going with them to the marble run rooms (so they were able to break their budget if they chose to). This was repeated for a second trial.

The researchers found that in the first trial, but not the second, participants in the budgeting condition saved more marbles for their more desirable marble run than those who did not create a budget. These results suggest that preschool-aged children are able to budget (in a limited sense, at least), and that by creating budgets, they are better able to save. They further found that children in the control (non-budgeting condition) saved more on their second trial than their first, bringing their saving performance to about the same as children in the budgeting condition. Kamawar et al. (2019) suggest that giving participants the opportunity to budget allowed them to be better able to consider their future selves and make a better plan about how they might spend their marbles, but that this advantage was not necessarily beyond what participants learned in their first trial.

Kamawar et al. (2019), in addition to including budgeting, also added measures of planning and self-control. The Truck Loading task, in which participants were required to follow

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a set of rules and plan how they would make deliveries by placing items in a truck so they could be delivered in a specific order was used as a measure of planning ability. The self-control measure consisted of a delay of gratification task in which participants could choose to have a small sticker prize right away or wait to have a larger sticker prize in the future (task based on Lemmon & Moore, 2007).

Although there was a relation between planning ability and saving performance for those in the budgeting condition, with those who were better at the Truck Loading task also saving more marbles, there was no such relation in the control condition (Kamawar et al., 2019). Further, no age differences were found in relation to the saving task. Kamawar et al. (2019) note that perhaps the age range was too small to find a significant age-related difference in general saving ability. The researchers also note that a possible limitation is that the second, more desirable marble run used was not interesting enough to the older participants, which may have led to boredom. Older participants, if bored, may have chosen to not save their marbles in order to avoid feeling bored in the present. This may have led to the lack of age-related differences. So, while Metcalf and Atance (2011) and Kamawar et al. (2019) did not find age-related differences in preschoolers' saving behaviour, Atance et al. (2017) did. The findings from studies that have used the marble task thus far appear to have a lack of consistency regarding age-related differences that has yet to be addressed.

Kamawar et al. (2019) note that by separating the marbles in the budgeting condition prior to beginning the task, participants had a visual reminder about how they had originally intended to use their resource before they went to use the marbles. This may have led to uncertainty regarding whether or not the participants remembered to follow their budget on their own, or if seeing the marbles separated acted as a visual cue which prompted saving.

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Measuring saving using a marble task does have some challenges. For example, Kamawar et al. (2019) suggest that it is perhaps not ideal for participants to save all of their marbles for the second, more desirable marble run, and that instead it may be beneficial for the participant to use some marbles in the first marble run so that they are not bored. By using some of the marbles in the small marble run they encounter first, they can avoid the boredom of the present and in that case, it may be beneficial to have slightly fewer marbles to use on the bigger marble run in the next room. This limitation prompts the question of what should be considered ideal in regard to saving. Is it best for participants to save all of their marbles for the second marble run? Or is it most beneficial to save at least one? These questions address the issue of what is considered successful when measuring saving, and that perhaps saving all of the marbles for the more desirable marble run is not necessarily the only condition under which participants should be classified as ‘savers’. For this reason, researchers consider both the number of marbles saved and whether or not at least one marble is saved, as determining the ‘correct’ number of saved marbles is a challenging task. As noted previously, another challenge to measuring saving in preschoolers is that when given two trials of the marble saving task (control condition in Kamawar et al., 2019; Metcalfe & Atance, 2011), participants were able to save significantly more marbles on the second trial relative to the first trial.

Chernyak et al. (2017) also measured young children’s saving ability using a task that, like the marble run saving task, measured saving in regard to the ability to save the resource itself. Their task measured saving using dinosaur stickers and two different paper options. Children were given five dinosaur stickers and were told that they could play with the stickers right now and stick them on to some plain, white paper, or they could wait until the researcher was done doing some work and they would be given a piece of paper with a dinosaur scene that

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they could stick their stickers on (presumably, the dinosaur scene was a more desirable way to use the stickers). The researcher would provide them with the stickers and the plain paper and then proceed to work while making minimal contact with the child. After three minutes had elapsed, children would have been given the dinosaur scene paper and been given time to place the rest of their stickers if they had any saved. The measure of interest was how many dinosaur stickers had been saved for the second sheet of paper.

A limitation of the marble run and the dinosaur sticker saving tasks in terms of their generalizability is that they only measure saving when the resource itself is the item being saved. In other words, the marbles and dinosaur stickers are the items that are both saved and used; thus, the marble run and sticker saving tasks do not address what one might encounter when are faced with saving money to purchase something. Therefore, recently, another saving task for preschoolers has been developed (Dueck et al., 2019). This task uses tokens to allow for a more real-life comparison to typical saving, where the tokens represent the need to use something in order to ‘purchase’ an item, similar to money, while still being age-appropriate. This allows for the task to be easily understandable with few rules (in comparison to a board game; e.g., Sonuga-Barke and Webley, 1993), and for the use of tokens which can be traded for an item (in comparison to the marble task, in which the item saved is the item used; Atance et al., 2017; Kamawar et al., 2019; Metcalf & Atance, 2011).

This new task allows us to measure saving in a way that is conceptually more similar to money and how one might encounter an instance where they must save in daily life. More specifically, tokens would be much more similar to money. In this newly-developed token saving task, participants are given the option to buy either a more or less desirable treat using tokens. As in the marble task, children begin with the treat they indicate is the least desirable, with the

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option to use or save their tokens for three minutes, and then they are given the treat they indicate is more desirable for three minutes.

Dueck et al. (2019) administered the token saving task to three- to seven-year-olds to examine whether it was suitable for children of this age group. Participants were shown two types of treats and tokens they could use to purchase them. They were also given two boxes that matched the colour of the trays in which they could deposit their tokens when they wished to 'purchase' their treat and the children are told that once they used one of their five tokens, it cannot be removed from the box to be used again. The researchers began with a preference check where participants were shown both treats (smarties and raisins) and asked which one they preferred. In this study, children were assigned to one of two conditions to determine whether giving prompts to save with this task would help children between the ages of three- and seven-years-old save, as prompts aided participants in Atance et al.'s (2017) marble task, but in this case with the use of a more symbolic saving task. Participants in the prompt condition were told that they could use all of their tokens for the first game, or that they could save some to use for the second game, prompting the idea that they could save their tokens for future use on the more desirable treat. The baseline condition did not receive the saving prompt before they played the game. Participants only completed one trial of this task and the number of tokens that participants saved was recorded.

Similar to Metcalf and Atance (2011) and Kamawar et al. (2019), Dueck et al. (2019) did not find any age-related differences in number of tokens saved, and similar to Atance et al. (2017), more children in the prompt condition saved than did those in the baseline condition. Further, Dueck et al. (2019) found that children's saving ability and saving status was related to

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their household's income (obtained using a parent-based questionnaire), suggesting that factors such as socioeconomic status may play a role in measuring children's saving ability.

This study supports the claim that the token saving task is suitable for children between three- and seven-years-old. The use of tokens potentially allows for better insight to how one might be required to save money in real life, therefore it is potentially a better representation of a typical saving scenario than the previously described marble tasks that measure saving in preschoolers. Further, the design of the task is more easily transported to childcare centres where testing typically occurs, compared to the marble run task.

More recently, Jerome (2019) modified the token saving task by using stickers and toys instead of smarties and raisins as rewards. Participants were given an opportunity to indicate which stickers and toys they preferred, and then asked if they liked the stickers or toys more. They began by playing the game that they indicated they preferred the least. The task then proceeded the same way the token saving task by Dueck et al. (2019) did: participants were given the instructions and were allowed to spend the five tokens they were given on the first, less-preferred game or save them for the next, more-preferred game. In addition, Jerome (2019) measured planning using a Truck Loading task and theory of mind. Jerome (2019) also compared performance on a control condition to when participants were budgeting and saving for themselves versus for another. Results indicated that there was no relation between saving and planning or to theory of mind, but that there was a benefit of budgeting. Both those who were in the budgeting condition for self and for another performed better on the token saving task than those in the baseline condition, but there were no differences between the self or other budgeting conditions (Jerome et al., in progress). This indicates that children can succeed on the

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token saving task even with non-food rewards and that this task is suitable for use with preschoolers.

More recently, Mazachowsky and Mahy (2020) conducted a study focused on creating a parent questionnaire that would measure future-oriented cognition in children. After doing a preliminary study of their survey online, the researchers conducted two new studies in which they compared results from the parent questionnaire with results from their children's performance on behavioural tasks designed to measure the same abilities addressed in the questionnaire. The researchers conducted two behavioural measures of each future-oriented thinking ability assessed in their questionnaire: saving, episodic foresight, prospective memory, planning, and DoG.

Their saving tasks consisted of the marble run paradigm and a modified board game task, designed to measure saving in children between the ages of three- and seven-years old. This saving board game displayed a scene of a town, with many different stores and locations that the participants could visit as they played. Children began the game with four tokens, and as they progressed through the town, they were given options to spend their tokens on smaller rewards (e.g., a toy animal at the pet store). However, children were also instructed that if they had saved at least three tokens, at the end of the game they would be able to 'buy' a more desirable item (children were given the choice of one of four desirable items before the game began, to ensure the prize was something worth saving for) when the game was over. After the instructions were given and a comprehension check was conducted, children began playing the board game. The experimenter would read out the cards and children would move to the location on the board game that was indicated. Four of the eight locations children visited had the option of buying a

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prize. When the game was over, participants were given the opportunity to purchase the desirable toy they had chosen before the game began.

In addition to these saving tasks, children were given behavioural measures of future-oriented thinking across two studies, in order to determine if children's performance on the behavioural tasks were related to how parents reported their children's behaviour. These abilities included episodic foresight, planning, DoG, and cognitive flexibility, in addition to a vocabulary measure.

The researchers report that overall, their results indicated that their parent questionnaires for future-oriented cognition were correlated with the behavioural tasks they conducted. However, it is important to note that the only behavioural measures that were statistically significantly correlated with the parent questionnaire were the episodic foresight and planning measures. Further, none of the behavioural measures (aside from one measure of episodic foresight) was significantly correlated with the parent questionnaire after age and general language ability were controlled for. Mazachowsky and Mahy (2020) further found that results from the questionnaire were correlated with age, suggesting, as previous studies had found, that performance on these types of tasks improve with age, thus finding further support for their questionnaire. Despite the lack of statistically significant findings regarding the correlations between the behavioural measures and the parent questionnaire, all of the correlations were in the direction the researchers expected, which was interpreted to mean that the findings provide evidence that the questionnaire is a valid measure of future-oriented thinking in children.

This finding provides an important new perspective on measuring future-oriented cognition in children through parent questionnaires, which may provide for a better overall view of how these skills develop. However, it is important to note that only one of the ten behavioural

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measures employed was still significantly correlated with their parent questionnaire after controlling for age and vocabulary. Further, regarding the saving board game task used, it is possible that the rules were perhaps more complicated for younger participants to understand. Similar to the board game task used by Sonuga-Barke and Webley (1993), there are many rules and lots of information to remember while participants are playing the game that may be too challenging for younger participants.

As previously mentioned, the purpose of this proposed thesis study is to determine if there is a relation between saving, prospective memory, and planning. A detailed description of prospective memory will now be discussed. First, I will define prospective memory and distinguish between different kinds of prospective memory. I will also discuss the methods of assessing prospective memory in preschoolers with a variety of tasks, the age at which prospective memory emerges in childhood, as well as some factors that might affect performance on prospective memory tasks.

Prospective Memory

Prospective memory (PM) is another future-oriented thinking skill (Atance & Jackson, 2009). As defined earlier, PM refers to remembering to do something in the future (Einstein & McDaniel, 1990), such as remembering to return a book to a friend the next time you see them. In contrast, retrospective memory refers to memory for something that has already occurred, such as remembering the name of an actor in a movie (Einstein & McDaniel, 1990). PM is essential in the day-to-day life of adults, but it is also relevant for children, as they too have to remember to do things in the futures, such as packing a jacket to bring to school (Mahy & Moses, 2011), or remembering to give a friend their toy back. The ability to do this requires a consideration for the future: one must be able to think about what will need to occur at a later

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point in time and behave accordingly. Beginning in preschool, children are typically given more responsibilities and opportunities to remember to do things in the future, and therefore have to rely on their PM abilities. Further, PM requirements in day-to-day events increase as children get older (Mahy & Moses, 2011). PM has been studied in more depth among adults, but there is some research on PM in young children, including preschool-aged children.

PM can be divided into two types: time-based PM and event-based PM (Einstein & McDaniel, 1990). Time-based PM refers to remembering to do something at a specific time (e.g., at noon) or after a specific time has elapsed (e.g., 30 minutes from now). Event-based PM, on the other hand, refers to remembering to do something when an external cue occurs (e.g., the next time I see my friend; Einstein & McDaniel, 1990). Event-based PM has been more broadly researched with preschoolers than has time-based PM, which is not surprising given the challenges young children face with telling and tracking time. Further, is it more practical to administer with preschool participants. Thus, the current study will examine the development of event-based PM in relation to saving ability, and PM will be used to refer exclusively to event-based PM.

The Early Development of Prospective Memory

When measuring PM in preschool-aged children in a laboratory setting, most event-based PM tasks require participants to recall an instruction to do something specific when they encounter a cue embedded into an ongoing task. PM tasks are designed in this way to simulate PM situations that might occur in everyday life. These situations typically involve children needing to interrupt some sort of activity they are engaged in (the ongoing task) when the PM cue appears in order to complete the PM action. Further, an important aspect of measuring PM is to ensure that the PM cue is out of view of the participant so that it cannot act as a continuous

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reminder of the task. A real-life parallel might be when a child needs to remember to give their parents a permission slip when they get home from daycare. This would require children to recognize that when they see the PM cue (their parents), they need to interrupt the activity that they are engaged in (perhaps playing) to perform the PM action (giving them the permission slip). More so, the permission slip would likely be in their bookbag, out of their direct line of sight, so there is no visual reminder of the PM cue. Furthermore, there would be a delay between when the permission slip and instructions to give it to one's parents were given, and the time at which they arrived home and saw their parents.

In laboratory-type settings, researchers often employ a card-sorting PM tasks with children (e.g., Kvavilashvili et al., 2001; Mahy & Moses, 2011). For example, in a study conducted by Mahy and Moses (2011), four- to six-year-old participants were asked to name images that appeared on cards (e.g., types of food, furniture, toys) and place the cards in a box. Mahy and Moses (2011) first introduced participants to Morris the Mole, a puppet who needs help knowing what is on the cards as he has trouble seeing in the daytime. The researchers then explained the PM task instructions, in which children are informed that cards with a specific image (animals) would require a different action, which was placing that card in a box behind them when they see it and not saying the card out loud, as Morris the Mole is afraid of animals. There is a pause of a few minutes between when the instructions are given and when the sorting task begins. Children are then given the opportunity to name and sort the cards as instructed, and their success rate with the PM cues is recorded (i.e., the number of times they remembered to put the animal card in the box behind them and not say it out loud).

In this task, naming the cards serves as the ongoing task and the animal cards act as the PM cue. The delay from when the instructions are given and when the task begins is important so

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that the reason that participants are able to recall the PM task is not just because the instructions are still in their working memory. An important aspect of these types of PM tasks is that the box where they were instructed to place the animal cards is not in their line of sight and could therefore not serve as a continuous cue as the task was being performed.

Mahy and Moses (2011) found that performance on the PM task improved with age, in that older participants completed the PM action more often than did the younger participants. However, Mahy and Moses (2011) note that six-year-olds were performing near ceiling on this task, therefore this type of PM task may not be suitable for children older than five-years-old, suggesting that this type of task is best for children between four- and five-years-old. Further, Mahy and Moses (2011) suggest that five-year-olds may have outperformed four-year-olds due to improvements in their ability to reflect on their own thoughts, allowing them to be better at considering their future and intentions to perform the PM task.

Another type of card-sorting PM task employed with young children requires participants to sort the cards as opposed to simply name them. For example, Mahy et al., (2014) instructed four- and five-year-old participants to sort images of items based on their size. This task was very similar to the card-sorting task as items were to be named and there was still a prospective memory cue embedded in the deck of which participants were given a specific action to accompany this type of card. In this study, children were told that a family was moving, and they needed help sorting items into two boxes depending on whether they were big or small. The prospective memory cue was animals; if participants saw a card with a picture of an animal, they were to ring a bell located behind them to let the family know they found their missing pet. The important, underlying aspect of these tasks is that an ongoing task is being interrupted so that the PM cue can be attended to, and so that it requires participants to recall the PM task instructions

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in order to successfully complete the task. Participants were also given a prompt at the end of the PM task, in which researchers asked about what they were supposed to do when they saw a card with an animal. Mahy et al. (2014) found that five-year-olds performed better on the PM task than four-year-olds.

In addition to the PM task, the researchers manipulated ongoing task difficulty by altering the size of the big items so they appeared smaller and the small items so they appeared bigger, thereby introducing conflict. They also manipulated cue salience by circling the PM target cards with a red border, which presumably draws more attention to those cards and in principle could help children notice the PM cue. They also measured executive function by assessing inhibition (ignoring one's prepotent response; Miyake & Friedman, 2012), working memory (the ability to use and storage information; Baddeley, 2003), and set shifting (the ability to switch from one set of instructions to a different set of instructions; Miyake et al., 2000) in order to determine if there were other variables that related to PM performance.

Overall, the researchers found that participants who completed the difficult ongoing task performed the same on the PM task, but high cue salience increased PM performance. Additionally, it was found that inhibition was related to PM performance. Mahy et al. (2014) note that overall, PM performance was low and that participants did not remember to perform the PM action very often and that this was perhaps because the ongoing task of sorting the cards and trying to find the PM cues was too difficult for participants to be successful. A possible limitation to this task is that, unlike the previously described card-sorting task, it requires both card-sorting and card naming, which may have been too difficult for the youngest participants.

There are also somewhat more naturalistic PM tasks that mirror everyday situations more so than do the card-sorting tasks. For example, Guajardo and Best (2000) used a naturalistic PM

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task, in addition to a computer-based PM task, in order to determine whether participants' ability to succeed on a computerized PM task was related to their performance on a naturalistic PM task. In the naturalistic portion of this study, three- and five-year-old participants were instructed to remember to ask the experimenter for a sticker and close the door when they were all done the computer task. A further instruction to remember to bring back a picture they were given in the first testing session and to ask for a pencil when they returned for the second session (after a longer delay) was also given. Guajardo and Best (2000) chose these tasks as they are types of activities children might encounter in a school setting. In the computer-based PM task, participants were told that they should try to remember all of the images that appeared on a screen, but they were also required to press the space bar on a keyboard when they encountered an image of a house or a duck (the PM cues).

Guajardo and Best (2000) found evidence that children as young as three-year-olds were able to demonstrate PM. The researchers also found that in regard to the naturalistic PM task, PM performance improved with age, in that five-year-olds outperformed three-year-olds. Guajardo and Best (2000) suggest that this might occur because five-year-olds are better able to develop strategies to use that will help them perform the PM task. Further, the researchers found that naturalistic and computer-based PM task performance was related when both ages were combined, but not when each age was examined independently. Guajardo and Best (2000) indicate that this may have occurred as the naturalistic task may have relied more heavily on planning than the computer task or that scripts may exist in regard to the naturalistic task, affecting the difference between the naturalistic and computer-based PM tasks.

Causey and Bjorkland (2014) also used a naturalistic PM task similar to that of Guajardo and Best (2000). Three- and four-year-olds completed either a high or low incentive PM task,

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which manipulated agency (i.e., whether the participant or the researcher was responsible for performing the action). In the high incentive condition, participants were asked to either remind the experimenter or remember (depending on the agency condition to which they were assigned) to get a sticker once they had completed the other tasks and before they left. In the low incentive condition, instead of receiving a sticker, participants were asked to remember or remind the experimenter to flip a sign on the door. Participants were also given three cues at the end of the session in order to prompt the PM action if they did not remember spontaneously. Participants remembered to perform more than half of the PM actions, suggesting that this task is perhaps less challenging than the card-sorting and naming task conducted by Mahy et al. (2014). The researchers found that incentive had an impact on PM performance, but agency did not.

Additionally, Causey and Bjorkland (2014) did not find any age-related differences in regard to PM performance. It is possible that this occurred because the task was easier to understand than previous tasks that have examined this relation, therefore even the younger children were able to succeed. As previously noted, an important aspect of PM tasks is that there is no continuous visual reminder of the PM cue throughout the ongoing task. However, in this study, the bag in which the sticker needed to be retrieved from as well as the sign that needed to be turned, were both within the participant's visual field, which may have acted as a continuous reminder to participants so that the PM target did not need to be retrieved (i.e., it was still active in working memory as they completed the other tasks).

The age at which PM appears to emerge varies across studies. Studies with participants as young as two years old have found evidence that even children that young were often able to succeed at the naturalistic memory task requiring caregivers to tell their child to remind them to do something in the future that was integrated in their everyday lives (e.g., buying candy at the

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store or bringing in the laundry; Somerville et al., 1983). The tasks varied based on high or low interest to the child in order to determine if something of higher interest to the participant would result in better PM performance as it was expected that participants may be more motivated to remember something of high interest to them. The researchers did not find an age difference between the two-, three-, and four-year-olds who participated in the study, but they did find that even the two-year-olds performed well when the tasks were of high interest to them. In contrast, Kliegel and Jager (2007) did not find evidence to support that two-year-olds were able to perform PM tasks successfully, but three-year-olds could in their card sorting laboratory-based PM task. Although not many other studies have investigated PM in two-years-olds, there have been many that assessed preschool to school aged children from age three and up (e.g., Guajardo & Best, 2000; Kliegel & Jager, 2007; Kvavilashvili et al., 2001; Mahy et al., 2014; Mahy & Moses, 2011), which generally suggest that PM performance improves between the ages of three and five years.

There are a number of factors that have been found to affect children's performance on a PM task, such as time delay (e.g., Mahy and Moses, 2011; Somerville et al., 1983), cue salience (e.g., Mahy et al., 2014), and motivation (e.g., Somerville et al, 1983; Causey & Bjorkland, 2014; Guarjardo & Best, 2000). A number of these have been addressed above, so I will briefly discuss the impact of time delay on children's PM performance.

An important aspect of PM tasks is the amount of time between when the PM instructions are given and when the task begins, and it is possible that if the task begins immediately after the instructions, that PM is not the cause for participants being able to recall what to do when they see the PM target item (for example, the animal card in a card-based PM task), but that participants are recalling it because the instructions are still in their working memory. Mahy and

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Moses (2011) manipulated the delay between when the instructions were given and when the task began and they found that five-year-olds (but not four- or six-year-olds) performed better after a long delay. Somerville et al. (1983) also manipulated the length of the delay in their PM study, and the results suggested that two- to four-year-old participants were better able to do the PM action when there was a short delay compared to a long delay. This suggests that there are many factors that may or may not increase PM performance, but that the type of task may have an impact on whether aspects such as incentive, number of intentions, or cues will be helpful for recall. For the purpose of this proposal, a standard PM paradigm will be employed, without any of these manipulations.

In summary, there has recently been an increase in research examining PM in preschoolers. Although there are a variety of tasks that measure this ability in young children, there are important similarities across them, such as having an ongoing task, a PM cue that requires a specific action, and having an amount of time pass between when the PM task is introduced and the beginning of the task (which includes the appearance of the PM cue). Finally, it is known that a variety of factors can influence young children's PM performance, including incentive, time delay, and cue salience.

Recall that another focus of the present study is to examine whether saving and prospective memory are related to another future-oriented thinking ability, that of planning. Planning and previous measures that have been used to assess planning ability in young children will now be discussed.

Planning

As previously noted, planning has been studied in relation to saving and PM and such research has found that planning ability is related to both skills. Planning refers to the use of

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strategies in order to prepare for a goal (Gauvain & Rogoff, 1989). Planning requires a consideration for the future in that one must think about what is required to achieve a goal or prepare for an event (Atance & Jackson, 2009). For example, preschoolers may require planning ability when they are faced with preparing to go outside for recess and need to plan to wear warmer attire in the winter. Researchers have suggested that planning is an aspect of future-oriented cognition as it requires a consideration for a future point in time. Ballhausen et al. (2017) conducted a study to determine if planning (measured using a route planning task) was predicted by executive function (measured using an inhibition task), general cognitive ability (measured using intelligence tests), or prospection (measured using a prospective memory task). Their results showed that planning in seven- to twelve-year-old participants was predicted by prospection, suggesting that planning is related to aspects of future-oriented thinking, thus the relation between it and other future-oriented thinking abilities (such as saving and PM) is of interest. Measuring planning in preschoolers will now be discussed.

Planning in preschoolers is often measured using tasks which require participants to follow a series of rules in order to reach an end goal. An example of a planning task employed with young children is the Tower of Hanoi (Simon, 1975). The Tower of Hanoi involves three posts and disks of different sizes that need to be stacked with the largest on the bottom to the smallest on the top. The disks start out on the first post, with the largest disk on the bottom and the smallest on top, and participants must move them to the third post so that they appear in the same order, while following a series of rules. The rules state that the disks may only be moved one at a time, from post to post, and they may never be placed on top of a disk smaller than themselves. This task requires the participant to create a strategy for how they might move the tower from the first post to the third post while considering the constraints from the rules in order

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to be successful. This task is challenging as it often requires children to move discs to the final tower only to move them back again before reaching the goal state.

A child-friendly version of the Tower of Hanoi has also been used when conducting research with preschool participants (e.g., Carlson et al., 2004; Tarasuik et al., 2017). In this variation, the rules and the task are the same, but the pegs are described as trees and the rings are described as a family of monkeys (the smallest ring is the baby monkey, the medium ring is the mommy monkey, and the largest ring is the daddy monkey). Participants are instructed that the monkeys are tired, so they need help being moved from the tree they were on already to their ‘sleeping tree’ (the last peg). Participants are told that they must follow rules when moving the monkeys: only one monkey can leave a tree at a time, that bigger monkeys were not allowed to sit on smaller monkeys, and that the monkeys must stay on the trees and cannot be placed on the ground. If participants made a mistake, the experimenter explained the rule violation and allowed them to try again. In both versions of the task, participants were scored on the number of moves they make to put all of the rings on the final post. Reaching the goal state in the minimum number of moves is considered success. Researchers have found that children generally succeed on this type of task at five-years of age (Klahr & Robinson, 1981).

Another planning task that has been used with young children is the Truck Loading task (Carlson et al., 2004). This is similar to the Tower of Hanoi in that there are a set of rules that govern how the task is played while trying to reach the final goal state. In the Truck Loading task, children are instructed that they will need to deliver mail. Specifically, there are coloured party invitations that will need to be delivered to houses of matching colours lined up along a one-way street. Children are given a delivery truck on which they can stack the invitations flat in order to deliver them to the houses. Participants are told that there are a series of rules that they

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need to follow when they stack the invitations on the truck for delivery. They are told that the invitations must match the colour of the house they are being delivered to and that they cannot go backwards as it is a one-way street, therefore they are only able to go down the street once. This means that the participants need to place the invitations in the truck in the correct order before they begin to deliver them, in that the last invitation that they would deliver would be placed on the truck first.

The Truck Loading task is separated into levels and each level corresponds to the number of houses that would have invitations delivered to them (the first level would have two houses and the last level would have five houses). If the child succeeds on the first try, they proceed to the next level. If the child does not succeed on the first try, the experimenter indicates which rule they broke and they are able to try again. If the child does not succeed on the second try, they do not move on to the next level. Children's performance is measured in terms of how many levels they successfully complete and researchers have found that children's performance on this task typically improves between the ages of four- and five-years-old (Atance & Jackson, 2009).

Another planning task used with this age group is the Zoo task (McColgan & McCormack, 2008). The Zoo task measures one's ability to consider and prepare for a future event. This task involves a piece of felt with cages containing animals on it. The cages are lined up in a semi-circle around a curved path. The cages contain an elephant, a kangaroo, a tiger, a giraffe, and a zebra. Four boxes (representing lockers) are also placed along the path, behind cages one, two, four, and five. Participants are first introduced to Molly, a doll who is visiting the zoo. Participants are further told that Molly wants to bring her camera (a Polaroid) to the zoo, and the experimenter showed the participants how the camera worked by taking a picture of Molly. The experimenter then notes that Molly needs to put her camera in a locker since she

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cannot carry it with her around the zoo. They are then shown the lockers, and that the camera should be put into a locker so Molly can get it when she is done at the zoo. Participants are then shown that Molly could only go around the zoo in one way, from the child's right to the left, and that Molly could not go around the zoo more than once or visit the same cage twice. A comprehension check is also conducted in which participants are asked to point to the start and the end of the path. Children are told that Molly wants to take a picture of the kangaroo (always located in the middle cage of the zoo; the other animals' locations varied for each participant) but that there is a locker beside the kangaroo's cage to put the camera in. The experimenter will then suggest that, "You could leave the camera in one of the other lockers and then Molly could get it when she goes round the zoo. What locker could you leave it in so that Molly is still able to take a photo of the kangaroo?" (McColgan & McCormack, 2008, p. 1483). Participants are scored on whether or not they are able to choose the correct locker to put the camera in (in this case, in either of the two lockers that appear prior to encountering the kangaroo). In general, research has shown that five-year-olds are typically successful on this task while four-year-olds are not (McColgan & McCormack, 2008).

Saving and Planning

As previously noted, young children's saving ability is a relatively new area of research, therefore there are a limited number of studies that address the relation between saving and planning. Recall that the definition of planning involves using strategies to prepare for a future goal (Gauvain & Rogoff, 1989), therefore it is considered a future-oriented thinking skill. Saving and planning in preschoolers has been shown to be related in the one reported study examining the relation (Kamawar et al., 2019). In this instance, the marble run savings paradigm and a Truck Loading task were used to measure these abilities (see above for task descriptions).

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However, it is important to note that Kamawar et al. (2019) found that the relation between planning ability and saving was only present when children were given the opportunity to create a budget, and only on the first of the two marble run saving trials. The authors interpreted this to mean that participants who were better at planning benefitted more from the budgeting condition, leading to having saved more marbles compared to those not in the budgeting condition.

Kamawar et al. (2019) suggest that preschoolers may not be able to plan to save a resource without first being given the option to budget, and therefore those with better planning ability were better able to use the budgeting options suggested to them, leading to the relation between saving and planning being present in the budgeting condition only. The researchers suggested that the relation between planning and saving having only been present in the first trial was due to some participants having potentially changed strategies and the effect of learning from the first trial, which may have potentially affected the ability to see the relation between saving and planning on trial two.

Given that only one study to date has examined the relation between saving and planning with children (that I am aware of), it is worth examining the related research with adults and this work has demonstrated a relation between these skills. Rabinovich and Webley (2007) studied whether adult participants who created a plan to save were more likely to actually save compared to those who did not create a plan to save. Results suggested that those who created a plan were more likely to save for the future compared to those who did not. Rabinovich and Webley (2007) suggest that planning to save does in fact have an impact on saving in adults. Thus, there is reason to further investigate the nature of this relation among children.

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In contrast to young children's ability to save, PM is a relatively more established area of developmental research, therefore the relation between PM and planning skills have been studied somewhat more extensively. I will now turn to that research.

PM and Planning

Planning has been shown to be related to PM in previous research (e.g., Causey & Bjorklund, 2014; Mahy & Moses, 2015). In order to complete a PM task, planning has been suggested as an important skill as participants must plan appropriately in order to determine how they will complete the PM task by thinking about what they would do should something happen (i.e., the PM cue), while considering their future goals and how they will be able to achieve them, and how they might react to the event (Causey & Bjorklund, 2014; Mahy & Moses, 2015).

Mahy and Moses (2015) found a relation between PM (using an event-based, card-sorting task) and planning (measured using the Truck Loading task) in four- to five-year-old participants when a difficult filler task (compared to a simple filler task) was employed, but not when participants were given an easy filler task. The filler tasks were completed between receiving the PM instructions and the beginning of the card sorting task and required participants to point to one of six images on a page that they had not previously pointed to for a total of six trials. In this case, the difficult filler task was made more challenging in that the images were not presented in the same location on the page, while the images remained in the same place across all trials in the simple filler task condition. This was manipulated so that participants in the difficult filler task condition had to rely only on their memory of the image when pointing to an item they had not previously seen and could not rely on where they recalled seeing on the page, presumably causing the task to be more challenging. Mahy and Moses (2015) suggest that this may occur because those who have better planning skills were able to ignore the distractions during the

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delay with the difficult filler task. They suggest that those who are better ‘cognitive planners’ (i.e., are better able to monitor a plan that requires high executive demands; Mahy & Moses, 2015) might be better able to continually monitor the task at hand with less effort.

A relation between PM and planning was also found when a time-based PM task was employed with participants between seven- and twelve-years-old (Mackinlay et al., 2009). Chernyak et al. (2017; described below) also found a relation between PM and planning using a naturalistic PM task.

Saving and PM

To the best of my knowledge, there appears to be only two studies which measure both saving and PM among preschoolers (Chernyak et al., 2017; Mazachowsky & Mahy, 2020). Chernyak et al. (2017) and Mazachowsky and Mahy (2020) do not report the relation between the saving and PM tasks, so no conclusions can be drawn about the relation between the two future-oriented skills. The study conducted by Mazachowsky and Mahy (2020) was described above. I will now discuss the other study that measured these two abilities (Chernyak et al., 2017).

Chernyak et al. (2017) wanted to determine whether getting children to think about themselves across time, in the past or future, was related to three future-oriented cognitions: PM, planning, and saving abilities. Three- to five-year old participants discussed different times points with a researcher in one of four separate conditions: near future, near past, distant future, or present. PM was measured using a naturalistic task similar to that of Guajardo and Best (2000; see above) which required participants to remember to get a gift at the end of the session. The planning task used was a mental time travel task, similar to that of Atance and Meltzoff (2005; see above) in which participants were given a hypothetical future scenario and a set of objects

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that they would be able to choose from that may help with a future need. Participants also completed a saving task, modeled very loosely on the Metcalf and Atance's (2011) marble run task, in which they were given five dinosaur stickers and given the option to stick them on plain white paper right away, or save them to stick on a fancy page with a dinosaur scene (which is presumably more preferred than the plain paper). Finally, the researchers also conducted a DoG task in which when given the prize at the end of the prospective memory task, children were asked if they wanted that one toy right away or if they were willing to wait until the end of the day in order to get two toys. The researchers found that participants who discussed either their near past or near future were more successful on PM and planning tasks than the participants who discussed the other two time points. The researchers suggest that talking about one's self in the future may contribute to making the future-self seem less distant from one's present self.

Chernyak et al. (2017) suggest that the results of their studies can inform day-to-day life if caregivers are conscious that talking to their young children about the future can help them better understand their future selves. However, the inter-relation between saving and prospective memory was not reported, which leaves the question of whether these future-oriented abilities are related unanswered.

In summary, there has been limited research regarding the contribution of planning to saving and PM. Kamawar et al. (2019) report a relation between saving and planning, but only when participants were given the option to budget using a marble run savings task. Mahy and Moses (2015) noted a relation between planning and PM, but only when a difficult filler task was used between when the instructions for the task were given and when the task began. Further, Chernyak et al. (2017) and Mazachowsky and Mahy (2020), to my knowledge, conducted the only studies in which both saving and PM in preschoolers was measured. Neither Chernyak et al.

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(2017) nor Mazachowsky and Mahy (2020) report the results regarding the relation between saving and PM, therefore there is still uncertainty regarding their relation. This gap in the literature regarding the relation between saving, PM, and planning in young children has yet to be addressed. Such information is valuable as it would help contextualize young children's saving ability within the context of other future-oriented skills.

Present Study

Although research in future-oriented thinking in preschoolers has been gaining momentum in recent years, there are still plenty of questions that have yet to be answered. Atance (2015) notes the importance of understanding the underlying cognitive mechanisms in how prospection develops in early childhood. Saving, PM, and planning are all abilities that are often used in everyday life, even in young children, but there are limitations in our understanding of these abilities, specifically in terms of how they may be related to each other and other future-oriented thinking abilities. More specifically, a clearer understanding of whether saving is related to other types of future-oriented thinking can help us better understand what impacts young children's ability to save. The present study was going to be an attempt to address the question of the relation among saving, PM, and planning skills.

The present study had intended to determine how these future-oriented thinking skills (saving, PM, and planning) are related to each other. Given that previous research has suggested that saving and planning are related (Kamawar et al., 2019) and that PM and planning are related (e.g., Mahy & Moses, 2015; Causey & Bjorkland, 2014), this relation was of interest. Additionally, the relation between saving and PM, and how these three future-oriented thinking skills are related to each other was also of interest. Overall, the goal of the present study was to

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determine if saving is related to these other more established future-oriented thinking skills (PM and planning).

The planned study was designed to include two tasks for each skill. The token saving task (Dueck et al., 2019) and the sticker saving task (Chernyak et al., 2017) would have been used to measure saving ability. The token saving task was chosen instead of a marble run task (Atance et al., 2017; Kamawar et al., 2019; Metcalf & Atance, 2011) for two reasons. First, it is a saving task that uses tokens in order to ‘purchase’ an item, thereby potentially extending its generalizability to money-like saving situations while still being age-appropriate for young children. Second, it has a practical advantage to the marble run task in that it is more easily transported to where testing will occur. There would have been one main variation in regard to the Dueck et al. (2019) task: the present study would have used toys and stickers instead of smarties and raisins so that it is able to be transported to daycares and schools that may have restrictions on which food items can be brought in. Our lab is currently in the process of using this variation successfully (Jerome & Kamawar, in progress). The sticker saving task (Chernyak et al., 2017) was chosen as another measure of saving ability in preschoolers in order to compare saving ability across the two tasks.

In order to measure PM ability, a card-sorting PM task (Mahy & Moses, 2011) and a naturalistic PM task (e.g., Guajardo and Best, 2000; Causey & Bjorkland, 2014) would have been employed. The PM tasks that were selected are age-appropriate versions of a card sorting and naturalistic event-based, tasks that has been used in a number of other studies with this age group (e.g., Kvavilashvili et al., 2001; Kvavilashvili & Ford, 2014; Mahy & Moses, 2011; Mahy & Moses, 2015; Guajardo & Best, 2000; Causey & Bjorkland, 2014). Further, the card-sorting task can be easily transported to childcare centres for testing and the naturalistic PM task is easy

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to administer. Finally, planning was to be measured using the Truck Loading Task (Carlson et al., 2004) and a modified Tower of Hanoi (Carlson et al., 2004). These tasks were chosen as they have shown to measure planning ability in preschoolers in previous research or have also been used in relation to saving or PM (e.g., Carlson et al., 2004; Mahy & Moses, 2015; Kamawar et al., 2019).

Hypotheses

The hypotheses for the present study are as follows:

1. The first hypothesis was that children who are better savers (as evidenced by the composite score of the saving tasks in regard to number of tokens and stickers saved) would be more successful on the planning tasks (as evidenced by the composite score of the Truck Loading task and Tower of Monkeys task), after controlling for age (in months) and language. This was predicted because planning has been shown to be related to saving in previous research (Kamawar et al., 2019) and because in order to save one must consider the future and create a plan to save.
2. Second, it was hypothesized that children who are more successful on the PM tasks (as evidenced by the composite score of the card-sorting task and naturalistic task) would also be more successful on the planning tasks (as evidenced by the composite score of the Truck Loading task and Tower of Monkeys task). This was predicted because PM has been shown to be related to saving in previous research with this age group (e.g., Causey & Bjorklund, 2014; Mahy & Moses, 2015).
3. The third hypothesis was that children who are better savers will also perform better on the PM tasks. More specifically, I hypothesized that children with higher saving scores on the saving tasks (as evidenced by the composite score of the token saving task and

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sticker saving task) would be more successful on the PM tasks (as evidenced by the composite score of the card-sorting and naturalistic tasks), above age (in months) and general language ability.

4. The fourth hypothesis is that saving, PM, and planning performance will be inter-related as each of these abilities requires consideration for the future. Further, previous research has suggested that saving and planning are related (Kamawar et al., 2019) and that PM and planning are related (e.g., Causey & Bjorklund, 2014; Mahy & Moses, 2015). More specifically, I hypothesize that the saving tasks (as evidenced by the composite score of the token saving task and sticker saving task) will be correlated with the PM tasks (as evidenced by the composite score of the card-sorting task and naturalistic task) and the planning tasks (as evidenced by the composite score of the Truck Loading task and Tower of Monkeys task) above and beyond the contributions made by age (in months) and PPVT.

Method

Participants

I had planned to recruit approximately 80 participants (determined by running a power estimate) between the ages of four- and five-years from preschool, daycare centers, and schools in Moncton, New Brunswick, and the surrounding area. The participants would have ranged from ____ to ____ months of age ($M=$ ____, $SD=$ ____). ____ participants indicated that their gender was female and ____ indicated their gender was male. Once ethics clearance was obtained, consent forms were sent to preschools and daycare centers explaining the study and what is required. Further, I applied for permission to conduct my research within the Anglophone East School District Board so that I could recruit at elementary schools. After consent from the

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directors and/or principals was obtained, consent forms were distributed to parents. Due to unforeseen circumstances involving the SARS-CoV-2 pandemic, ethics required that research requiring interaction with participants be concluded, therefore no further recruitment or testing was able to occur. What follows is what I would have done should data collection have been able to continue. Written consent from the parents and verbal assent from the children would have been required before any tasks were administered. Children would have been told that they can stop a testing session at any time, and the researcher would have ensured that no child became upset or uncomfortable, and would have ended a session early if necessary. Each child would have received stickers for their participation, regardless of the number of tasks they were able to complete, and participants would have also been allowed to keep any stickers or toys they received throughout the saving tasks and naturalistic PM task. Preschool, daycare centers, and school classrooms would have been given an age-appropriate storybook when testing was completed to thank them for participating.

Procedure

Testing sessions would have taken place in a quiet area of the daycare or school which the participants attend. Children who had signed consent forms from parents would have first been asked if they would like to play some games with the experimenter and they would be told that they can stop playing at any time. Participants would have completed the tasks individually and testing sessions would have occurred over two 20-minute sessions on two separate days. Each session would have included the naturalistic PM task, and the instructions for this task would have been given prior to commencing any activity. In the first session, children would have begun with a warm-up activity, but this task will not be discussed in this thesis. The first session would have also included the token saving task, the card-sorting PM task, and the Truck

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Loading task. The second session would have included the sticker saving task, the Tower of Monkeys task, the PPVT-V, and another measure (which will not be discussed in this thesis).

The tasks would have been kept in a fixed order as is typical for research that examines individual differences when interpreting correlations (for more about this reasoning, see Carlson & Moses, 2001).

Saving Tasks

Token Saving Task

The token saving task that would have been used in this thesis is adapted from Dueck et al. (2019) by Jerome & Kamawar (in progress; see Appendix G for full protocol and images) and would have been one of two measures of saving ability. While there are many similarities between the Dueck et al. (2019) task described above, there are some important variations so the task will be described in full detail here. Children would have been told that they are going to play two games with prizes, a toy game and a sticker game. There would have been two trays, one green and one blue, each with a colour-matched bowl that contains either stickers or toys (one type per tray). The blue tray would have contained ten small toys and the green tray would have contained ten stickers (see Appendix A for examples). Accompanying each tray would have also been a small colour-matched box in which children could place their tokens. Children would have first been asked to indicate which five stickers and which five toys from the trays they preferred and place them into the bowl on that tray. This would have been done in order to ensure that the children found the toys and stickers appealing in both games. Additionally, the experimenter would have chosen a toy and a sticker that they ‘like the most’ and placed them into the respective bowls. The bowls (with either six stickers or six toys) would have then been placed onto the trays of corresponding colour and the unchosen prizes would have been put

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away. Next, a preference check in which participants would have been asked if they prefer the toys or the stickers more would have been used to determine which order the games would be played. If the children chose the toys as their favourite, they would play the toy game second, and if they chose stickers as their favourite, the sticker game would be played second (i.e., they play their least preferred game first).

The experimenter would have then placed seven tokens on the table, in front of the child. It would then be explained that they may use one token in order to get one prize by placing the token into the box, and that once a token goes into the box, it cannot be removed because it is 'all used up'. The experimenter would have then demonstrated how the toy and sticker games are played by putting one token into the box and taking a prize (the experimenter will take the toy or sticker prize that they had previously chosen) and placing the prize into a white box. The child would have also been given their own white box and explained that once a prize is collected, that they must put the prize in their box while they play the games. This would have been done in order to ensure that the child does not get distracted by the prizes they have already obtained. After the demonstration was complete, there would have been five tokens remaining on the table which were to be used by the children during the task. It would have been made clear to the children that there are no more tokens available beyond those five.

Children would have been given three minutes with each game, beginning with the game they indicated was their least favourite, with the other game out of sight. The experimenter would have pretended to be working during the three minutes (writing on a clipboard) and would not have interacted with the child. If the child asked them a question, the experimenter would have responded with, "I have to do my work over here". Next, this would have been repeated with the more preferred game. If participants used all five tokens in the first game, they would

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have been told, “Guess what? We’re lucky! I found five more tokens, so you get to play the [preferred prize] game!”. The procedure would have been the same as for the first, least preferred prize game.

At the end of the task, all of the prizes would have been placed in an envelope and given to their classroom teacher until the participants go home. The number of tokens that are saved for the second game would have been recorded (0 – 5).

Sticker Saving Task

In the sticker saving task (from Chernyak et al., 2017; see Appendix H for full protocol), participants would have been shown five dinosaur stickers and would have been told that they could use the stickers right away on a plain, white piece of paper, or they could wait a few minutes while the experimenter completed some work, and if they saved some stickers, they would be able to use them on a more interesting piece of paper (they would be shown a piece of paper depicting a dinosaur scene). The experimenter would have then worked for three minutes while making little contact with the child. If the child attempted to interact with the experimenter, the experimenter would have said, “I have to do my work over here”. After three minutes passed, the experimenter would have given the child the dinosaur paper and they would have been given time to place any remaining stickers on the scene. Participants would have been given one point for each sticker they saved for the dinosaur paper for a score ranging from zero to five.

PM tasks

Card-Sorting PM Task

The card-sorting task would have been the task used by Mahy and Moses (2011; adapted from Kvavilashvili et al. (2001); see Appendix I for images and protocol). Children would have

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first been told a story about Morris the mole (a stuffed animal). It would be explained that Morris the mole has difficulty seeing during the day and needs the child's help to sort some cards.

Children would have been given four decks of cards, each containing 13 cards with a variety of images of everyday objects on them, such as food, furniture, and toys. The children would have been told that in order to help Morris, they should say, out loud, what they see on the card one at a time, since he has a hard time seeing them but wanted to know what was being depicted on each card. In addition to the pictures of these items, there would have been two images of animals placed at varying locations throughout the deck which would have acted as the PM cues. Children would have been told that Morris is afraid of animals, and that if they see an animal card within the deck that they should put it in the box behind them and not say it out loud, as not to scare Morris. The animal cards would have been placed as the 7th and 12th card in deck one, the 4th and 10th card in deck two, the 6th and 11th card in deck three, and the 5th and 10th card in deck four, as was the order used by Mahy and Moses (2011).

Before the task began, two practice trials would have been conducted in which children would have been asked to name what is on the card. Prior to beginning the task, a comprehension check would have been included in which the children would have been asked what they should do if they see an animal card. As per Mahy and Moses (2011), there would have then been a three-minute delay between when the instructions were explained and when the task began with the first deck of cards during which the child would draw some picture for Morris. Additionally, after completing one deck of cards and beginning the next deck, children would have been given three minutes to draw. After completing all four decks of cards, children would have been given a memory check and asked, "What you were supposed to do when you saw an animal?" (as per Mahy & Moses, 2011, p. 274) to ensure that it was not a retrospective memory error of the

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instructions that caused the issues with the PM cue. PM performance would have been measured by scoring each correct placement of the target animal cards into the box behind them as one point, for a maximum score of eight points. This score would have been used in the analyses.

Naturalistic PM Task

A naturalistic PM task (adapted from Guajardo & Best, 2000; see Appendix J for full protocol) would have been used as a measure of PM ability in addition to the card-sorting PM task. Participants would have been given two opportunities to complete this task, once during the first session and once during the second session. At the beginning of the first session, participants would have been shown a box and informed that there is a gift inside for them that they could have when they are all done playing games that day. The experimenter would have told the participants that they should remind them to open the box and give them the gift when the experimenter says, “we’re all done for today!” (the PM cue) and before they go back to their class. When the testing session was complete, the experimenter would have waited approximately ten seconds after the PM cue and would then provide a second cue, “Did you have to remind me of something?” and would have waited ten more seconds. If the participant failed to respond, the experimenter would have opened the box and given the gift to the child. Participants would have received a score of two if they remembered the box without needing the second prompt, a score of one if they required the second prompt, and a score of zero if they did not remember. The same procedure would have occurred for the second session. Total scores across both sessions would range from zero to four.

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Planning Tasks

Truck Loading Task

The Truck Loading task would have been one measure of planning ability (drawn from Carlson et al., 2004; see Appendix K for protocol and images; note that this task was described in detail in the introduction on page 31). Children would have received a score of one for each level they complete, for a range of scores between zero and four. This score would have been used in the analyses.

Tower of Monkeys

A modified Tower of Hanoi, the Tower of Monkeys, would have been another measure of planning ability (Carlson et al., 2004; see Appendix L; note that this task was described in detail on page 31 of the introduction). As described in the introduction, participants would have been shown a board with three pegs which will be introduced as trees. Participants would have begun with a practice trial, in which the researcher would have shown them two different sized rings. The smaller ring would have been introduced as the little brother monkey and the bigger ring would have been introduced as the big sister monkey. Participants would have been instructed that the bigger monkey cannot go on top of the smaller monkey, and that the table surrounding the pegs is ‘water’, so the monkeys cannot be placed on the table as they cannot swim. After a comprehension check to ensure that participants understood the rules, the experimenter would have begun with trial one. The experimenter would have brought out a second board with pegs and rings, and explained that the participant’s monkeys are copycat monkeys, and they need to move their monkeys to new trees so that they can match the experimenter’s monkeys. Each level would have had a specific number of moves required in order to achieve the goal state. If a rule was broken, the experimenter would have explained the

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mistake and ask the child to try again, or if the participant took too many moves, they would have been asked to try again (for a maximum of two tries per level). If the child did not follow the rules or takes too many moves a second time, they would not go on to the next level. As the levels progress, a third ring (introduced as the baby monkey) would have been added and the trials would increase in difficulty as they would require more steps in order to be completed. Children would have received a score of one for each level they achieved, for a range of scores between zero and six. This score would have been used in the analyses.

If performance on each pair of tasks (per skill) were correlated, then composite scores would have been computed. For example, children's total number of saved items (up to five tokens and up to five stickers) would indicate their saving performance (out of a total of ten). For the planning measure, children's scores on the two tasks would have been summed for a score out of eight to indicate Planning performance (the score on the Tower of Monkeys Task would have been first scaled to be out of four so it would be equally weighted with the Truck Loading task). Finally, PM performance would have been summed across the two tasks for a score out of four (with the number of successful PM trials scaled to be out of two, so as to equally weight the two tasks). If performance between pairs of tasks for a given skill were not correlated, relations would have been examined individually for each measure.

Peabody Picture Vocabulary Test – Fifth Edition (PPVT-V)

An abbreviated version of the PPVT-V (Dunn & Dunn, 1997; see Appendix M) would have been used as a measure of children's receptive language abilities and would have been used to control for general language ability. This would have been used because the tasks require instructions to be given verbally and sometimes require verbal responses, therefore the PPVT-V would have been used to ensure that any differences in general language ability could be

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controlled for, thereby allowing me to interpret remaining correlations without being concerned that they are being carried by language ability. Participants would have been instructed to match images they would be shown with the word an experimenter would say, as per the task manual. There would be four images that the participants can choose from to match with the word the experimenter says. Participants would have begun with two to four practice trials and the experimenter would have provided feedback. Typically, there would have been 12 trials in each set, and participants would have continued with a new set until they make eight mistakes in a set, and each set would have become more difficult. However, for the purpose of the present study an abbreviated version would have been used (as done in Skwarchuk et al., 2014; Vendetti, et al., 2019). All participants would have begun where five-year-olds begin (Set three) and would end when eight or more errors are made, or when they reach Set 11 (whichever comes first). The raw score would have been calculated by subtracting the number of errors participants made from the ceiling item reached. This score would have been used in the analyses.

Planned Analysis

Unexpected Circumstances

In February, I received ethics clearance to begin this study (CUREB-B, #112111). I began recruitment at a number of schools and daycares near Moncton, New Brunswick, with consent forms sent out and one session of data collection completed when everything was shut down due to SARS-CoV-2. At that point, I had collected session one data on two participants. In this thesis, I will report the descriptive information about those two participants, but I will mostly report the analyses I would have done, had I had sufficient data to run them.

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Preliminary Analyses

An alpha of .05 would have been used for all statistical analyses. Sample sizes, means, and standard deviations for all measures would have been found in Table 1. Data was collected for two participants for session one, and their descriptive statistics can be found in Table 1.

The skewness and kurtosis statistics of these measures would have been checked and would have been considered normal if the skew index was less than three and the kurtosis index was less than ten (Kline, 2016). If they were not, the appropriate normalizing transformation would have been conducted (Kline, 2016). For example, if there had been a positive skew, I would have added a constant of 1.0 to the data and then performed a square root transformation.

Table 1.

Sample Size, Means, and Standard Deviations for all Measures

	Total Sample			4-Year-Olds			5-Year-Olds		
	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>	<i>n</i>	<i>M</i>	<i>SD</i>
Saving									
Token Task	2	0	0	-	-	-	2	0	0
Sticker Task	-	-	-	-	-	-	-	-	-
Prospective Memory									
Naturalistic	2	0.5	0.35	-	-	-	2	0.5	0.35
Card-Sorting	2	6	1.41	-	-	-	2	6	1.41
Planning									
Truck Loading	2	3.5	0.71	-	-	-	2	3.5	0.71
Tower of Monkeys	-	-	-	-	-	-	-	-	-
PPVT-V	-	-	-	-	-	-	-	-	-

The distribution of scores for number of tokens saved on the token saving task would have been found in Figure 1. The distribution of scores for number of stickers saved in the sticker saving task would have been found in Figure 2. Assuming a significant, positive correlation of at least .5 between these two tasks was found, ($r(df)=$, $p=$) a composite score would have been formed by averaging each child's score across the tasks (each of the tasks had a

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total score out of five). Higher composite scores would have indicated better performance on the saving tasks.

The distribution scores for performance on the naturalistic PM task would have been found in Figure 3. The distribution scores for performance on the card-sorting PM task would have been found in Figure 4. Assuming a significant, positive correlation of at least .5 between these two tasks was found ($r(df)=$, $p=$), a composite score would have been formed by averaging the two scores, after scaling the card-sorting PM task to be out of four, to make it match the naturalistic task. Higher composite scores would have indicated better performance on the PM tasks.

The distribution scores for performance on the Truck Loading task and Tower of Monkeys task would have been found in Figure 5 and 6 respectively. Assuming a significant, positive correlation of at least .5 between these two tasks was found ($r(df)=$, $p=$), a composite score would have been formed by averaging the two scores (after scaling the tasks so that each would have had a possible score of two). Higher composite scores would have indicated better performance on the planning tasks.

Performance on Saving, PM, and Planning Tasks

To test my first three hypotheses, I would have conducted a partial correlation across all tasks, after controlling for age (in months) and language ability (PPVT-V performance). This information would have been reported in Table 2.

In order to test my first hypothesis, that saving and planning ability are correlated, I would have examined the partial correlation between the saving composite score and the planning composite score, while controlling for age (in months) and PPVT performance. If there had been a significant, positive correlation between saving and planning ($r(df)=$, $p=$), this would

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have supported my second hypothesis. If the correlation between saving and planning was not significant ($r(df)=, p=$), it would have suggested that saving and PM are not related, and I would have failed to find support for this hypothesis.

To test my second hypothesis, which was that PM and planning performance are correlated, I would have examined the partial correlation with age (in months) and PPVT performance controlled for (again, using composite scores). If there had been a significant, positive correlation between planning and PM, it would have suggested that planning and PM are related ($r(df)=, p=$), thereby supporting this hypothesis. If the correlation between planning and PM was not significant ($r(df)=, p=$), it would not have supported this hypothesis.

To test the third hypothesis, that those with higher saving scores would be more successful with PM, I would have examined the partial correlation (two-tailed) between the saving and PM composite scores controlling age (in months) and PPVT performance. If there was a significant, positive correlation between saving and PM, it would have suggested that saving and PM are related ($r(df)=, p=$), and would have been in support of my hypothesis. If the correlation between saving and PM was not significant ($r(df)=, p=$), I would not have found support for my first hypothesis.

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Table 2.

Correlations between Saving, PM, and Planning Task Performance while Controlling for Age (in months) and General Language Ability, N= ____

Measure	1	2	3	4	5	6
Saving						
1 Token Task						
2 Sticker Task						
Prospective Memory						
3 Naturalistic						
4 Card-Sorting						
Planning						
5 Truck Loading						
6 Tower of Monkeys						

* = $p < .05$ ** = $p < .01$

Exploratory Factor Analysis

The final hypothesis was to determine whether there was an interrelation among saving, PM, and planning ability. An exploratory factor analysis would have been conducted to test this possibility. Age (in months) would have been controlled for in this analysis. Table 2 would have included the partial correlations and, should they have all been above .3 (which would have suggested that there was no relation between variables) but less than .9 (as this may have suggested multicollinearity; as per Yong & Pearce, 2013) , I would have proceeded with the factor analysis. First, correlations among the six items would have been examined to ensure that they were correlated with at least one other item. If Bartlett's test of sphericity was significant ($\chi^2(_) = _, p < .05$), it would have indicated that the analysis could proceed as the correlations would have been considered to have patterned relationships. The Kaiser-Meyer-Olkin measure (KMO = $_$) would have indicated that the sample data was adequate for factor analysis. Had

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the data failed to meet these assumptions I would have attempted to find a solution. For example, should there have been multicollinearity, I would have removed the item that was causing it and proceeded with the analysis. Further, had the KMO measure not indicated that the sample data was suitable for analysis, I would have removed the item that was causing the issue. I will describe what pattern of findings would have supported a one- and two-factor model.

Table 3.

Exploratory Factor Analysis

Items	Factor			
	1	2	3	4
Saving				
Token Task				
Sticker Task				
Prospective Memory				
Naturalistic				
Card-Sorting				
Planning				
Truck Loading				
Tower of Monkeys				

Factor Analysis for the One-Factor Model

Using a cut-off point of .4 and the Kaiser criterion of eigenvalues greater than one, and assuming that there was one underlying factor that explained the variance, the maximum likelihood factor analysis would have suggested that a one factor solution was the best fit for the data and accounted for ____% of the variance. The results of the factor analysis would have been found in Table 3. The results of this factor analysis would have suggested that saving, PM, and planning and loaded onto a single factor, suggesting that there is an underlying factor across the

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three abilities. This factor would have had an eigenvalue of __ and accounted for ____% of the variance. This finding would have suggested that there is an underlying cognitive ability that explains a large portion of the variance between these three future-oriented thinking abilities. Model fit indices for each model would have been found in Table 4.

Factor Analysis for the Two-Factor Model

Using a cut-off point of .4 and the Kaiser criterion of eigenvalues greater than one, and assuming that two factors explained the variance between the variables, the maximum likelihood factor analysis would have suggested that a two factor solution was the best fit for the data and accounted for ____% of the variance. The results of the factor analysis would have been found in Table 3. These possible results of this factor analysis would have suggested that saving, PM, and planning did not load onto a single factor and instead the data fit best for the model containing two factors (with the specifics to be based on which tasks loaded on to each factor). Loadings would have been assessed in order to determine if there was a way to categorize the groupings. This would have suggested that there is not a single, underlying factor that accounts for the variance among these three future-oriented thinking abilities. One of the factors would have had an eigenvalue of __ and accounted for ____% of the variance and the other factor would have had an eigenvalue of __ and accounted for ____% of the variance. This finding would have suggested that there is not a single underlying cognitive ability or experience that explains the variance between these three future-oriented thinking abilities. Model fit indices for each model would have been found in Table 4.

Table 4.

Model Fit Indices

Models	χ^2	<i>df</i>	<i>p</i>	CFI	RMSEA	SRMR	AIC	BIC
1 factor								
2 factors								
3 factors								

I will be pre-registering this study with the Open Science Initiative before data analysis occurs. As the data collection for this study has been delayed, careful consideration and time has been taken regarding the planned analyses. This will contribute to the Open Science Initiative as the analyses were planned in great detail a priori and will be less affected post hoc.

Discussion

The main goal of the present study was to determine how future-oriented thinking skills, more specifically, saving, PM, and planning are related to one another in young children, as it would provide insight into our understanding of the development of future-oriented cognition. Children would have been administered two saving tasks, two PM tasks, and two planning tasks, in addition to a vocabulary measure. Given that previous research has shown that saving and planning, and PM and planning, were related (e.g., Kamawar et al., 2019; Mahy and Moses, 2011), it was expected that all three future-oriented skills would be inter-related.

Given the SARS-CoV-2 situation, and the necessary social distancing measures put in place, it was not possible to empirically test these possibilities. It is worth noting that the proposed study will be completed as soon as it possible to directly interact with participants again. Given the current situation, the Chair of Psychology (Dr. Joanna Pozzulo) and the Graduate Supervisor of Psychology (Dr. Michael Wohl) both indicated to my supervisor (Dr.

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Deepthi Kamawar) that I could proceed with my thesis by examining the potential interpretation for finding, and failing to find, support for my hypotheses (see Appendix P for screenshots of the approval emails). The discussion section reports such interpretations.

Performance on Saving and Planning Tasks

My first hypothesis was that children who succeeded on the saving tasks would also be more successful on the planning tasks. If the saving composite score had been significantly, and positively, correlated with the planning composite score (after controlling for age and vocabulary), there would have been support for this hypothesis. This would have suggested that saving and planning, which are both considered future-oriented thinking abilities, are in fact related. It is possible that this occurs because both saving and planning require a consideration of a future point in time, and that once this ability has been developed, that it is relevant to success on both saving and planning tasks. Saving requires participants to consider their future selves and in turn, prepare for that future by avoiding consuming a limited resource right away. Saving, therefore, requires a certain planning component, in order to think about and prepare for the future by considering the resource that one currently has and how one might need to save it for a future prize. This finding would have provided support that saving and planning are related abilities that develop around the same time in early childhood. Further, this finding would have been consistent with previous research that suggested a relation between saving and planning in young children (i.e., Kamawar et al., 2019), but importantly would have extended this finding by demonstrating it with the use of different tasks. Kamawar et al. (2019) measured saving using a marble run paradigm and measured planning using the Truck Loading task. The present study would not have been a mere replication of this earlier work, but it would have extended it by: (1) measuring saving using two different kinds of saving tasks (token saving task and sticker saving

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task); and (2) including two different kinds of planning tasks (Tower of Monkeys and Truck Loading task), including one which had not been examined in relation to saving (Tower of Monkeys). Therefore, the hypothesized finding would have been more meaningful than that seen in earlier research as it would have provided support for the relation between saving and planning in young children using a variety of tasks. This would have been an important finding as it would have provided further support that previous research had only been able to suggest under certain circumstances (i.e., under a budgeting condition only; Kamawar et al., 2019). This would have contributed to our understanding of what impacts young children's ability to save, suggesting that planning is related to this skill.

If the composite score for the saving tasks and the planning tasks had not been significantly correlated after controlling for age and vocabulary, my first hypothesis would not have been supported. This would have suggested that saving and planning were not empirically related, though they appear to be conceptually related. This would have been inconsistent with previous findings regarding this relation (i.e., Kamawar et al., 2019). Such a discrepancy may have been due to the differences between tasks used; perhaps the saving task used by Kamawar et al. (2019), which measured saving using a task which required saving the limited resource itself, made different demands than did the token saving tasks measured saving in the present study. Further, Kamawar et al. (2019) found that saving and planning were related only for participants in the budgeting condition (i.e., those who were given the opportunity to create a budget for saving their marbles), and suggested that this was because better planners benefitted more from the budgeting condition, which meant they had saved more marbles than those who were not in the budgeting condition. Kamawar et al. (2019) only found that this relation was present in the first of their two trials, and suggested that this may have been because participants

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adapted their strategies between the trials, which impacted the ability to see the relation between saving and planning in trial two.

If the present study had not found a relation between saving and planning, it might suggest that saving and planning are only related given the right circumstances (e.g., budgeting, trial number) or that the type of tasks used was driving the relation, or possibly that they are not related. Had I failed to find a relation between the composite scores for saving and planning, I would have followed up to see if there was specific relation between the sticker task (as it required one to save the limited resource itself) and the Truck Loading task to determine whether they would be related, as in Kamawar et al. (2019). This would have suggested that saving and planning, although both considered future-oriented thinking abilities, perhaps rely on different aspects of saving (i.e., saving the resource itself or saving a token) in order for participants to be successful on the tasks that measure these abilities. This would have contributed to our understanding of these abilities by indicating that they only correlate under specific circumstances.

To determine the nature of those circumstances, future studies should consider looking at this relation by expanding the number, and types, of saving and planning measures employed. The present study only included one trial of each saving task, and Kamawar et al. (2019) only found a relation between the two abilities on the first trial, therefore future research could use a modified version of the present study's saving tasks to determine if the relation between saving and planning is present using these tasks when participants are given a second trial and an opportunity to plan for saving. This would provide evidence that saving improves with learning across trials with a different saving task than the marble task used by Kamawar et al. (2019). Future research could also address this question by comparing performance on the saving board

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game task used by Mazachowsky and Mahy (2020) with the planning tasks, as the board game task provides many opportunities for saving (i.e., children have the opportunity to save each time they visit a new store during the game). This would allow for a better understanding of how saving and planning are related when children are given more than one opportunity to save.

It is also important to note that a greater number of tokens or stickers saved does not necessarily indicate that a participant is a better saver. For example, someone who saves only two or three tokens or stickers for their desired reward or more interesting paper may be trying to avoid boredom during the three-minute delay, which might be a valuable strategy as well. Thus, saving more tokens or stickers does not necessarily indicate that a participant is a better saver than someone who saves at least a few tokens or stickers for after the delay. Future research could consider a participant a successful saver if they save at least some tokens or stickers, or, more specifically, if they save more than half of the resource for their preferred prize or more interesting paper. This may be a better indication of saving ability as saving all of the resource is not necessarily the only saving strategy.

Performance on PM and Planning Tasks

The second hypothesis was that children who were more successful on the PM would also be more successful at planning. If there was a correlation between the composite scores for these skills after controlling for age and vocabulary, it could have been suggested that PM and planning were related. This finding would have been consistent with previous research (e.g., Causey & Bjorklund, 2014; Mahy & Moses, 2015). This finding was expected as both PM and planning are future-oriented thinking skills, and in order to be successful on a PM task, there is a certain planning component. For example, in order for one to remember to ask the experimenter for a prize at the end of the session, the participant needs to prepare for how they might do this

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when the instructions are first explained. Therefore, planning is associated with one's PM performance.

It is, however, possible that there are other aspects of both the planning and PM tasks that would have contributed to their relation. For example, both the PM and planning tasks depend on retrospective memory. In the PM tasks, participants needed to recall what to do when they encountered the PM cues, and in the planning tasks, participants needed to recall the planning instructions (e.g., the rules for how the truck was allowed to move in the Truck Loading Task and the rules about how the monkeys were supposed to move in the Tower of Monkeys Task). Further, both the PM and planning tasks rely on working memory, as the card-sorting PM task and both planning tasks required participants to hold information in working memory as they carried out the tasks (i.e., hold the PM cue and planning rules in working memory). It is possible that participants who had more developed retrospective or working memory, or both, would have been more successful on both of these tasks, which may have led to the relation. Future work could test for this by conducting studies that measure working memory and retrospective memory in addition to planning and PM, in order to control for the former two abilities in analyses. If it was found that retrospective memory or working memory significantly affected performance, then it would indicate that these abilities have an impact on success for these types of tasks. Alternatively, if it was found that retrospective memory or working memory did not affect performance, then it would indicate that these abilities do not affect success on these types of tasks. Either way, such a study would provide more information about how working memory and retrospective memory impact these future-oriented thinking abilities and would further allow for a better understanding of how planning and PM might be related, above and beyond working memory and retrospective memory.

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If there was not a correlation between the PM and planning composite scores after controlling for age and vocabulary, the second hypothesis would not have been supported and it would not have been appropriate to suggest that PM and planning were related. This would have been inconsistent with previous research suggesting that planning and PM were related (e.g., e.g., Causey & Bjorklund, 2014; Mahy & Moses, 2015). This would have been an especially interesting finding as Mahy and Moses (2015) used a card-sorting PM task and the Truck Loading planning task (two of the four PM and planning tasks used in the present study) when they found a relation between planning and PM. However, Mahy and Moses (2015) only found a relation when a difficult filler task was used, and not when participants completed an easy filler task (recall that a filler task refers to the task that participants perform between when the instructions for the PM task are given and when the PM begins). The present study did not manipulate filler task difficulty, and participants would have simply been required to draw some pictures between when the instructions were given and when the PM task began. As Mahy and Moses (2015) suggested, they may have only found that those with better planning skills performed better on the PM task with a difficult filler as those with better planning skills would have been better able to ignore the distractions during the difficult filler task delay. Therefore, because participants in the present study would have only completed what they would call an ‘easy filler task’, it is possible there may not have seen a relation between PM and planning.

Relatedly, Chernyak et al. (2017) also note that PM and planning are related when using a naturalistic PM task, as was used in the present study, therefore a finding suggesting these abilities are not related would be surprising and contradict previous research. However, Chernyak et al. (2017) used a mental time travel task as their planning task, and it is therefore possible that this type of task does not fully capture planning ability as it is more commonly used

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as a measure of general future-oriented thinking ability (Atance & Meltzoff, 2005). Further, Mackinlay et al., (2009) also found a relation between PM and planning, however, their study involved a time-based PM task, in contrast to the event-based PM tasks employed in the present study, therefore it is possible that time-based tasks are more closely related to planning ability than event-based tasks. This is perhaps because they specify a specific time in the future that participants would know is coming, and therefore be able to plan more specifically for, which might explain why those who are more successful on this type of task are also more successful planners. It is possible that the ambiguity of when the event cue in an event-based task might occur adds a more challenging layer for planning and therefore success on the PM tasks that would have been used in the present study would be less dependent on planning ability. Future studies could address this by measuring PM using both an event-based and time-based task and comparing performance on these tasks to planning ability in order to determine if time-based PM tasks rely more heavily on planning ability than event-based PM tasks.

Performance on Saving and PM Tasks

The third hypothesis was that saving and PM performance would be positively and significantly correlated. It was expected that those who were more successful on the saving tasks would also be more successful on the PM tasks, above and beyond age and vocabulary. If support for my third hypothesis was found, it would have suggested that these two future-oriented thinking abilities were related. Given that previous research has not directly examined this relation (e.g., Chernyak et al., 2017; Mazachowsky & Mahy, 2020), this finding would have added to our understanding of saving and PM in young children. If this finding had been significant, it would have provided support that both future-oriented thinking skills rely on similar cognitive factors or experiences. For example, the development of certain executive

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function skills (e.g., cognitive flexibility, inhibition, working memory) may be especially relevant in affecting success on these future-oriented thinking skills. Previous research has suggested that executive function is related to PM (e.g., Causey & Bjorkland, 2014; Mahy & Moses, 2011), and therefore had PM and saving been related, it is possible that executive function development may have been an important aspect driving the relation. Future work could assess this by measuring executive function ability in addition to measuring saving and PM to determine if executive function explains the relation between these two abilities. Causey and Bjorkland (2014) also suggest that theory of mind (the ability to reason about the mental state of others) and metacognition (the ability to reason about one's own mental states) are related to PM, therefore these abilities may also be relevant in explaining a relation between saving and PM, should it have been found.

If support for this hypothesis had not been found, that would suggest that these two abilities are not related. This may indicate that saving and PM, although both considered future-oriented thinking skills, may rely on different cognitive abilities or experiences for success on these types of tasks. As mentioned, previous research has suggested that PM is related to executive functions, theory of mind, and metacognition (e.g., Causey & Bjorkland, 2014; Mahy & Moses, 2011). However, it is important to note that in regard to saving, Atance et al. (2017) did not find a relation between working memory or inhibitory control and saving, and further found a negative relation between theory of mind and saving. Therefore, it is possible that although saving and PM are both considered future-oriented thinking abilities and develop around the same time in early childhood, they may rely on different experiences or cognitive abilities. This would have been an important finding as it would have provided information that previous research had not yet determined regarding how saving is related to PM. It is therefore

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possible that perhaps successful saving and planning relies on something other than these abilities. For example, performance on saving tasks could rely on the ability to consider oneself in the future. It is possible that experience in speaking and thinking about oneself in the future may impact performance on this skill (e.g., Chernyak et al., 2017). Future research could test for this by measuring saving and PM before and after an intervention in which participants discuss the future with an experimenter (similar to the way in which Chernyak et al., 2017 talked with participants about the future) in order to determine if future-oriented thinking performance improves after the intervention as Chernyak et al. (2017) suggested that this improved participants future-oriented thinking performance on the tasks they used to measure these abilities.

Performance across Saving, PM, and Planning Tasks

The final hypothesis was that saving, PM, and planning would all be explained by one factor as evidenced by the exploratory factor analysis. If support for this hypothesis had been found, it would have suggested that these three future-oriented thinking skills were related. Previous research had not looked at if these three future-oriented thinking skills in young children are related, therefore this would have provided interesting insight into the development of saving, PM, and planning.

Although it is not possible to say for certain what the factor could have been, this finding could have been interpreted to mean that saving, PM, and planning all have something in common than explains their relation and that this could be ‘future-oriented thinking’. If these abilities had all loaded on to one factor, the requirement of a consideration for a future point in time for saving, PM, and planning could be the underlying factor, suggesting that general future-oriented thinking ability explains success on each of these tasks. This finding could have

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suggested that each of these abilities are future-oriented thinking abilities and rely on the ability to think about the future in order to be successful. Future research could conduct a longitudinal study in which saving, PM, and planning are measured from a young age over time to determine when participants begin to succeed on these tasks. If success occurs at the same age for each of these tasks, it would provide evidence that children's success on these abilities follow the same developmental trajectory and provide additional support that these abilities are related.

It is also possible that executive functions could explain the relation between these three abilities. For example, previous research (e.g., Chernyak et al., 2017; Mahy & Moses, 2011) has suggested that PM and executive functions were related, and planning is considered an executive function skill (in addition to being considered a future-oriented thinking skill), therefore if these abilities had been found to all load onto a single factor, it is possible that executive function development could have explained the relation. This finding could have been interpreted to mean that these skills were united by the shared recruitment of executive function skills, with those who are more successful on executive function tasks also being more successful on future-oriented thinking tasks.

Further, if all three abilities had loaded on to a single factor, it is possible that in addition to cognitive factors, certain experiences may have affected performance on saving, PM, and planning tasks, and that children who had more success with these tasks may have had experiences which provided a learning opportunities important for future-oriented cognition. For example, perhaps the children who were more successful on these tasks were also more likely to talk about the future in their daily lives with their parents. Chernyak et al. (2017) found that discussing the future with an experimenter improved performance on a variety of future-oriented thinking skills. Therefore, had support for a one-factor model been found, it might have been

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suggested that discussing the future with others explained the relation between these three skills. This could be interpreted to mean that talk about one's future in everyday life or through lab-based intervention could have benefitted on saving, PM, and planning tasks. Future work could test for this by determining if performance on these types of tasks is related to children's experience talking about the future. A similar study to that of Chernyak et al., (2017) in which children discussed the past and future could be conducted to determine if children are better at these types of tasks when they have experience thinking and talking about themselves in the future. Further, a parent survey could be used to compare parents' perception of their children's instances of talking about their future in everyday life and their performance on lab-based, future-oriented thinking tasks. Mazachowsky and Mahy (2020) used a parent survey in which they were asked questions about their child's saving, PM, planning, DoG, and episodic foresight were measured, but future work could extend this by asking parents how often they talk about the future with their child in order to determine if this type of experience discussing the future impacts performance on lab-based tasks measuring saving, PM, and planning.

If performance on the saving, PM, and planning tasks had not loaded onto one factor and instead the data best fit the model with two factors, it would have suggested that these skills, despite being considered future-oriented thinking skills, are not necessarily related based on a single factor. This would have suggested that there is not a single underlying cognitive ability or experience that is a sufficient component for success on these future-oriented thinking skills, with the specific factors depending on which tasks fit into each of the factors. I would have examined the tasks to determine which tasks loaded together. If tasks of a given ability loaded together (i.e., had both saving tasks loaded on to one factor and the PM and planning tasks loaded onto the other), it would have been possible to suggest that there was something that

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affected success on the saving tasks that did not impact success on the PM and planning tasks. If this was not the case (i.e., had the pairs of tasks for each ability not been grouped together – for example, had the token saving, Truck Loading task, and card-sorting PM tasks loaded on to one factor and the sticker saving, Tower of Monkeys, and naturalistic PM tasks loaded on to the other), I would have examined the task demands to determine what was similar and different about the tasks in order to understand why they loaded on the factors in that way.

If a two-factor model had been found, it would have suggested that future research should focus on determining what is different about these skills, as they are all typically considered future-oriented thinking abilities and require a consideration for a future point in time. It is possible that cognitive factors (such as inhibitory control) or social factors, such as a parent giving children PM cues at home (i.e., asking children to remember to give their friend their toy when they see them at school) may explain why these skills are not related. It is also possible that, had the data suggested that these abilities were not related, that this may have been specific to the age group tested. The present study would not have provided insight into how these skills are related at all age points; therefore, it is not possible to state that performance on these skills are never related in early development. Future research could assess this with a longitudinal study to determine if these skills are related at ages different than the ages specified in the present study. For example, a future study could assess whether saving, PM, and planning in early childhood predicts these abilities in adulthood (i.e., saving for retirement, remembering to do something in the future, planning successfully in order to achieve goals). It would be interesting to determine if these abilities are related at different ages in order to determine if there is a single factor that could explain the relation at an age that was not of interest in the present study.

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If the task analysis had revealed that the saving tasks loaded on to one factor and the other tasks loaded on to the second factor, it is possible that there was something different about the saving tasks than the PM and planning tasks that caused them to load on to different factors. For example, it is possible that the saving tasks required ‘hot’ executive function (problem solving that involves an affective component such as rewards; Garon, 2016) and that the PM and planning tasks would have been affected by ‘cool’ executive function (problem solving ability that is more abstract, such as doing a puzzle; Garon, 2016). Saving could be an ability that is more likely impacted by ‘hot’ executive function as there is a personally relevant reward that is received if participants were successful. Excluding the naturalistic PM task, the card-sorting and planning tasks did not include a reward, which would classify them as being ‘cooler’ tasks. This may explain why the tasks loaded on to the factors in this way, should that have been the case. If the tasks had not loaded on to the two factors by grouping on type of tasks, it is possible that there were differences in demands for the types of tasks. For example, the token saving task, Truck Loading task, and Tower of Monkeys task require that participants sit for a longer amount of time and remain focused during the instructions for longer than the other three tasks (naturalistic PM task, sticker saving task, and card-sorting PM task). Therefore, had these tasks loaded on to the two factors in this grouping, it is possible that participants’ attention affected the grouping. Future research could assess this by measuring these abilities using a variety of tasks in order to determine if the task demands are what is causing the factor loadings to be split in this way.

It is important to note that although it is possible that the results of this study may have been affected by the tasks themselves (i.e., the task demands), there is some reason to believe that these measures are valid measures of these abilities. This is supported by Mazachowsky and

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Mahy's (2020) recent study, which used the Truck Loading task, the naturalistic PM task, and the Tower of Monkeys task when comparing participant's performance on these lab-based measures with a parent questionnaire measuring future-oriented thinking abilities. They found that the parent question was related to performance on these tasks, which further suggests that these tasks are valid measures of these future-oriented thinking abilities. However, future work could test for this by comparing performance tasks that are considered measures of these abilities in order to ensure that they are valid measures of saving, PM, and planning.

Descriptive Information on Two Participants

Due to the COVID-19 pandemic, data collection had to be stopped just as it was beginning. I was able to collect session one data for two children; therefore, I will now discuss the experience I had with those participants. It is important to note that the experiences with the two children who were able to complete session one is not representative of what would have occurred in all testing situations, but given the circumstances I believe it is important to discuss what I observed.

Recall that the tasks performed in the first session were the naturalistic PM task, the card-sorting PM task, the token saving task, and the Truck Loading task. The few participants that were tested were all able to successfully complete each of the tasks. Neither of the participants were able to save any tokens in the token saving task for their more preferred game, despite succeeding on the comprehension checks. This is a very limited sample; therefore, these results likely do not capture how most young children would perform on this task. Previous research has found that participants are able to save using the token saving task (Jerome & Kamawar, in progress), therefore, had this study been able to continue, there would have hopefully been more variation in participants saving ability. If after 10 participants, I did not see any variability in

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saving ability, I would have carefully examined the responses from children to determine whether there was a problem with the instructions, or in the comprehension checks. Adjustments would have been made to the task before proceeding with another 10 participants (second pilot test). The initial participants' data would have not been included in the final sample, nor would the second group's data if further modification were required to the tasks.

Given that children only received session one tasks, it is not possible to compare performance on this task with the other saving task, the sticker saving task, which may have provided further information into the participants' saving ability. Both participants were largely successful on the card-sorting PM task and demonstrated that they understood the rules and that there was no retrospective memory error (as they both successfully responded to the memory check question at the end of the task). However, neither participant wanted to sit for the complete three minutes of the drawing filler task between when the instructions were given and when the task began and were distracted from their drawing and eager to move on before the complete three minutes had elapsed. When this study is able to continue, I will ensure that the drawing filler task captures their attention more (e.g., by asking them to draw something specific for Morris) so that each participant is busy enough to wait the appropriate three minutes between tasks without wanting to do something else (both participants stated about thirty seconds into drawing that they were done and wanted to do the next round of cards). Finally, the participants, although mostly successful on the Truck Loading task, seemed to be more interested in playing with the truck instead of performing the task, which may have acted as a distraction and caused some lower scores. Future data collection can address this by providing participants with an opportunity to play with the truck before the task begins so that they are not quite as distracted

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by a new, interesting toy, or by promising time to play with the truck once the task is complete (this latter option has generally worked quite well in research in my lab).

Limitations and Future Research

It is important to discuss some potential limitations that would have applied to the present study. First, it is important to note that the main limitation of the present study was that data collection was not able to occur. It would be ideal if at some point in the future, when it becomes safe to do so, that the data for the present study be collected (my supervisor plans to see this study through to completion when it is possible). However, because data collection did not occur, any results discussed in this thesis are hypothetical.

One limitation of the present study is that it would not have provided information about how saving, PM, and planning develop over time. A longitudinal study would have provided more insight into how these abilities evolve as children age. The present study would have only measured saving, PM, and planning at one age, and therefore we would not be able to infer how these abilities develop in relation to one another over time. Future research could address this limitation by conducting a longitudinal study in order to determine how future-oriented thinking abilities develop over time. The present study would have only provided a glimpse into these abilities for children between the ages of four- and five-years-old. For example, future research could assess children's saving ability over time in order to provide more insight into this ability as children develop to determine if there is a shift in how children save as they age and are given more information and responsibility regarding saving. Ashby et al., (2015) assessed saving in participants from adolescence to adulthood using a questionnaire but saving at an earlier age was not measured. Future research could extend this by measuring saving in young childhood and continue to assess this skill and PM and planning as children age and move into adulthood. This

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study could be designed so that participants complete the lab-based measures in early childhood (e.g., token saving task, card-sorting PM, Truck Loading task) and follow up with questionnaires as the participant ages (for example, they could be given the questionnaire during late childhood, adolescence, early adulthood, and late adulthood) about how they save, plan, and remember to do things in the future. This information would allow us to better understand if these abilities change over time, or if those who are better at these types of abilities at a young age are also successful with saving, PM, and planning when they are older. This would also provide more information about how these abilities are related (i.e., are they related across all age points of testing?). Further, if the study found that success on these abilities in early childhood was related to success on these abilities in older adulthood, it would suggest that providing intervention to improve these abilities at an early age could be beneficial as one ages.

Regarding the saving tasks, it is also important to consider that the tasks planned for the present study (i.e., the token saving task and the sticker saving task) may not be ecologically valid methods of measuring saving in young children. Although the token saving task more closely resembles what children might encounter in everyday life (using ‘money’ to purchase a treat), it is a lab-based task that is not something they would typically experience when practicing saving at home (for example, by saving money from an allowance to use towards a desired toy). The sticker saving task, during which participants save the item itself and not a token used to ‘purchase’ something, may also not be an ecologically valid method of measuring saving (i.e., compared to saving a resource such as money).

Future research could address this limitation by assessing different methods of measuring saving in young children to determine which tasks might be the most ecologically valid measure of this ability. There have been a variety of tasks that have been used to measure saving recently,

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such as the marble run task (e.g., Metcalf & Atance, 2011), the token saving task (Dueck et al., 2019), the sticker saving task (Chernyak et al., 2017) and more recently, a newer version of a saving board game task (Mazachowsky & Mahy, 2020). It would be interesting to compare these tasks regarding saving in young children, as there are certainly positive and negative aspects of each (e.g., transportation, level of difficulty for young children). Using a wider range of measures, coupled with parental observations, would allow us to better understand how these skills occur in everyday life. This type of study could go beyond the parent survey and observational measures conducted by Mazachowsky and Mahy (2020) by asking parents more questions about future-oriented thinking in general, such as questions regarding how often parents discuss, or how often their children ask, about ‘tomorrow’ or ‘next week’ or ‘next month’. This would provide more insight into future-oriented thinking in children’s day to day lives and how it might affect their performance on the lab-based tasks. If there is not consistency regarding how often parents talk about the future with their children and performance on lab-based measures, it would suggest that these tasks do not easily predict future-oriented thinking in children’s day to day lives.

As previously noted, the ecological validity of saving tasks is an important aspect of measuring saving in young children to consider. Although the token saving task mimics saving a resource (such as money) in order to purchase a prize, it is not necessarily identical to a saving situation that children might encounter in everyday life as it is a lab-based task and participants are not saving ‘real’ money in a typical, everyday, scenario. Future studies could address this by conducting diary studies or surveys, in which parents report their children’s saving behaviour by describing daily saving events. These types of questions could be incorporated into the potential future study described above in which parents are asked about how often they discuss the future

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with their children. For example, parents could also report whether their children gets an allowance, if they save their money using a piggy bank, if they talk to their children about saving, or what their children do when they receive a larger sum of money all at once (for example, do they save birthday money or do they immediately want to go to the store?).

Questions regarding saving that does not refer to money, similar to those using in the parent report questionnaire by Mazachowsky and Mahy (2020), such as “Saves a seat for someone who has not yet arrived (e.g., at the dinner table or at a play)” (p.16), and “Saves an item to show someone at a later date (e.g., saves artwork to show a relative visiting later in the week)” (p.16), may also be informative for understanding how children save non-money resources. A future survey could also include questions about whether the participants has siblings, if the parent classifies their child as a saver, and whether they talk about saving at home. These types of questions may better reflect children’s typical saving behaviour that a laboratory-based task may not capture and some of the influences that may impact saving ability. Additionally, comparing parents’ responses to these types of questions with the laboratory-based tasks used previously (e.g., token saving task, sticker task) may provide insight into how these types of tasks reflect how children typically save in day to day events.

Finally, future research should also consider the relation between the skills that were to be examined in this study and other future-oriented thinking skills. Although saving, planning, and PM were of focus in the present study, the relation between saving and other future-oriented thinking skills that were not measured in the present study, would also be interesting. For example, future studies could investigate how saving, delay of gratification, and planning are related, or saving, episodic foresight, and delay of gratification are related, as previous research has touched briefly on how pairs of these abilities are related but has not looked at all

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combinations in detail (e.g., Chernyak et al., 2017; Kamawar et al., 2019; Mahy & Moses, 2015). Studying this would provide insight into how saving, a relatively new area of study in regard to future-oriented thinking in preschoolers, is related to other future-oriented thinking skills that have previously been studied in more detail. As previously noted, more recently, Mazachowsky and Mahy (2020) developed a parent questionnaire for assessing a variety of future-oriented thinking skills in children, and future research should consider including this survey in their measurement of these skills to get a more detailed depiction of these abilities in young children. Future research could expand this study by incorporating different types of survey questions for parents and using a variety of lab-based saving tasks (e.g., token saving task, sticker saving task) to get a better understanding of future-oriented thinking in children more broadly. Saving ability in young children is still a relatively new area of research, therefore there are still plenty of areas in which it could be explored to further our understanding of this future-oriented thinking skill.

Conclusion

Although data collection was not able to occur, the present study provides an important direction for future research to investigate. Saving is a growing area of research in the field of children's cognitive development and, as discussed, there are many directions that future research should consider. When it is safe for data collection for this study to be collected, this study could provide important information regarding how future-oriented thinking abilities in young children develop and how they might be related. This information would allow us to better understand how future-oriented thinking skills in young children develop in relation to one another and provide direction for understanding underlying cognitive or social factors that may drive their development. This would allow us to better understand how children save, prepare, and plan for the future, which are all important skills to develop for success in everyday life.

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More specifically, had all three future-oriented thinking skills loaded on to a single factor, it may have suggested that providing support for children when developing the underlying skill should presumably help children develop saving, PM, and planning ability. This would be valuable information for parents and teachers as this would provided direction for understanding how we might be able to support the development of saving, PM, and planning in young children so that they are successful with these types of skills in everyday life.

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Appendices

Appendix A

Daycare Consent

Children's Representational Development Lab

www.carleton.ca/crdl

Winter/Spring 2020

Dear Program Coordinator,

As part of a new project on children's cognitive development, we are talking to children to understand about how they think about the future. This study has been cleared by Carleton University Research Ethics Board-B (**CUREB-B Clearance #112111**). In this letter, we will describe the project and request your permission for your centre's participation.

Should you wish to participate in the current project, we will provide you with individual informed consent letters to distribute to the parent(s) or guardian(s) of the four- to six-year-old children in your centre. Once consent letters have been returned to you from parents/guardians, we will arrange a convenient time for you to have our researcher at your centre to conduct the study. The researcher is a university student with a current police record check and copies of this document will be provided to the daycare director before we commence any interviews with the participating children. The researcher will also be sensitive to the children at all times.

Children will play a series of games in which they will be given the opportunity to save. We are interested in whether children will save for stickers and toys. We are also interested in whether children can remember to do something in the future. Children will play a card sorting game in which they are to remember to do something when they see a specific card. Finally, children will play games that will give them the opportunity to plan for a trip to zoo, a route for a truck, and to build a tower. We will also play a game that measures skills related to their vocabulary.

Children usually enjoy these kinds of activities and will be given stickers as thanks (even if they stop playing part-way through) and will be able to keep all the toys and stickers from the saving game (they'll be placed in a bag and given to the classroom teacher to go home with the children at the end of day). We will also provide enough stickers for all children in the participating classroom to the daycare, so that all children will receive some, regardless of their participation in the study.

We will meet with each child twice, for approximately 15-20 minutes each session.

Participation in this study is completely *voluntary*. Children will be asked if they want to participate, and if they don't, they will not be pressured into participating. Children can stop playing at any time during the session and will still receive their stickers/toys.

The information collected in this study is confidential and will be coded such that a child's name is not associated with their responses. The information provided will be used for research

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purposes only, and will only be accessible to the researchers directly involved in the project. The consent form will be kept separate from the data in a locked cabinet and will be destroyed after 2 years. The datafile and hard-copies of data, though they do not include identifying information, are stored on a password protected computer (the datafile) and in a locked room (the hard copies). As soon as we have entered the information about a child's responses, we will remove all links between the child's names and their identification numbers used in the datafile. In other words, it will no longer be possible to identify an individual child's responses (the data will be anonymized). As a result, participants will no longer be able to withdraw their data. We estimate that this will occur approximately 2 weeks after meeting with them. Analyses presented in presentations or written publications will only contain group data, with no identification of individuals or schools who participated in this study.

The research supervisor of this project is Dr. Deepthi Kamawar and she may be reached at 613-520-2600, ext. 7021 or deepthi.kamawar@carleton.ca. **The primary researcher involved in this project is Ellen Doucet, M. A. Candidate, and she can be reached by email at ellen.doucet@carleton.ca.**

This study has been cleared by **Carleton University Research Ethics Board-B (CUREB-B Clearance #112111)** and has been deemed minimal risk. Some participants may find a particular task taxing, which could cause them to become upset. In those rare cases, children are dealt with in a very sensitive manner (told that we're all done, thanked for doing a great job) and taken back to their teachers. We have used similar tasks with children in the same age ranges over the past 17 years and found this reaction to be extremely rare. **Should you have any ethical concerns with the study, please contact the REB Chair, Carleton University Research Ethics Board-B (by phone: 613-520-2600 ext. 4085 or by email: ethics@carleton.ca. For all other questions about the study, please contact the researcher.**

Your consent is required for your centre's participation in this project. Kindly sign the attached consent form indicating whether we may provide you with individual consent forms for parents or guardians of children within this age range in your centre. If you would like a summary of the research results once the study is completed, please contact Ellen Doucet at ellen.doucet@carleton.ca. However, please note that individual feedback regarding the children cannot be provided.

Thank you for your consideration.

Sincerely,

Deepthi Kamawar, PhD
Associate Professor
Psychology/Cognitive Science

Ellen Doucet
M.A. Candidate
Psychology

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN YOUNG CHILDREN

Carleton University Study – Saving and Prospective Memory in Preschoolers

The information collected for this project is confidential and protected under the Provincial Freedom of Information and Protection of Privacy Act.

I have read the attached description of the study ‘Saving and Prospective Memory in Preschoolers’ and I understand the conditions of my child care centre’s participation. I understand that the study will require two 15-20-minute testing sessions, with children of appropriate ages who have given verbal assent, and whose parents/guardians have given written consent for their children’s participation in the research project.

Name of Centre: _____

Address: _____

Signature: _____ Date: _____

Name & Title: _____

Appendix B

School Consent

Winter/Spring 2020

Children's Representational Development Lab

www.carleton.ca/crdl

Dear Principal,

As part of a new project on children's cognitive development, we are talking to children to understand about how they think about the future. This study has been cleared by Carleton University Research Ethics Board-B (**CUREB-B Clearance #112111**). In this letter, we will describe the project and request your permission for your centre's participation.

Should you wish to participate in the current project, we will provide you with individual informed consent letters to distribute to the parent(s) or guardian(s) of the four- to six-year-old children in your school. Once consent letters have been returned to you from parents/guardians, we will arrange a convenient time for you to have our researcher at your school to conduct the study. The researcher is a university student with current police record checks and copies of this document will be provided to the school principle before we commence any interviews with the participating children. The researcher will also be sensitive to the children at all times.

Children will play a series of games in which they will be given the opportunity to save. We are interested in whether children will save for stickers and toys. We are also interested in whether children can remember to do something in the future. Children will play a card sorting game in which they are to remember to do something when they see a specific card. Finally, children will play games that will give them the opportunity to plan for a trip to zoo, a route for a truck, and to build a tower. We will also play a game that measures skills related to their vocabulary.

Children usually enjoy these kinds of activities and will be given stickers as thanks (even if they stop playing part-way through) and will be able to keep all the toys and stickers from the saving game (they'll be placed in a bag and given to the classroom teacher to go home with the children at the end of day). We will also provide enough stickers for all children in the participating classroom to the teacher, so that all children will receive some, regardless of their participation in the study.

We will meet with each child twice, for approximately 15-20 minutes each session.

Participation in this study is completely *voluntary*. Children will be asked if they want to participate, and if they don't, they will not be pressured into participating. Children can stop playing at any time during the session and will still receive their stickers/toys.

The information collected in this study is confidential and will be coded such that a child's name is not associated with their responses. The information provided will be used for research purposes only, and will only be accessible to the researchers directly involved in the project. The consent form will be kept separate from the data in a locked cabinet and will be destroyed after 2

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN YOUNG CHILDREN

years. The datafile and hard-copies of data, though they do not include identifying information, are stored on a password protected computer (the datafile) and in a locked room (the hard copies).

As soon as we have entered the information about a child's responses, we will remove all links between the child's names and their identification numbers used in the datafile. In other words, it will no longer be possible to identify an individual child's responses (the data will be anonymized). As a result, participants will no longer be able to withdraw their data. We estimate that this will occur approximately 2 weeks after meeting with them. Analyses presented in presentations or written publications will only contain group data, with no identification of individuals or schools who participated in this study.

The research supervisor of this project is Dr. Deepthi Kamawar and she may be reached at 613-520-2600, ext. 7021 or deepthi.kamawar@carleton.ca. **The primary researcher involved in this project is Ellen Doucet**, M. A. Candidate, and she can be reached by email at ellen.doucet@carleton.ca.

This study has been cleared by **Carleton University Research Ethics Board-B (CUREB-B Clearance #112111)** and has been deemed minimal risk. Some participants may find a particular task taxing, which could cause them to become upset. In those rare cases, children are dealt with in a very sensitive manner (told that we're all done, thanked for doing a great job) and taken back to their teachers. We have used similar tasks with children in the same age ranges over the past 17 years and found this reaction to be extremely rare. **Should you have any ethical concerns with the study, please contact the REB Chair, Carleton University Research Ethics Board-B (by phone: 613-520-2600 ext. 4085 or by email: ethics@carleton.ca). For all other questions about the study, please contact the researcher.**

Your consent is required for you school's participation in this project. Kindly sign the attached consent form indicating whether we may provide you with individual consent forms for parents or guardians of children within this age range in your school. If you would like a summary of the research results once the study is completed, please contact Ellen Doucet at ellen.doucet@carleton.ca. However, please note that individual feedback regarding the children cannot be provided.

Thank you for your consideration.

Sincerely,

Deepthi Kamawar, PhD
Associate Professor
Psychology/Cognitive Science

Ellen Doucet
M.A. Candidate
Psychology

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN YOUNG CHILDREN

Carleton University Study – Saving and Prospective Memory in Preschoolers

The information collected for this project is confidential and protected under the Provincial Freedom of Information and Protection of Privacy Act.

I have read the attached description of the study ‘Saving and Prospective Memory in Preschoolers’ and I understand the conditions of my school’s participation.

I understand that the study will require two 15-20-minute testing sessions, with children of appropriate ages who have given verbal assent, and whose parents/guardians have given written consent for their children’s participation in the research project.

Name of Centre: _____

Address: _____

Signature: _____ Date: _____

Name & Title: _____

Appendix C

Parental Consent

Children's Representational Development Lab

www.carleton.ca/crdl

Winter/Spring 2020

Dear parent(s) or guardian(s),

As part of a new project on children's cognitive development, we are talking to children to understand about how they think about the future. This study has been cleared by Carleton University Research Ethics Board-B (**CUREB-B Clearance #112111**). In this letter, we will describe the project and request your permission for your child to participate. The purpose of an informed consent is to ensure that you understand the purpose of the study and the nature of your child's involvement.

Children will talk to a researcher, one at a time, and will play a saving game in which they can 'buy' stickers and toys with plastic tokens. They will get to keep the toys and stickers from this task. We are also interested in children's ability to remember to do something in the future. Children will play a card game in which they must remember to do something when they see a particular card. Children will also play three planning games, where they will be given the opportunity to plan a trip to the zoo, the route for a truck, and building a tower. We are interested in whether saving is related to memory for the future and whether or not planning ability is an important factor. We will also play a game that measure skills related to word knowledge. Children usually enjoy these kinds of activities and will be given stickers as thanks (even if they stop playing part-way through). We will play these games in a corner or hallway of the children's daycare or school, depending on what location is most convenient for the teacher and the rest of the class. We will provide enough stickers for all children in the participating classrooms to the daycare, so that all children get some, even if their parents have not consented to their participation.

We will meet with each child twice, for approximately 15-20 minutes each session.

Participation in this study is completely *voluntary*. Children will be asked if they want to participate, and if they don't, they will be asked only once more on a different day, and will not be pressured into participating. Children can stop playing at any time during the session and will still receive their stickers.

The information collected in this study is confidential and will be coded such that a child's name is not associated with their responses. The information provided will be used for research purposes only and will only be accessible to the researchers directly involved in the project. The consent form will be kept separate from the data in a locked cabinet and will be destroyed after 2 years. The datafile and hard-copies of data, though they do not include

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN YOUNG CHILDREN

identifying information, are stored on a password protected computer (the datafile) and in a locked room (the hard copies). As soon as we have finished talking with a participating child, and entered their information, remove the information linking that child's name to their identification number used in the datafile. In other words, it will no longer be possible to identify an individual child's responses (the data will be anonymized). As a result, participants will no longer be able to withdraw their data. We estimate that this will occur on July 31st. Analyses presented in presentations or written publications will only contain group data, with no identification of individuals who participated in this study.

The research supervisor of this project is Dr. Deepthi Kamawar and she may be reached at 613-520-2600, ext. 7021 or deepthi_kamawar@carleton.ca. **The primary researcher involved in this project is Ellen Doucet, M. A. Candidate and she can be reached by email at ellen.doucet@carleton.ca.**

This study has been cleared by **Carleton University Research Ethics Board-B (CUREB-B Clearance #112111)** and has been deemed minimal risk. Some participants may find a particular task taxing, which could cause them to become upset. In those rare cases, children are dealt with in a very sensitive manner (told that we're all done, thanked for doing a great job) and taken back to their teachers. We have used similar tasks with children in the same age ranges over the past 15 years and found this reaction to be extremely rare. **Should you have any ethical concerns with the study, please contact the REB Chair, Carleton University Research Ethics Board-B (by phone: 613-520-2600 ext. 4085 or by email: ethics@carleton.ca. For all other questions about the study, please contact the researcher.**

Your consent is required for your child's participation in this project. Kindly sign the attached consent forms indicating whether your child may participate in this research and return them to your child's daycare. If you would like a summary of the research results once the study is completed, please contact Ellen Doucet at ellen.doucet@carleton.ca. However, please note that individual feedback regarding the children cannot be provided.

Thank you for your consideration.

Sincerely,

Deepthi Kamawar, PhD
Associate Professor
Psychology/Cognitive Science

Ellen Doucet
M.A. Candidate
Psychology

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN YOUNG CHILDREN

Carleton University Study – Saving and Prospective Memory in Preschoolers

The information collected for this project is confidential and protected under the Provincial Freedom of Information and Protection of Privacy Act.

I have read and understood the request for my child to participate in the study *Saving and Prospective Memory in Preschoolers*. I have discussed it with my child and ...

- ☐ I consent to my child's participation in the current study **[please fill out the next page]**
☐ I do not consent to my child's participation in the current study

Child's Name (please print): _____

Parent's/Guardian's Name (please print): _____

Signature: _____ Date: _____

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN YOUNG CHILDREN

Participant Information**Carleton University Study – Saving and Prospective Memory in Preschoolers**

If you have consented to your child participating on the previous page, please provide us with the following information about your child. If you have not provided consent, please do not fill out this page.

Please note: your child's name and birth date will be kept separate from their data and consent form, and only researchers directly involved in this project will have access to this information.

Child's Date of Birth: year _____ month _____ day _____

Please indicate the language(s) spoken at home and then please circle the ones that your child is fluent in: _____

Appendix D

Script for Obtaining Verbal Assent from Children

“Hi [child’s name], my name is Ellen! And guess what my job is? I make games so that I can learn about how boys and girls think and play. I brought some of my favourite games for us to play today. Your parents said it was okay for you to play these games with me. I’m ready to paly them right over here (point to location that teacher made available). Would you like to come over and play the games with me?”

If the child says ‘No’, I will say, “That’s okay. Can I ask you again another day if you want to play?”. If the child says ‘No’, they will not be asked to play again, and this will be noted. If the child says ‘Yes’, I will note this and ask the child another day. If they do not wish to participate the second time they are asked, I will not ask the child again so as not to coerce the children into participating.

If a daycare teacher tells a child that they have to go with us because a parent signed a consent form, I will inform the teacher and the child (clearly and cheerfully) that it is entirely the decision of the child if they would like to participate and that they do not have to play the games if they do not want to, even if they have a returned consent form from a parent or guardian.

Appendix E

Debriefing Letter for Parents and Guardians

Winter/Spring 2020

Dear Parent(s) or Guardian(s),

Recently we contacted you to invite your child to participate in our study Saving and Prospective Memory in Preschoolers. Thank you for agreeing to allow your child to participate – we had a lot of fun!

The purpose of this study was to better understand how children think about the future. To achieve this goal, your child played a series of games in which they were given the opportunity to save tokens to ‘purchase’ prizes, sort cards, and to plan the route of a truck, a trip to the zoo, and the building of a tower. We are interested in whether performance in these games are related to each other. More specifically, we are interested in whether those who are more successful on the saving game are also better at the card sorting and planning games. Previous research has suggested that these are all abilities that require the consideration for the future that develop around the same time. Your child’s participation in these games will help us learn more about how these types of abilities are related to each other.

We are very excited to start investigating the results of our study. For more information about our findings, or for a summary of the project once it is complete, please contact Deepthi Kamawar by email at deepthi.kamawar@carleton.ca or 613-520-2600, ext. 7021. Should you have any ethical concerns with the study, please contact the REB Chair, Carleton University Research Ethics Board-B (by phone: 613-520-2600 ext. 4085 or by email: ethics@carleton.ca). The ethics protocol number for this study is #112111.

The information collected in this study is confidential and will be coded such that a child’s name is not associated with their responses. The information provided will be used for research purposes only, and will only be accessible to the researchers directly involved in the project. The consent form will be kept separate from the data in a locked cabinet and will be destroyed after 2 years. The datafile and hard copies of data, though they do not include identifying information, are stored on a password protected computer (the datafile) and in a locked room (the hard copies).

The information collected in this study is confidential and will be coded such that a child’s name is not associated with their responses. The information provided will be used for research purposes only and will only be accessible to the researchers directly involved in the project. The consent form will be kept separate from the data in a locked cabinet and will be destroyed after 2 years. The datafile and hard-copies of data, though they do not include identifying information, are stored on a password protected computer (the datafile) and in a locked room (the hard copies). As soon as we have finished talking with a participating child, and entered their information, we will remove the information linking that child’s name to their identification number used in the datafile. In other words, it will no longer be possible to identify an individual child’s responses (the data will be anonymized). As a result, participants will no longer be able to

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN YOUNG CHILDREN

withdraw their data. We estimate that this will occur on July 31st, 2020. Analyses presented in presentations or written publications will only contain group data, with no identification of individuals who participated in this study.

Analyses presented in presentations or written publications will only contain group data, with no identification of individuals who participated in this study. If you would like a summary of the research results once the study is completed, please contact Ellen Doucet at ellen.doucet@carleton.ca. We cannot provide any information about an individual child, only about the study as a whole. If you have any concerns about any aspect of your child's development, we suggest that you consult with your family doctor or pediatrician. Thank you,

Deepthi Kamawar, PhD
Associate Professor
Psychology/Cognitive Science

Ellen Doucet
M. A Candidate
Psychology

Appendix F

Script for Phone Recruitment of Daycare

This is an approximate script for daycare recruitment by telephone.

All of the information that we discuss on the phone appears in the written consent form for daycares. Students receive training for daycare recruitment by an experienced graduate student. If program coordinators request a written copy of this information by email, we provide them with the text from the consent form for daycares.

Hi there, my name is Ellen and I am a Masters student in the Children's Representational Development Lab at Carleton University. I am calling today to invite your center to participate in a research project about 4- to 5-year-olds' cognitive development. This study has been approved by Carleton University's Research Ethics Board-B (ethics protocol number: #112111). Is this something you'd be interested in hearing more about?

[If yes*:] Our project is looking at children's developing ability consider the future. We will play a series of games and ask questions regarding what babies know, what they know, and what adults generally know. In the past, children have enjoyed these types of games.

We would work with each child individually, for two 20-minute sessions, about a week apart. These sessions can take place wherever works best for you – either in a quiet corner of the classroom, in the hallway just outside of the classroom, or in a lunch room or library. It is really at your discretion. All we need is a small table and chairs. We will visit the centre at times that are convenient for you, until we've seen each child twice. Depending on the number of children participating and the number of times the teachers would like us to come in each week, we are usually done at a center within a few weeks to a month. The researcher has a current criminal record check and experience working with kids. Copies of police record checks will be provided to you, if you chose to participate.

If it is alright with you and with the classroom teachers, we bring small sheets of stickers as "thank you" gifts for the children – and we always bring enough for all of the children in the class so that children who do not participate get stickers too. We can either give these to the kids directly after we talk to them, or we can leave those for the classroom teacher to distribute.

Does this sound like something you'd be interested in participating in? [If previous participation in one of our lab's studies: Please know that having participated in a prior study conducted in our lab does not mean that you have to participate in the present study].

[If yes*:] Great! So our first step is to drop off a consent form for the daycare itself that describes all of this information to you in writing, along with enough consent forms for all of the four- and five-year-old children in your center to go home to parents. Then, in a couple of weeks I will get in touch with you again to see if we've had some forms come back, and to set up a time for me to come in and get started. I can bring my original record check to show you when I drop off the forms, and I'll leave you a copy of that as well. [Then these details are discussed].

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN YOUNG CHILDREN

* If and when a program coordinator declines interest/hearing more about the project, we thank them for their time and ask them if we can contact them again in the future.

Typically, projects are declined because it is a “busy time” at the daycare or because there are not many children in the age group. If either of these are the case, we ask if there is a better time of year for us to try them or if we can contact them in the event we have a project better suited to their age groups. We record all of this information on our database so that we do not inconvenience a center by calling too often or if they have asked us not to call them in the future.

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN YOUNG CHILDREN

Appendix G

Verbal Debriefing for Child Participants

“That was our last game. Thank you for playing with me – that was fun. I wanted to learn more about how kids think about the future. Do you have any questions about any of the games we played today? Thanks again for your help and have a great day!”

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN PRESCHOOLERS

Appendix H

Ethics Approval

Office of Research Ethics
 4500 ARISE Building | 1125 Colonel By Drive
 Ottawa, Ontario K1S 5B6
 613-520-2600 Ext: 4085
ethics@carleton.ca

CERTIFICATION OF INSTITUTIONAL ETHICS CLEARANCE

The Carleton University Research Ethics Board-B (CUREB-B) has granted ethics clearance for the research project described below and research may now proceed. CUREB-B is constituted and operates in compliance with the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans* (TCPS2).

Ethics Protocol Clearance ID: Project # 112111

Research Team: Ellen Doucet (Primary Investigator)
 Dr. Deepthi Kamawar (Research Supervisor)

Project Title: Future-Oriented Thinking: Saving, Prospective Memory, and Planning in Young Children

Funding Source (If applicable):

Awards File No	Title	Status	
109840	Preschoolers' Future Oriented Cognition: Developing the Ability to Save	Active	A. CORIS Awards

Effective: January 31, 2020

Expires: January 30, 2021.

Please ensure the study clearance number is prominently placed in all recruitment and consent materials: CUREB-B Clearance # 112111.

Restrictions:

This certification is subject to the following conditions:

1. Clearance is granted only for the research and purposes described in the application.
2. Any modification to the approved research must be submitted to CUREB-B via a Change to Protocol Form. All changes must be cleared prior to the continuance of the research.
3. An Annual Status Report for the renewal of ethics clearance must be submitted and cleared by the renewal date listed above. Failure to submit the Annual Status Report will result in the closure of the file. If funding is associated, funds will be frozen.

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN PRESCHOOLERS

4. A closure request must be sent to CUREB-B when the research is complete or terminated.
5. During the course of the study, if you encounter an adverse event, material incidental finding, protocol deviation or other unanticipated problem, you must complete and submit a Report of Adverse Events and Unanticipated Problems Form, found here:
<https://carleton.ca/researchethics/forms-and-templates/>

Failure to conduct the research in accordance with the principles of the *Tri-Council Policy Statement: Ethical Conduct for Research Involving Humans 2nd edition* and the *Carleton University Policies and Procedures for the Ethical Conduct of Research* may result in the suspension or termination of the research project.

Upon reasonable request, it is the policy of CUREB, for cleared protocols, to release the name of the PI, the title of the project, and the date of clearance and any renewal(s).

Please contact the Research Compliance Coordinators, at ethics@carleton.ca, if you have any questions.

CLEARED BY:

Date: January 31, 2020

Natasha Artemeva, PhD, Chair, CUREB-B

Janet Mantler, PhD, Vice-Chair, CUREB-B

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN PRESCHOOLERS

Appendix I

Token Saving Task

Jerome & Kamawar, in progress; modified from Dueck et al., 2019

Introduction

- ***I'm going to show you two games today. One game is on the green tray [point to green tray] and one game is on the blue tray [point to blue tray].***
- ***I have some different prizes for these games [There should be 12 toys and 12 stickers laid out in front of the participant]***
- ***Do you know what these are called?*** [Point to both types of stickers]
 - *If “stickers” → ***That's right, these are stickers.***
 - *If other response → ***Actually, these are stickers.***
- ***Do you know what these are?*** [Point to both types of toys]
 - *If “toys” → ***That's right, these are toys.***
 - *If other response → ***Actually, these are toys.***
- ***So, there are two games: the stickers game and the toys game.***

Tokens

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN PRESCHOOLERS

- ***I have something else for these games.*** [Show child seven tokens]
- ***Do you know what these are called?*** [Point to tokens]
 - *If “tokens” → ***That’s right, these are called tokens***
 - *If other response → ***In these games, these are called tokens.***

Preferences

Ask child to pick the 5 stickers and the 5 toys they like best from the piles in front of them.

- ***Let’s take a look at these stickers.*** [point]
- ***We need 6 stickers for the stickers game.***
- ***Your job is to pick the 5 stickers you like best and put them in here*** [Point to green bowl and count stickers as child puts them in.]
- ***Now I will pick one!*** [Pick a sticker and put it in the green bowl. Make sure to track which sticker you placed in the bowl.]
- ***Great! Now, let’s take a look at these toys.*** [point]
- ***We need 6 toys for the toys game.***
- ***Your job is to pick the 5 toys you like best and put them in here*** [Point to blue bowl and count toys as child puts them in.]
- ***Now I will pick one!*** [pick a toy and put it in the blue bowl. Make sure to track which toy you placed in the bowl.]

Explanations:

- ***Now, I’m going to show you how to play the two games and then you will get your turn.***

How to play the stickers game:

- ***This is the stickers game. It is on the green tray.*** [Point to green tray]
- ***In this game, one token gets you one prize.***
- ***Let me show you how it works.***
- ***If I want a sticker, I have to put one token into this green box.*** [Put token in green box]
- ***Now I can have one sticker. I’m going to take the one I picked!*** [take the sticker you picked out of the bowl]
- ***Remember, the rule is, once you put a token in the box you can’t take it out because it is all used up.***
- ***Now, my sticker goes in here*** [put sticker into white box, point to it]. ***My sticker has to stay in here.***
- ***This one*** [point to child’s box] ***is for your prizes. When you get prizes, they have to stay in here.*** [point to beige box]
- ***That is how you play the stickers game.***
-

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN PRESCHOOLERS

How to play the **toys** game:

- *This is the toys game. It is on the blue tray.* [Point to blue tray]
- *In this game, one token gets you one prize.*
- *Let me show you how it works.*
- *If I want a toy, I have to put one token into this blue box.* [Put token in blue box]
- *Now I can have one toy. I'm going to take the one I picked!* [Take the toy you picked out of the bowl]
- *Remember, the rule is, once you put a token in the box you can't take it out because it is all used up.*
- *Now my toy goes in here* [put toy into white box, point to it]. *My toy has to stay in here.*
- *This one* [point to child's box] *is for your prizes. When you get prizes, they have to stay in here.* [point to beige box]
- *That is how you play the toys game.*

Preference check

- Ask the child which prize they like more, between their preferred stickers and preferred toys.

(Circle response)

<i>Which do you like more?</i> [point to each] <i>These or these?</i>	Stickers	Toys
---	----------	------

Record task order: (circle response)

- Always present less preferred stimulus (e.g., the one they like less) first

Record task order:		
First stimulus:	Stickers	Toys
Second stimulus:	Stickers	Toys

Token Savings Paradigm Protocol: Introduction (Toy=preferred prize)

*The protocol for the other option (if stickers were chosen as the most preferred prize) will be the same, but 'stickers' and 'green' will be used instead of toys and 'blue' throughout

Explanations:

- *Now it is almost your turn.*
- *First, I will put the stickers game here* [point] *for three minutes.*
- *After that, I will take the stickers game away and put the toys game here* [point] *for three minutes.*

Memory check (Circle responses)**Question A**

<i>Okay, so which game will I put on the table first?</i>	Correct	Incorrect	Don't Know	No Answer
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SAVING, PROSPECTIVE MEMORY, AND PLANNING IN PRESCHOOLERS

*If “green/stickers” → <i>That’s right, you will get the green tray with the stickers game.</i> *If “blue/toys” → <i>No, you will get the green tray with the stickers game.</i> *If other response → <i>You will get the green tray with the stickers game.</i> *If incorrect, repeat memory question				
<i>Okay, so which game will I put on the table first?</i>	Correct	Incorrect	Don’t Know	No Answer
*If incorrect again, correct and continue				

Question B

<i>Okay, so which game will I put on the table after that?</i>	Correct	Incorrect	Don’t Know	No Answer
*If “toys/blue” → <i>That’s right, you will get the blue tray with the toys game.</i> *If “green/stickers” → <i>No, you will get the blue tray with the toys game.</i> *If other response → <i>You will get the blue tray with the toys game.</i> *If incorrect, repeat memory question				
<i>Okay, so which game will I put on the table after that?</i>	Correct	Incorrect	Don’t Know	No Answer
*If incorrect again, correct and continue				

Question C

<i>Now, how do you get a sticker in this game?</i>	Correct	Incorrect	Don’t Know	No Answer
*If correct (e.g., put a token into the green box) → <i>That’s right, you put a token in the green box to get a sticker.</i> *If incorrect response → <i>No, you will put a token in the green box to get a sticker.</i> *If other response → <i>You put a token in the green box to get a sticker.</i> *If incorrect, repeat memory question				
<i>Now, how do you get a sticker in this game?</i>	Correct	Incorrect	Don’t Know	No Answer
*If incorrect again, correct and continue				

Question D

<i>Now, how do you get a toy in this game?</i>	Correct	Incorrect	Don’t Know	No Answer
*If correct (e.g., put a token into the blue box) → <i>That’s right, you put a token in the blue box to get a toy.</i> *If incorrect response → <i>No, you put a token in the blue box to get a toy.</i> *If other response → <i>You put a token in the blue box to get a toy.</i> *If incorrect, repeat memory question				
<i>Now, how do you get a toy in this game?</i>	Correct	Incorrect	Don’t Know	No Answer
*If incorrect again, correct and continue				

Instructions:

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☐ *Remember, one token gets you one prize, and once you put a token in the green box you can't take it out.*

☐ *I am giving you five tokens to use: one, two, three, four, five.* [Place tokens on table as you count them out loud, place them equidistant from both games, in a single line with equal spaces between them]

☐ *These are all the tokens I have for you today, so once they are all used up you can't get any more prizes.*

<i>Do you get any more tokens after these are all used up?</i>	Correct	Incorrect	Don't Know	No Answer
*If "no" → <i>That's right, these are all the tokens you get.</i> *If "Yes" → <i>No, you do not get any more tokens. These are all the tokens you get.</i> *If other response → <i>These are all the tokens you get.</i> *If incorrect, repeat question				
<i>Do you get any more tokens after these are all used up?</i>	Correct	Incorrect	Don't Know	No Answer
*If incorrect again, correct and continue				

Token Savings Paradigm Protocol- Toy is preferred

*protocol for stickers is preferred is the same, but begin with the toy game

Standardization Guidelines:

- If child tries to take used tokens out of the box say, *"Remember, we can't use those tokens anymore"*
- If child attempts to interact with experimenter say, *"I have to do my work over here."*
- If child attempts to take prizes out of the beige box say, *"Remember – your prizes have to stay in here [point to child's box]."*

Start stickers game:

- ☐ *Now it is time for the stickers game.*
- ☐ *I am going to put the toys game away.* [Put blue tray with toys out of sight and place the green tray with stickers centered on child's location; this should result in the tokens being centered in front of the tray]
- ☐ *My timer is set for three minutes. That is how long you get with the stickers game.*
- ☐ *I am going to do some work over there.*
- ☐ *Let's start right now.* [Turn away and pretend to work for three minutes]

Observations for stickers game:

- ☐ Continue game for 3 minutes and encourage child to wait until the time is over (e.g., there are two minutes left, we need to wait a little longer, etc.). If game is ended early, explain why and indicate the ending time on the table below.

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Time	# Tokens used	Attempts to retrieve token	Verbalizes saving strategy	Tries to take prize without using token	Other verbal or behavioural observations (child or experimenter)
0:00-0:30					
0:30-1:00					
1:00-1:30					
1:30-2:00					
2:00-2:30					
2:30-3:00					

Number of tokens used in the stickers game: _____

*If child asks questions about game or rules or breaks rules, provide neutral response and redirect to task (e.g., *“now we are playing the stickers game”*, *“you can choose how you use your tokens”*, *“in this game you use one token to get one prize”*, *“remember, the rule is once the token is in the box it is all used up”*, *“we still have some more time to play this game”*, *“remember, the rule is that you only get a prize if you use a token”*, *“you play the stickers game and I am doing some work”*)

Memory check: (circle responses)

<i>Okay, we are done with the sticker game, do you remember which game I will put on the table now?</i>	Correct	Incorrect	Don't Know	No Answer
<p>*If “toys/blue” → <i>That's right, now it's time for the blue tray with the toys game.</i></p> <p>*If “green/stickers” → <i>No, now it's time for the blue tray with the toys game.</i></p> <p>*If I don't know → <i>It's time for the blue tray with the toys game.</i></p> <p>*If incorrect, repeat memory question</p>				

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<i>Okay, do you remember which game I will put on the table now?</i>	Correct	Incorrect	Don't Know	No Answer
*If incorrect again, correct and continue				

I am going to put the stickers game away. [Put green tray with stickers out of sight]

If child has tokens:

- *Now it is time for the toys game.* [Put blue tray with toys on the table]
- *My timer is set for three minutes. That is how long you get with the toys game.*
- *I am going to do some work over here.*
- *Let's start right now.* [Turn away and pretend to work for three minutes]

[Use observation table on next page and end game after child has used all remaining tokens.]

If child does not have any tokens:

Guess what? We're lucky! I found 5 more tokens, so you get to play the toys game!

[Bring out blue tray and give child tokens to play toys game. This allows the child to play the desired game and have fun. No need to record detailed observations of this activity. Only make note of any saving-related statements.]

Observations for toys game:

*Note: end game once child has used all tokens and indicate ending time on table below.

Time	# Tokens used	Attempts to retrieve token	Verbalizes saving strategy	Tries to take prize without using token	Other verbal or behavioural observations (child or experimenter)
0:00-0:30					
0:30-1:00					
1:00-1:30					
1:30-2:00					
2:00-2:30					

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2:30-3:00					
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Number of tokens used in the toys game: _____

*If child asks questions about game or rules or breaks rules, provide neutral response and redirect to task (e.g., ***“now we are playing the toys game”***, ***“you can choose how you use your tokens”***, ***“in this game you use one token to get one prize”***, ***“remember, the rule is once the token is in the box it is all used up”***, ***“we still have some more time to play this game”***, ***“remember, the rule is that you only get a prize if you use a token”***, ***“you play the toys game and I am doing some work”***)

*At the end of the task, put all 10 prizes (5 toys and 5 stickers) into an envelope and give it to the teacher.

☐ ***Thank you for playing these games with me. Guess what?! You get to keep all of the prizes! I will put them in an envelope for you and give it to your teacher. She will keep it safe until the end of the day and then you can take it home!***

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Appendix J

Sticker Saving Task

(Chernyak et al., 2017)

[participant is given five dinosaur stickers and a plain, white piece of paper]

Here are some dinosaur stickers! You can use these stickers right away on this piece of paper

[point to white paper], ***or if you want, you can wait until I'm done working and I will give you this piece of paper to put your stickers on!*** [show cool dinosaur scene]. ***I'm going to go work over here now for a few minutes.***

[proceed to 'work' for three minutes while making minimal contact with the child. If the child attempts to interact, say ***'I have to do my work over here!'***]

[after three minutes, if the child has stickers left]

Here's the dinosaur paper! Thanks for waiting while I did my work!

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Appendix K

Card-Sorting Prospective Memory Task

Mahy and Moses, 2011

Ongoing task instructions – [bring out Morris the Mole puppet] *This is Morris the Mole and he would like your help. Morris can't see very well in the daylight. These four stacks of cards [point to stacks of cards] belong to Morris, and he would very much like to know what is on the cards. Because it's daytime, he can't see the pictures very well, so would you help Morris by saying out loud what is on the cards, one by one? Do your best to say exactly what is on the card. Morris would also be very happy if you draw some pictures for him, too.*

Experimenter example

So, if you see this card [show card of book] I want you to say "book" and then set it down, face down, next to the stack of cards [demonstrate].

PM instructions

Oh, there is one more thing. Morris [point to Morris] is really scared of animals. If you see an animal card while we're playing, don't say it out loud and put the card in this box [point to box]. No, if you see a card with an animal on it, I want you to not say anything and not put it in the pile with the other cards. Instead, put it in this box [point to box again, then move the box behind them]. This box will be behind you.

Experimenter example

So, if you see this card [show example card of an animal], I want you to stop reading cards out loud, and put it in the box. Like this [demonstrate].

Now you try!

[give two practice cards from top of the deck to name (watermelon and yo-yo)]
[correct the child if they do not name the card or place it face down on the table in front of Morris]

Comprehension check:

So what should you do if you see an animal card?

If correct, continue.

If incorrect, *No, if you see an animal card you should not say it out loud and put it in the box behind you.*

Okay good, you know how to play this game. I have to get some things set up before you can play. You can draw something while I get things ready. Here is some paper and crayons. Let the child draw for 3 minutes.

Ok, now it's time to start the sorting game so let's put our paper and crayons away.

Testing (no feedback)

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***Correct responses are bolded**

Circle child's response ('animal' means it is placed in the box behind them)

Stack 1

1	Non-animal	Animal
2	Non-animal	Animal
3	Non-animal	Animal
4	Non-animal	Animal
5	Non-animal	Animal
6	Non-animal	Animal
7	Non-animal	Animal
8	Non-animal	Animal
9	Non-animal	Animal
10	Non-animal	Animal
11	Non-animal	Animal
12	Non-animal	Animal
13	Non-animal	Animal

Okay, let's draw for Morris now! [let child draw for 3 minutes]

Time to do some more cards!

Stack 2

1	Non-animal	Animal
2	Non-animal	Animal
3	Non-animal	Animal
4	Non-animal	Animal

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5	Non-animal	Animal
6	Non-animal	Animal
7	Non-animal	Animal
8	Non-animal	Animal
9	Non-animal	Animal
10	Non-animal	Animal
11	Non-animal	Animal
12	Non-animal	Animal
13	Non-animal	Animal

Okay, let's draw for Morris now! [let child draw for 3 minutes]

Time to do some more of the cards!

Stack 3

1	Non-animal	Animal
2	Non-animal	Animal
3	Non-animal	Animal
4	Non-animal	Animal
5	Non-animal	Animal
6	Non-animal	Animal
7	Non-animal	Animal
8	Non-animal	Animal
9	Non-animal	Animal
10	Non-animal	Animal

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11	Non-animal	Animal
12	Non-animal	Animal
13	Non-animal	Animal

Okay, let's draw for Morris now! [let child draw for 3 minutes]

Time to do some more of the cards!

Stack 4

1	Non-animal	Animal
2	Non-animal	Animal
3	Non-animal	Animal
4	Non-animal	Animal
5	Non-animal	Animal
6	Non-animal	Animal
7	Non-animal	Animal
8	Non-animal	Animal
9	Non-animal	Animal
10	Non-animal	Animal
11	Non-animal	Animal
12	Non-animal	Animal
13	Non-animal	Animal

Okay, that's the end of this game. Oh, can you remind me what you were supposed to do when you saw an animal card?

Great, thanks for helping Morris today! He had a great time.

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Prospective Memory Task Stimuli**Practice Trials** **Non-Animal Cards (44)**

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Animal Cards (8)

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Appendix L

Naturalistic PM task

(Guajardo & Best, 2000)

[show child small box containing toy prize before testing session begins]

I have a gift for you in this box when we are all done playing our games today! When I say, 'we're all done our game for today!', you have to remind me to get the box with your gift out for you, okay?

[after all games have been played for the session]

We're all done playing games today!

[if the child does not remind the experimenter to give them their gift]: ***Did you have to remind me of something when we were all finished playing the games for today?***

[if the child does not remember]

Thanks for playing with me today! Here's your gift!

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Appendix M

Tower of Monkeys

From Carlson, Moses, and Claxton (2004)

Warm-up with 2 circles

(Set up the 2 circle Tower of Hanoi, horizontally in front of the child, with C's tower on the left peg.)

Training		
Child		

O.K. Now we're going to play a game where we pretend that these wooden circles are monkeys. This small circle is a little brother monkey (point to small circle) and this large circle is a big sister monkey (point to large circle). See the little brother monkey is sitting on the big sister's back. And we're going to pretend that these pegs (point to pegs) are trees.

Now you know that monkeys like to jump from tree to tree, right? Well, these monkeys love to jump from tree to tree. But only one monkey can jump at a time and the big sister monkey can never go on the back of the little brother monkey, because you know what would happen? The big sister is much heavier than the little brother and the big sister monkey would smush the little brother monkey and we don't want that to happen, do we? But the little brother monkey can go on the back of the big sister monkey just like he is now (point to circles), because the little brother is much smaller than the big sister.

Now there is water all around these trees, so the monkeys always have to stay in the trees and can only jump from one tree to another and never into the water.

So would you like to play the monkey jumping game? O.K. Can you point to the little brother monkey?

___ CORRECT
That's right!

___ INCORRECT
Whoops! That monkey is the big sister monkey. Can you point to the little brother monkey?
*# of tries until correct*___

Can you point to the big sister monkey?

___ CORRECT

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That's right!

INCORRECT

Whoops! That monkey is the little brother monkey. Can you point to the big sister monkey?

of tries until correct

Rule #2 – Jumping Rules

Now watch, the little brother monkey is going to jump to this tree, like this. [move small circle to second peg] Remember, the little brother monkey can go on the big sister's back, but the big sister monkey can never go on the little brother's back. Now, where should the big sister jump?

CORRECT

That's right, cause if he moved here [point to second peg], then he would smush the little brother monkey and if we moved here [point to table top], then he'd fall in the water and we don't want that to happen do we? No way!

INCORRECT

Whoops! Oh no, the little brother monkey is being smushed. (*remove large circle and **keep in hand***) Remember that the little brother can go on the big sister's back, but the big sister can never go on the little brother's back. (*Replace large circle on **left peg***) Now where should the daddy jump?

of tries until correct

LEVEL 1—2 disks, ONE MOVE

(Bring out E's tower with circles stacked on right peg. Place parallel to C's board.)

Level 1			Level 1		
Experimenter			Child		
L		R			

Now look, I've got some just like yours. (*point to E's*) Did you know that monkeys like to copy each other? Well, your monkeys are copycat monkeys (*point to C's*) and they always want to look just like my monkeys (*point to E's*). So, can you make your monkeys look just like my monkeys, so that your monkeys are sitting in this tree (*point to C's right peg*), just like my monkeys are sitting in this tree (*point to E's right peg*).

Indicate Trial #

CORRECT # of moves (1)

That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!

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_____ COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)

Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again.

INCORRECT (remind of rule broken and indicate which trial)

_____ Remember, only one monkey can jump at a time.

_____ Remember, the monkeys need to be in the trees, they can't swim in the water.

____ Whoops! Now the little brother monkey is being smushed by the big sister monkey.

Remember, the little brother monkey can be on the back of the big sister monkey, but the big sister monkey can never be on the back of the little brother monkey.

____ Whoops! Your monkeys don't look exactly the same as mine. See, (state why).

____ Whoops! My monkeys need to stay in this tree. They just sit and watch your monkeys jump.

____ Whoops! These trees can't move. They need to stay just like this. (turn trees back)

This one is a hard one. Let's try again.

TRIAL 1: PASS (go to next level) FAIL (repeat)

TRIAL 2: PASS (go to next level) FAIL (stop)

LEVEL 2 – 2 disk, TWO MOVE

<u>Level 2</u>			<u>Level 2</u>		
Experimenter			Child		

(Take off C's circles **one at a time** and **place in hands**.)

O.K., now I'm going to move your monkeys back over to this tree.

(place one at a time from hand, with large disk on bottom on C's left peg).

Let's say that the little brother monkey jumps to this tree

(move small circle to middle peg).

Now remember, your monkeys (*point to C's board*) like to copy my monkeys (*point to E's board*) Can you make your monkey's look exactly like my monkeys?

Indicate Trial #

CORRECT # of moves (2)

_____ **COMPLETED TASK IN TOO MANY MOVES** (# of moves made _____)

INCORRECT (remind of rule broken and indicated which trial)

_____ Whoops! Now the little brother monkey is being smushed by the big sister monkey.

This one is a hard one. Let's try again.

TRIAL 2: PASS (go to next level) FAIL (stop)

(Take off C's circles one at a time and place in hands.)

O.K., now I'm going to move your monkeys back over to this tree.

(place one at a time from hand, with large disk on bottom on C's left peg).

Indicate Trial #

CORRECT # of moves (3)

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That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!

_____ **COMPLETED TASK IN TOO MANY MOVES** (# of moves made _____)

Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again.

_____ **INCORRECT** (remind of rule broken and indicate which trial)

_____ Remember, only one monkey can jump at a time.

_____ Remember, the monkeys need to be in the trees, they can't swim in the water.

_____ Whoops! ! Now the little brother monkey is being smushed by the big sister monkey. Remember, the little brother monkey can be on the back of the big sister monkey, but the big sister monkey can never be on the back of the little brother monkey.

_____ Whoops! Your monkeys don't look exactly the same as mine. See, (state why).

_____ Whoops! My monkeys need to stay in this tree. They just sit and watch your monkeys jump.

_____ Whoops! These trees can't move. They need to stay just like this. (turn trees back)

This one is a hard one. Let's try again.

TRIAL 1: PASS (go to next level) FAIL (repeat)

TRIAL 2: PASS (go to next level) FAIL (stop)

LEVEL 4 – 3 disk, TWO MOVE

(Take off C's circles one at a time and place in hands.)

Level 4					Level 4				
Experimenter					Child				

Now look who wants to play. This is the new baby monkey. *(Take out tiny circle and place on top of E's other two circles)*. Isn't she tiny? Since she's so tiny, the little brother monkey can't jump on her back, cause he would smush her, and the big sister monkey can't jump on her back, cause then she would really smush her. But the baby monkey can jump on the big sister's back and on the little brother's back.

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Look, you have a baby monkey too. Now let's pretend that the big sister monkey is sitting in this tree (*place large circle on right peg*) and the little brother monkey is sitting in this tree (*place small circle on middle peg*) and the baby monkey is sitting in this tree (*place tiny circle on left peg*).

Now remember, your monkeys are copycat monkeys and they like to copy my monkeys. Can you make your monkeys look exactly like my monkeys?

Indicate Trial #

_____ **CORRECT # of moves (2)**

That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!

_____ **COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)**

Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again.

INCORRECT (remind of rule broken and indicate which trial)

_____ Remember, only one monkey can jump at a time.

_____ Remember, the monkeys need to be in the trees, they can't swim in the water.

_____ Whoops! Now the little brother monkey is being smushed by the big sister monkey. Remember, the little brother monkey can be on the back of the big sister monkey, but the big sister monkey can never be on the back of the little brother monkey.

_____ Whoops! Now the baby monkey is being smushed by the little brother monkey. Remember, the baby monkey can be on the back of the little brother monkey, but the little brother monkey can never be on the back of the baby monkey.

_____ Whoops! Your monkeys don't look exactly the same as mine. See, (state why).

_____ Whoops! My monkeys need to stay in this tree. They just sit and watch your monkeys jump.

_____ Whoops! These trees can't move. They need to stay just like this. (turn trees back)

This one is a hard one. Let's try again.

TRIAL 1: PASS (go to next level) FAIL (repeat)

TRIAL 2: PASS (go to next level) FAIL (stop)

LEVEL 5 – 3 disk, THREE MOVE

(Take off C's circles *one at a time and place in hands.*)

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<u>Level 5</u>				<u>Level 5</u>			
Experimenter				Child			

O.K., let's do another one. Let's pretend that the daddy monkey is sitting in this tree (*place **large circle** on **right peg***) and the boy monkey is sitting in this tree (*place **small circle** on **middle peg***) and the baby sister monkey is sitting on the back of the boy monkey (*place **tiny circle** on **top of small circle***). Now, can you make your monkeys look exactly like my monkeys?

Indicate Trial #

_____ **CORRECT # of moves (3)**

That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!

_____ **COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)**

Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again.

_____ **INCORRECT** (remind of rule broken and indicate which trial)

Remember, only one monkey can jump at a time.

Remember, the monkeys need to be in the trees, they can't swim in the water.

Whoops! Now the little brother monkey is being smushed by the big sister monkey. Remember, the little brother monkey can be on the back of the big sister monkey, but the big sister monkey can never be on the back of the little brother monkey.

Whoops! Now the baby monkey is being smushed by the little brother monkey. Remember, the baby monkey can be on the back of the little brother monkey, but the little brother monkey can never be on the back of the baby monkey.

Whoops! Your monkeys don't look exactly the same as mine. See, (state why).

Whoops! My monkeys need to stay in this tree. They just sit and watch your monkeys jump.

Whoops! These trees can't move. They need to stay just like this. (turn trees back)

This one is a hard one. Let's try again.

TRIAL 1: PASS (go to next level) FAIL (repeat)

TRIAL 2: PASS (go to next level) FAIL (stop)

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LEVEL 6 – 3 disk, FOUR MOVE

(Take off C's circles one at a time and place in hands.)

Level 6					Level 6				
Experimenter					Child				

All right, let's do another one. Let's pretend that the daddy monkey is sitting in this tree (*place large circle on left peg*) and the boy monkey is sitting in this tree (*place small circle on middle peg*) and the baby sister monkey is sitting on the back of the boy monkey (*place tiny circle on top of small circle*). Now can you make your monkeys look exactly like my monkeys?

Indicate Trial #

_____ **CORRECT # of moves (4)**

That's right! Now your monkeys look exactly like my monkeys. Your monkeys sure are good copycats!

_____ **COMPLETED TASK IN TOO MANY MOVES (# of moves made _____)**

Now your monkeys look exactly like my monkeys, but maybe they can do it without so much jumping. Let's try again.

INCORRECT (remind of rule broken and indicate which trial)

_____ Remember, only one monkey can jump at a time.

_____ Remember, the monkeys need to be in the trees, they can't swim in the water.

_____ Whoops! Now the little brother monkey is being smushed by the big sister monkey. Remember, the little brother monkey can be on the back of the big sister monkey, but the big sister monkey can never be on the back of the little brother monkey.

_____ Whoops! Now the baby monkey is being smushed by the little brother monkey. Remember, the baby monkey can be on the back of the little brother monkey, but the little brother monkey can never be on the back of the baby monkey.

_____ Whoops! Your monkeys don't look exactly the same as mine. See, (state why).

_____ Whoops! My monkeys need to stay in this tree. They just sit and watch your monkeys jump.

_____ Whoops! These trees can't move. They need to stay just like this. (turn trees back)

This one is a hard one. Let's try again.

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TRIAL 1: PASS (stop) FAIL (repeat)

TRIAL 2: PASS (stop) FAIL (stop)

OK! We're all done with this game. Thanks for playing!

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Appendix N

Truck Loading Task Protocol

Based on Carlson et al. (2004)

Colour check: [place sheet with colours on table]

Can you show me Purple? Yellow? Green? Blue? Red? (randomize)

Record accuracy:

Purple____ Yellow____ Green____ Blue____ Red____

(start with yellow house and envelope)

O.K. Now we're going to play a new game. Let's pretend that you're a mail carrier. We're going to have a party and I need you to deliver this party invitation to this house [point]

See, the yellow invitation goes to the yellow house. First, we need to load the truck [let child place yellow invitation in back of truck]

Direction Rule

Now this is a one-way street which means that you can only drive this way with the truck (point with finger). You have to follow the arrows. Why don't you deliver the yellow invitation to the yellow house? [place truck at start, and have child drive the truck all the way around the road, back to the start]

If incorrect: ***O.K. remember this is a one-way street, so you need to drive around***

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like this [demonstrate]. *Why don't you try again?*

Total # of tries until correct (max 3, then continue): _____

O.K.! [take back yellow invitation]

Order Rule:

(add purple house) Now there are two houses that we want to invite to the party.

The yellow invitation goes to the yellow house and the purple invitation goes to the purple house [point]

Now, we need to deliver these party invitations fast so that everyone will be able to come to the party. The fastest way is to drive around the block only one time.

We need to put the invitations in the back of the truck so that the top invitation goes to the house that you are driving by. You always have to take the invitation off the top of the truck so that the top invitation goes to the first house and the next invitation goes to the next house.

So now we need to load the truck. Let's see here, it looks like the first house you will drive by is the yellow house, so the yellow invitation has to go on the very top.

And the second house you will drive by is the purple house, so the purple invitation needs to go on the bottom.

So first let's put in the purple invitation and then put in the yellow invitation.

[Pile the 2 invitations in truck, one at a time]

Now, remember, we can only take an invitation from the top of the truck. We can never take an invitation from the bottom of the truck. So, can I take one from the bottom like this? [demonstrate]

No way!

If yes, repeat until says no (max 3 times, then continue)

Total # of tries until correct: _____

Now let's deliver the invitations. Why don't you drive? (try and have C deliver the invitations, but help if needed) See, now as I drive by, I can first deliver the yellow invitation to the yellow house and then next I can deliver the purple invitation to the purple house. Yeah, now everyone can come to the party!

LEVEL 1: 2 houses

[Place red then green]. Here's a red invitation for the red house and a green invitation for the green house [point]

Now it's your turn to deliver the party invitations to all of the houses on the block so that everyone can come to the party. O.K., remember the rules, each colour invitation goes to the same colour house, and you need to follow the arrows around

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the block because this is a one-way street. And when delivering the invitations, you can only take the top invitation; you can never take one from the bottom. Here are the invitations. [Place down, red slightly to C's left and green slightly to right]

OK, now it's your turn to load the truck.

____ CORRECT

Good job! Let's add another house.

____ INCORRECT (remind of rule broken and circle)

____ [colour rule] *Whoops! Remember each colour invitation goes to each colour house*

____ [direction rule] *Whoops! Remember this is a one-street, so you have to follow the arrows. You can only drive in one direction, no backing up.*

____ [order rule] *Whoops! Remember you can only take an invitation from the top of the truck. You can never take an invitation from the bottom of the truck.*

____ [tries to drive around block another time] *Whoops! We ran out of time. It's time for the party to start. Remember you can only drive around the block once.*

TRIAL 1: PASS (go to next level) FAIL (repeat; *This one is a hard one. Let's try again*).

TRIAL 2: PASS (go to next level) FAIL (stop)

LEVEL 2: 3 houses

Now let's pretend that there are 3 houses on the block, and you want to invite all 3 houses to the party [place blue, yellow, green]. Here's a blue invitation for the blue house. Here's a yellow invitation for the yellow house. And here's a green invitation for the green house [point]

Here are the invitations [place down, green slightly to C's left, blue in front, and yellow slightly to right]

Go ahead and load up the truck.

____ CORRECT

Good job! Let's add another house.

____ INCORRECT (remind of rule broken and circle)

____ [colour rule] *Whoops! Remember each colour invitation goes to each colour house*

____ [direction rule] *Whoops! Remember this is a one-street, so you have to follow the arrows. You can only drive in one direction, no backing*

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up.

____ [order rule] **Whoops! Remember you can only take an invitation from the top of the truck. You can never take an invitation from the bottom of the truck.**

____ [tries to drive around block another time] **Whoops! We ran out of time. It's time for the party to start. Remember you can only drive around the block once.**

TRIAL 1: PASS (go to next level) FAIL (repeat; **This one is a hard one. Let's try again**).

TRIAL 2: PASS (go to next level) FAIL (stop)

Level 3: 4 houses

Now let's pretend that there are 4 houses on the block, and you want to invite all 4 houses to the party [place purple, green, blue, yellow] Here's a purple invitation for the purple house, etc. [point].

Here are the invitations. [place down centered from left to right: green, blue, purple, yellow]

Go ahead and load up the truck.

____ CORRECT

Good job! Let's add another house.

INCORRECT (remind of rule broken and circle)

____ [colour rule] **Whoops! Remember each colour invitation goes to each colour house**

____ [direction rule] **Whoops! Remember this is a one-street, so you have to follow the arrows. You can only drive in one direction, no backing up.**

____ [order rule] **Whoops! Remember you can only take an invitation from the top of the truck. You can never take an invitation from the bottom of the truck.**

____ [tries to drive around block another time] **Whoops! We ran out of time. It's time for the party to start. Remember you can only drive around the block once.**

TRIAL 1: PASS (go to next level) FAIL (repeat; **This one is a hard one. Let's try again**).

TRIAL 2: PASS (go to next level) FAIL (stop)

Level 4: 5 houses

Now let's pretend that there are 5 houses on the block and you want to invite all 5 houses to the party. [place green, yellow, red, purple, blue]

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Here are the invitations. [place centered left to right: green, blue, purple, red, yellow]

Go ahead and load up the truck.

____ CORRECT

Good job!

INCORRECT (*remind of rule broken and circle*)

____ [colour rule] ***Whoops! Remember each colour invitation goes to each colour house***

____ [direction rule] ***Whoops! Remember this is a one-street, so you have to follow the arrows. You can only drive in one direction, no backing up.***

____ [order rule] ***Whoops! Remember you can only take an invitation from the top of the truck. You can never take an invitation from the bottom of the truck.***

____ [tries to drive around block another time] ***Whoops! We ran out of time. It's time for the party to start. Remember you can only drive around the block once.***

TRIAL 1: PASS (stop) FAIL (repeat; ***This one is a hard one. Let's try again.***)

TRIAL 2: PASS (stop) FAIL (stop)

Great job!

TOTAL NUMBER OF TRIALS: _____

HIGHEST LEVEL ACHIEVED: _____

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Appendix O

Peabody Picture Vocabulary Test- Fifth Edition (PPVT-V)

Basal Set Rule: 1 or no errors in a set.
Ceiling Set Rule: 8 or more errors in a set.

START Ages 2-6-3 SET 1

Item	Word	Key	Response	Error
1.	cat	(2)		E
2.	baby	(3)		E
3.	airplane	(1)		E
4.	running	(1)		E
5.	money	(3)		E
6.	swinging	(4)		E
7.	broom	(2)		E
8.	eating	(4)		E
9.	mail	(3)		E
10.	circle	(4)		E
11.	ladder	(2)		E
12.	candle	(1)		E

No. of Errors

START Age 5 SET 3

Item	Word	Key	Response	Error
25.	broken	(2)		E
26.	picking	(4)		E
27.	bottle	(4)		E
28.	dressing	(1)		E
29.	coin	(2)		E
30.	peeking	(3)		E
31.	camera	(3)		E
32.	goat	(4)		E
33.	ambulance	(1)		E
34.	pulling	(1)		E
35.	desk	(3)		E
36.	yawning	(2)		E

No. of Errors

SET 4

Item	Word	Key	Response	Error
37.	lock	(4)		E
38.	panda	(1)		E
39.	triangle	(4)		E
40.	fruit	(1)		E
41.	arguing	(1)		E
42.	full	(2)		E
43.	dentist	(3)		E
44.	time	(3)		E
45.	caterpillar	(3)		E
46.	computer	(4)		E
47.	branch	(2)		E
48.	chain	(2)		E

No. of Errors

START Ages 6-7 SET 5

Item	Word	Key	Response	Error
49.	cheering	(1)		E
50.	cobweb	(3)		E
51.	jogging	(4)		E
52.	huge	(3)		E
53.	uniform	(4)		E
54.	wrist	(2)		E
55.	sharing	(2)		E
56.	binoculars	(2)		E
57.	statue	(4)		E
58.	coming	(3)		E
59.	jewelry	(1)		E
60.	terrified	(1)		E

No. of Errors

START Age 4 SET 2

Item	Word	Key	Response	Error
13.	neck	(3)		E
14.	throwing	(4)		E
15.	kangaroo	(2)		E
16.	plant	(1)		E
17.	can	(4)		E
18.	shark	(3)		E
19.	pouring	(2)		E
20.	horn	(1)		E
21.	shovel	(4)		E
22.	farmer	(3)		E
23.	gate	(2)		E
24.	swimming	(1)		E

No. of Errors

SET 6

Item	Word	Key	Response	Error
61.	liquid	(4)		E
62.	peacock	(3)		E
63.	leaking	(2)		E
64.	brain	(2)		E
65.	hive	(1)		E
66.	root	(1)		E
67.	floating	(2)		E
68.	tortoise	(1)		E
69.	printing	(4)		E
70.	rough	(4)		E
71.	tugging	(2)		E
72.	tornado	(3)		E

No. of Errors

START Ages 8-9 SET 7

Item	Word	Key	Response	Error
73.	ankle	(1)		E
74.	sanding	(2)		E
75.	hyena	(4)		E
76.	pair	(3)		E
77.	antlers	(4)		E
78.	nutritious	(2)		E
79.	annoying	(1)		E
80.	walrus	(3)		E
81.	flaming	(3)		E
82.	jaw	(4)		E
83.	cliff	(1)		E
84.	directing	(2)		E

No. of Errors

START Ages 10-11 SET 8

Item	Word	Key	Response	Error
85.	shuttle	(4)		E
86.	tropical	(2)		E
87.	refueling	(2)		E
88.	angle	(1)		E
89.	river	(3)		E
90.	deflated	(1)		E
91.	calculating	(1)		E
92.	shore	(3)		E
93.	funnel	(2)		E
94.	predatory	(3)		E
95.	cruiser	(4)		E
96.	grain	(4)		E

No. of Errors

3

Basal Set Rule: 1 or no errors in a set.
Ceiling Set Rule: 8 or more errors in a set.

SET 9

Item	Word	Key	Response	Error
97.	sorting	(1)		E
98.	canine	(2)		E
99.	greeting	(3)		E
100.	triplets	(4)		E
101.	applauding	(3)		E
102.	arctic	(2)		E
103.	exiting	(4)		E
104.	pelican	(1)		E
105.	pyramid	(3)		E
106.	snarling	(4)		E
107.	colliding	(1)		E
108.	hoof	(2)		E

No. of Errors

START Ages 12-16 SET 10

Item	Word	Key	Response	Error
109.	compass	(3)		E
110.	harvesting	(4)		E
111.	abundant	(2)		E
112.	astonished	(3)		E
113.	gnawing	(3)		E
114.	scholar	(4)		E
115.	fictional	(1)		E
116.	beverage	(1)		E
117.	grooming	(2)		E
118.	steeple	(2)		E
119.	assisting	(1)		E
120.	reel	(4)		E

No. of Errors

SET 11

Item	Word	Key	Response	Error
121.	trumpet	(2)		E
122.	escorting	(4)		E
123.	speedometer	(3)		E
124.	salutation	(4)		E
125.	parallel	(4)		E
126.	archaeologist	(1)		E
127.	glider	(3)		E
128.	construction	(2)		E
129.	pod	(3)		E
130.	assembling	(1)		E
131.	banister	(2)		E
132.	hovering	(1)		E

No. of Errors

SET 12

Item	Word	Key	Response	Error
133.	sedan	(4)		E
134.	duet	(1)		E
135.	irregular	(1)		E
136.	physician	(4)		E
137.	swine	(3)		E
138.	wedge	(3)		E
139.	composing	(2)		E
140.	easel	(4)		E
141.	lubricating	(1)		E
142.	amphibian	(3)		E
143.	weary	(2)		E
144.	axle	(2)		E

No. of Errors

START Ages 17-Adult SET 13

Item	Word	Key	Response	Error
145.	porcelain	(2)		E
146.	embracing	(3)		E
147.	liberated	(1)		E
148.	peninsula	(4)		E
149.	goblet	(4)		E
150.	orating	(1)		E
151.	aviation	(2)		E
152.	descending	(2)		E
153.	attire	(4)		E
154.	gavel	(3)		E
155.	currency	(3)		E
156.	agriculture	(1)		E

No. of Errors

SET 14

Item	Word	Key	Response	Error
157.	siblings	(1)		E
158.	illumination	(4)		E
159.	incisor	(2)		E
160.	towl	(3)		E
161.	enticing	(3)		E
162.	trowel	(4)		E
163.	angler	(1)		E
164.	dwelling	(1)		E
165.	nape	(2)		E
166.	enumerating	(4)		E
167.	reflection	(2)		E
168.	submerging	(3)		E

No. of Errors

ABBREVIATED INSTRUCTIONS AND SETS OF TEST STIMULUS WORDS

Study Part 2 of the manual before using the test and using the Training Items as Training Plates. Use Training Items A and B with persons 8 and older.

HOW TO BEGIN THE TEST

When you begin a set of test items, always start with the first item in the set and always start with the first item in the set with the Start item, which is the first item designated for the test taker's age, in sets and in the box below.

all Set Rule is one (1) or no errors in a set. If you reverse sequentially by sets until the Ceiling Set Rule is obtained.

HOW TO RECORD RESPONSES AND ERRORS

Errors for Each Item. Use numerals to record the number of errors made by the examinee from the Basal Set through the Ceiling Set. This is the Raw Score.

HOW TO CALCULATE THE RAI

Record the number of the Ceiling item, which is the last item in the Ceiling Set. Subtract from it the total number of errors made by the examinee from the Basal Set through the Ceiling Set. This is the Raw Score.

Cell
in
Term
Error
Raw
Score

4

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Appendix P

Approval Emails for Continuing with Thesis

From: Joanna Pozzulo <Joanna.Pozzulo@carleton.ca>
Date: Saturday, March 28, 2020 at 11:22 AM
To: Deepthi Kamawar <DeepthiKamawar@cunet.carleton.ca>, Michael Wohl <Michael.Wohl@carleton.ca>
Subject: Re: Data collection and completion of MA theses

Hi Deepthi,
 Thank you for this. These are certainly unprecedented times and moving forward the word seems to be "flexible".

I don't think we want to hold anyone back. I think your plan is a good one on how to move forward for students in this position. Please meet with the student committees and feel free to move forward in a manner that makes most sense for the students to defend on time.

Please let me know if you have any questions.

Thank you! Hope you are staying well.
 Joanna

From: Deepthi Kamawar <DeepthiKamawar@cunet.carleton.ca>
Date: Saturday, March 28, 2020 at 10:42 AM
To: Joanna Pozzulo <JoannaPozzulo@CUNET.CARLETON.CA>, Michael Wohl <Michael.Wohl@carleton.ca>
Subject: Data collection and completion of MA theses

Hi Joanna and Michael,

I'm sorry if you've sent out information on this and I've missed it -- there have been a lot of emails (as I'm sure you both know).

I am writing to ask if there's a departmental decision regarding MA students who were otherwise on track to be done by the end of this summer, but will not have data given the current situation, as I have MA students to whom this applies. For example, Allie Russell had everything in place and had begun recruitment, but cannot collect data with preschool-aged children. Her study does not lend itself to online data collection (the tasks just don't transfer). Further, she's been admitted to a counselling program in the fall which requires her to have completed this degree. Another student, Ellen Doucet, already began data collection (again, with preschoolers), but had fairly little completed before daycares closed (though, she had a number of participating daycares and many consent forms out). Again, her tasks do not transfer to online collection. I'm sure you get the idea.

My stance on this is if students were doing what they were supposed to be doing (i.e., generally on track), then I do not want to hold them back from graduating on time due to a lack of data, given that the lack of data is not something under their control (no facet-to-face testing is currently possible, and doesn't sound like it will be for some time). I would meet with their committee to discuss an acceptable alternative final product (e.g., writing up the analyses they would have done if they had data, writing a discussion based on having found support for their hypotheses, etc.) that allows them to defend on time.

Thank you,
 Deepthi

SAVING, PROSPECTIVE MEMORY, AND PLANNING IN PRESCHOOLERS

Re: Data collection and completion of MA theses

Deepthi Kamawar <DeepthiKamawar@cunet.carleton.ca>

Sat 2020-03-28 11:36 AM

To: Michael Wohl <MichaelWohl@cunet.carleton.ca>; Joanna Pozzulo <Joanna.Pozzulo@carleton.ca>

Hi Joanna and Michael,

Thank you both for your very quick responses, and your support for my plan. I will reach out to my students' committee members and come up with a plan.

We are all doing well - thank you.

I hope you and your families are all keeping healthy,
Deepthi

Deepthi Kamawar
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Graduate Supervisor, ICS
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the Department of Psychology
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K1S 5B6
deepthi.kamawar@carleton.ca
Office: 613.520.2600 x7021

From: Michael Wohl <MichaelWohl@cunet.carleton.ca>

Sent: March 28, 2020 11:26 AM

To: Joanna Pozzulo <Joanna.Pozzulo@carleton.ca>; Deepthi Kamawar
<DeepthiKamawar@cunet.carleton.ca>

Subject: Re: Data collection and completion of MA theses

Thank you Joanna. I was in the midst of writing a very similar response.
Deepthi, I hope all is well with you and your family. Please let your students know they are free to contact me any time should they have queries.
Michael

--
Michael J. A. Wohl, Ph.D.
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Department of Psychology
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"Your next action could change the world, so make it a good one"